AUDITORY DISTRACTIONS IN OPEN OFFICE SETTINGS: A MULTI ATTRIBUTE UTILITY APPROACH TO WORKSPACE DECISION MAKING

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AUDITORY DISTRACTIONS IN OPEN OFFICE SETTINGS: A MULTI ATTRIBUTE UTILITY APPROACH TO WORKSPACE DECISION MAKING

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To my parents, husband, son, and sister-in-law

whose beautiful love and unconditional sacrifices made it possible for me to compose this precious piece of knowledge.

I am heartily grateful for your efforts.

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LIST OF ABBREVIATIONS

AW	Adaptable workspace
EGIAD	Externally generated involuntary auditory distractions
MAUA	Multi-attribute utility analysis
MAUF	Multi-attribute utility functions
MAUT	Multi-attribute utility theory
MCDM	Multi-criteria decision-making
NGT	Nominal group technique
OCB	Organizational citizenship behavior
SAUF	Single-attribute utility functions

SUMMARY

In open office settings, auditory distractions coming from surrounding work environment are shown to be a considerable source of indirect costs to an organization, such as performance costs, behavioral costs, and healthcare costs, to name a few. Evans and Johnson (2000) showed that stress from surrounding noise increases the risk of developing musculoskeletal problems, resulting in increased healthcare and performance costs. These costs are substantial to affect the net productivity of an organization, where productivity is equal to revenue minus the costs. BASEX showed that distractions cost the U.S. economy $588 billion per year (Spira and Feintuch, 2005). Therefore, this research argues that the costs of auditory distractions should be estimated when evaluating the value of a workspace for an organization. However, organizational decisions are generally guided by cost-benefit analysis and a precise dollar figure cannot be attached to the stated indirect costs because these are subjective in nature; therefore, these are generally ignored.

Furthermore, research on building technology and environments suggest co-existence of support for individual and collaborative work at any workspace in a given workplace at any given time as a must-have requirement for conducting knowledge work. Brill et al. (2001) report that compromise in either of the two requirements results in real costs to businesses in terms of lost productivity, higher attrition, and difficulty recruiting highly valued intellectual capital.

In view of the above stated costs that are critical to sustainability and development of a business, and the fact that cost-benefit approach is no longer providing

consistent results, a more robust decision-based approach to workspace selection is proposed. A decision-based approach is seen as an organized approach to select between workspace options under uncertainty and risk wherein the selected workspace is maximized in terms of some expected utility. Here utility is defined as the measurement of strength or intensity of a person's preferences. The advantages of using a decision-based approach include consideration of a multitude of environmental decision variables, objective or subjective, in a single equation or model and processing of the same in a limited amount of time with rationality and consistency. A multi-attribute workspace choice utility decision model is developed with the intent to facilitate systematic understanding and analysis of workspace alternatives for an organization.

This research shows how the decision-making approach to workspace selection simplifies the problem by providing it a structure that is easily comprehensible, and allows simultaneous processing of both qualitative and quantitative conflicting objectives through a single decision-making model. In doing so, this research firmly establishes the importance of a workspace's adaptability to auditory distractions for office workers, particularly knowledge workers, who are constantly undertaking a range of complex tasks. This study holistically and systematically puts forth the fundamental issues prevalent in state-of-the-art North American open plan office settings, the issue of fulfilling two extremely contrasting requirements, concentration and collaboration, in the same workspace and work environment at a given time.

CHAPTER 1

INTRODUCTION

1.1. Introduction

Auditory distractions in open office settings are a natural phenomenon. A number of studies from many disciplines have shown that these distractions are a significant source of nuisance for office workers, particularly knowledge workers. It impacts their ability to concentrate, and increases stress, frustrations, anger, and hostility among co-workers. These bearings are mostly subjective in nature, and are driven by many individual factors like, mood, sensitivity to noise, and overall well-being, both in general and on a particular day, among other factors. Nevertheless, for an organization, the consequences are the same: reduced net productivity due to increase in performance costs, health care costs, and behavioral costs, to name a few. Evans and Johnson (2000) showed that stress from surrounding noise increases the risk of developing musculoskeletal problems. The consequences are increase in health care costs, increased absenteeism, reduced motivation, or reduced performance due to ill-health, all eventually affecting the productivity of an organization. The *American Journal of Medicine* published that the direct medical costs of problems related to indoor air quality to U.S. businesses is approximately 15 billion dollars per year (ASID, 2004). Literature in building technology and organizational behavior identifies these costs as indirect because their occurrence and severity depends on the bearings of workplace design and environment on its occupants and individual personality.

Furthermore, research in building technology and environments suggest co-existence of support for individual and collaborative work at any workspace in a given workplace at any given time as a must-have requirement for conducting knowledge work. Brill et al. (2001) reports that compromise in either of the two requirements results in real costs (direct and indirect) to businesses in terms of lost productivity, higher attrition, and difficulty recruiting highly valued intellectual capital.

This study argues that both these costs, i.e., the costs of auditory distractions and the costs of a workspace's must-have requirements; are significant to be estimated when evaluating the value of a workspace for an organization. However, organizational decisions are generally guided by cost-benefit analysis and a precise dollar figure cannot be attached to the stated costs because of their subjective nature; therefore, these are generally ignored. In addition, the cost-benefit analysis of workplace selection suggests open office settings as the most cost-effective workspace solutions. Consequently, in view of the costs of auditory distractions in open office settings and the costs of workspace's must-have requirements, the question of significant importance is: Are open plan workspaces really valuable for knowledge-based organizations?

This research theorizes that for knowledge-based organizations an adaptable workspace (AW) is more valuable than the predominant open office settings. An adaptable workspace, as defined in this study, is a workspace that allows (and assists) its users in exercising control over distractions coming from the surrounding work environment. It supports the conflicting requirements of collaboration and concentration and also informs the surroundings of individuals' social readiness. It allows the environment to adapt to the needs of the user or it allows the user to adjust the micro-environment to suit to ones needs, such as functional, psychological, and physiological needs. The appropriate illustrations are: IBM's BlueSpace; Queens University's Attentive

Office Cubicle; and Clemson's Animated Work Environment. Nonetheless, direct costs of adaptable workspaces are much higher compared to cost-effective open workspaces, such as one BlueSpace, which costs $4000-$4500. High cost is one reason why these have been disregarded by busy decision-makers, who are also often misguided that they have all the required information to make an informed choice. Therefore, rationalizing the value of AW is imperative for their adoption.

Considering previous findings and the need for a more robust approach, a decision-based approach to workspace selection is proposed as an alternative to the traditional cost-based approach. This study hypothesizes that a structured decision-based procedure for workspace selection can be developed. The advantages of using a decision-based approach include consideration of a multitude of environmental decision variables in a single equation, and processing of the same in a limited amount of time with rationality and consistency. In addition, a decision-based approach allows the involvement of workspace's key stakeholders, i.e., knowledge workers, in the decision-making process. In the following sections, a few definitions are provided and a brief background is set up to explain the research problem and the objective of this research study.

1.2. Important Definitions

1.2.1. Adaptable Workspace

An adaptable workspace (AW), as defined in this study, is a workspace that allows (and assists) its user to exercise control over distractions coming from the surrounding work environment. It supports the conflicting requirements of collaboration and concentration and also informs the surroundings of individuals' social readiness. It allows the environment to adapt to the needs of the user, or it allows the user to adjust the micro-environment to suit to one's needs, such as functional, psychological, and physiological, among other needs. The appropriate illustrations are: IBM's BlueSpace; Queens University's Attentive Office Cubicle; and Clemson's Animated Work Environment.

1.2.2. Knowledge Work

Peter Druker in 1959 first introduced the term knowledge work to describe the use of information as the raw material of work. Analysis, creativity, problem-solving, and collaboration are some aspects of what is involved when conducting knowledge work. This requires both highly concentrated individual work and work in teams. Memory and seriation are the key properties of this type of work, involving tasks such as reading comprehension, analytical reasoning, for example.

1.2.3. Knowledge Worker

All the individuals who are involved with the production and processing of knowledge work are called knowledge workers. They constitute the intellectual capital of knowledge-based organization.

1.2.4. Knowledge-based Enterprise/Organization

According to (Hejduk, 2005), a "knowledge-based enterprise is an organization whose structure is subordinate and guided by developing positive business values, supported by an effective use of knowledge" (p. 8). The main characteristics of these organizations are the following:

- They either provide knowledge-based services or manufacture products whose key components are knowledge-based, e.g. the Tata Consulting Services vs. McDonald's fast food restaurants.
- Knowledge workers provide the most essential output among all employed.
- Knowledge-based enterprises place their market value on their intellectual capital.
- They derive their knowledge from various sources, including customer knowledge, competitor knowledge, product knowledge, process knowledge, financial knowledge, and people knowledge (Davies, 2005).

1.2.5. Open Office Settings

Open office settings, as conceived and designed in the 1950s by Eberhard and Wolfgang, are mainly categorized by an absence of walls and partitions. Although a number of variations of this model, like cubicles, bull-pens, and shared workspaces, have evolved over time, the main characteristic of these designs is an absence of a floor-to-ceiling partition.

1.2.6. Workspace

Workspace refers to a work-station assigned to a specific individual to work while he or she is in the office. It includes a chair, a table, equipment, supplies, among other items required to complete office tasks by an individual.

1.3. A Brief Description – Motivation and Research Problem

Research on open office settings, the predominant office settings in North America, provide mixed results. Despite the fact that open offices are not recommended for jobs involving undisturbed concentration, they have enjoyed considerable popularity since their birth in the 1950s; open offices started replacing enclosed offices in the 1960s and have experienced exponential growth over the past few decades. Open offices continue to be adopted because of their perceived benefits, including cost effectiveness, improved information flow, facilitated interactions, improved collaborations, and flexibility for re-configurations. However, a number of studies argue that, while open office settings are cost-effective, this savings is coming at the potential expense of the productivity of its occupants. Employees working in these settings feel little enthusiasm about their work environment. The most frequent and the most critical of employee complaints include issues with auditory distractions, like people talking, phones ringing, keyboards clicking, fax machines beeping, and rough laughter from a nearby team meeting, to name a few complaints; all these factors becoming a cause for unnecessary stress, fatigue, annoyance, and frustration, among other problems. A series of studies conducted in the past three decades document that conversational distractions and uncontrolled noise is the primary cause of complaints and productivity loss within offices. For example, Leaman and Bordass (1999) report that noise is seen as the greatest influence on productivity; likewise, Carsia (2002) states that 70% of her subjects agreed that productivity would increase if auditory distractions would decrease. The American Society of Interior Designers argue that auditory distractions in open office settings causes 71% of overall workspace environment distractions and, thus, is associated with negative impacts on worker productivity (ASID, 1996). Researchers call these problems ‘non-auditory impacts of office noise’ and this has been a topic of great research interest in the field of cognitive sciences, psychology, and social sciences. Non-auditory effects of noise are identified as “all those effects on an individual which are caused by exposure to noise with the exclusion of effects on the hearing organ and effects which are due to masking of auditory information, i.e., communication problems" (Smith, 1991, p.49). These generally include: cognitive performance effects, like issues with memorization, reading comprehension, concentration, and intervention strategies; psychological effects like stress, arousal; and physiological effects, like annoyance and sleep disturbance, among other effects. The argument model for open office settings is shown in Figure 1.1.

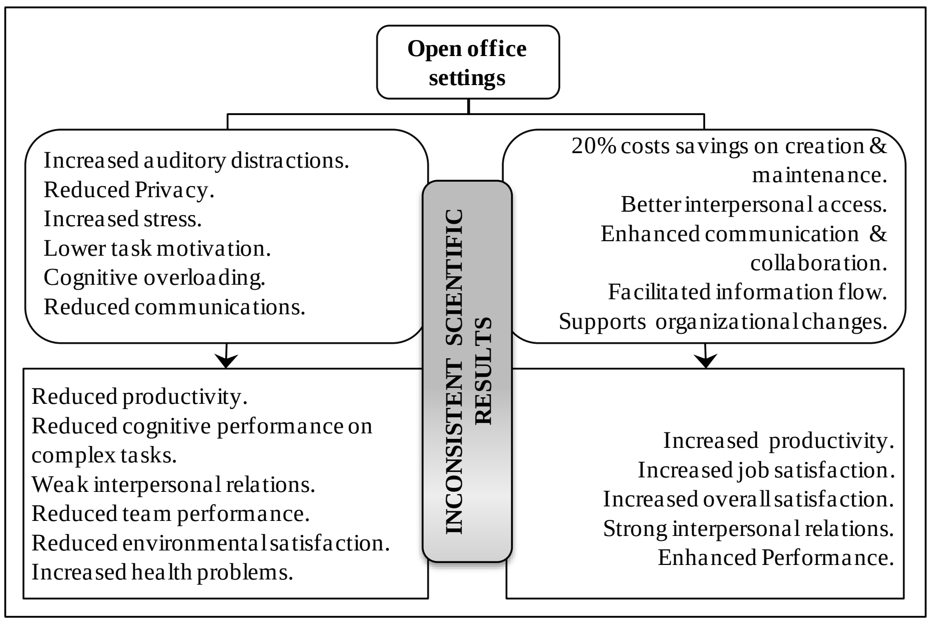


Figure 1.1 - Argument Model for Open Office Settings

Furthermore, research in the field of organizational theory shows that, in today's hyper-competitive knowledge-based marketplace, knowledge workers are the key to sustainability and development of knowledge-based organizations (Toffler, 1980, Davenport and Prusak, 1998). These knowledge workers are the key productivity components; while they are a major organizational cost, accounting for approximately 78% of total annual operating costs (Administration, 1999), they are also key revenue generators for most organizations. Davies (2005) states that “productivity resides in the individual. It is the collective efforts of individuals that generate the output for any organization” (p. 450). The productivity of these organizations depends so highly on the productive output per knowledge worker that the factors that negatively affects them are of significant concern to these organizations. Consequently, the focus needs to be on the individual.

Existing research demonstrates the importance of addressing the issue of auditory distractions (both speech and sound) for office workers, particularly knowledge workers, in open office settings. Maintaining the conflicting needs of both concentration and collaboration in the same workspace is another significant problem that demands attention. While numerous studies have addressed these problems piecemeal in different academic disciplines, there is a dire need to integrate them into a comprehensive framework. This will help assure that decisions about workspace for office workers, particularly knowledge workers, are well-informed and align with business strategy of the organization. Considering the critical nature of the problem, this study is dedicated to the issue of auditory distractions in open office settings. The focus is on the competing demands of maintaining both concentration and collaboration at the same workspace in open office settings, and their significance for office workers, particularly knowledge workers, who are involved in a range of complex tasks. Also central to this study is the complex problem of workspace decision-making. Although decisions to select open office settings are generally guided by cost-benefit valuation, this traditional approach is providing inconsistent results in reference to the studies on auditory distractions and behavioral effects of workplace design and environments. Consequently, a more robust decision-based approach to workspace selection is proposed. The hypothesis is that, to contain the costs of auditory distractions and costs of workspaces' must-have requirements, a structured decision-based procedure for workspace selection can be developed. It is expected that this decision-based procedure will offset the inconsistencies and limitations of the cost-benefit approach for workspace selection.

A decision-based approach is seen as an organized approach to select between workspace options under uncertainty and risk wherein the selected workspace is maximized in terms of some expected utility. The advantages of using a decision-based approach include consideration of a multitude of environmental decision variables, objective and subjective, in a single equation; these variables can then be processed in a limited amount of time with rationality and consistency. This approach provides the basis for achieving the much needed alignment between business and workspace strategy. Most importantly, the individuals who are the end users of the workspaces can easily be involved in the decision-making process. Furthermore, use of a decision-based approach empowers the decision-maker with justifiability, accountability, and reasonability for the decision outcome, which are regularly seen as pre-requisites for making complex and risky decisions.

1.4. Dissertation Objectives – Research Questions

This dissertation is motivated by the most fundamental issues with open office settings for knowledge workers: the issue of auditory distractions and the challenge of maintaining two extremely contrasting requirements - concentration and collaboration - in the same workspace and work environment at a given time. Furthermore, in today's competitive global knowledge-based economy, organizations continuously need to create and sustain competitive advantages, decrease costs, and improve productivity through the provision of an environment that merges seamlessly with the organization's business bottom line. Central to this study is the complex problem of workspace decision-making; while decisions to select open office settings are generally guided by cost-benefit valuation, this traditional approach is no longer working. Consequently, a more robust decision-based approach to workspace selection is proposed.

The study takes a multi-disciplinary approach and draws on research from a number of different fields and sub-fields. The model for theory contributing domains is shown in Figure 1.2. The integration of disciplines provides a more holistic and systematic picture of issues with open office settings that predominate in today's organizations.

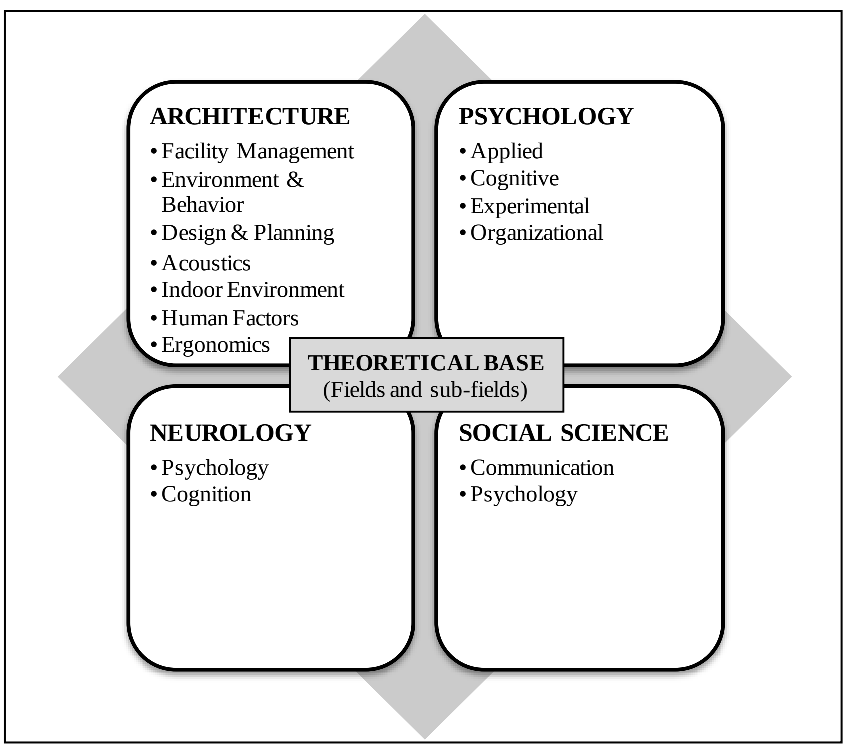


Figure 1.2 – Theory Contributing Domains

The objectives of this study are twofold: First, from a theoretical standpoint, the objective is to establish a holistic and systematic review of the fundamental issues with open office settings, thereby setting up the importance of a decision-based approach to workspace selection over the conventional cost-benefit approach. The rationale is that a decision-based approach allows simultaneous processing of objective and subjective decision factors, and risks and uncertainty at a given decision point in time. Also, a decision-based approach, because of its structure, facilitates the involvement of end users, i.e. knowledge workers, in the decision-making process, which is suggested as an important criterion for appropriate workspace selection. Second, from a practical standpoint, the objective is to aid facility decision-makers in making an informed decision about the choice of a workspace with consistency and rationality. In doing so, following research questions are addressed:

1. How does office noise, speech and sound affect office workers, in general, and knowledge workers in particular?
2. Given that the cost-benefit approach to selection of a workspace, i.e. open, closed, semi-closed, adaptable, and flexible, among other options, is inconsistent in reference to results presented through various studies, is there a way to rationalize the decision for choice of a workspace for a particular organization?
3. For knowledge-based organizations, is an adaptable workspace that provides user control over distractions more valuable than the predominant open workspace for organizational productivity?

In addressing the questions posed by this research, the following contributions are expected to be made:

- Create a framework for workspace decision-making that will improve decision-making, allowing the decision-maker to make better decisions with rationality and consistency.

This work will use multi-attribute utility theory to develop a mathematical framework for decision-making. An additional objective is to speed and simplify the decision-making process with respect to small variations in workspace alternatives.

- Build a strong theoretical framework for clarifying the relationship between auditory distractions (speech and sound), complex task, knowledge workers, and key design and environmental features of workspace.

The problem has been scientifically addressed in a number of academic domains from various perspectives; however, these still contains significant inconsistency, and the research is not integrated across disciplines to provide significant knowledge value. Therefore, to clarify the problem, the aim is to collate this knowledge and theories from different domains and sub-fields that are related but are thinly connected in the current literature.

1.5. Organization of the Dissertation

The dissertation is organized as follows: Chapter 1 provides the introduction, the problem statement, research motivation, dissertation objectives, and the organization of this dissertation. Chapter 2 describes the research design and methodology used throughout this research. Chapter 3 focuses on the theoretical background and reviews the current literature on non-auditory effects of auditory distractions, open-office settings, and behavioral aspects of workplace design and environment. This chapter also provides a list of factors that are important to workspace decision-making within the scope of the decision context that is specified in Chapter 2.

Chapter 4 is divided into two main sections. A discussion on multi-criteria decision-making (MCDM) is the focus of Section 4.2. Reasoning is provided for the appropriateness of selecting multi-attribute utility theory (MAUT) for this dissertation problem. Section 4.3 provides a discussion on the structure of the fundamental objective hierarchy for workspace choice, the attributes, and the measurement index.

Validation of the workspace choice objective hierarchy, attributes, and measurement scale developed in Chapter 4 is a prerequisite to further using this value structure for systematic multi-attribute evaluation of workspace alternatives; this is the focus of Chapter 5. This chapter explains how the expert-based Delphi study was designed, conducted, and results processed to validate the fundamental objective hierarchy for workspace choice (first step in applying MAUA).

Chapter 6 discusses various workspace alternatives that will be tested in Chapter 7.

In Chapter 7, the workspace choice objective hierarchy developed in Chapter 4 and validated in Chapter 5 is used to develop the multi-attribute utility decision model for workspace choice. This is followed by a multi-attribute evaluation of the five workspace alternatives discussed in Chapter 6. The chapter provides the results of participant preferences for workspace alternatives. Though the results will help verify the argument made in this study, namely, that for knowledge-based organizations, an adaptable workspace is valuable over more cost-effective open plan workspace. The results are not generalizable and are valid within the assumptions and limitations stated in Sections 7.3.1

and 7.3.2 of the Chapter 7. In Chapter 8, the rankings of workspace alternatives are validated using coefficient of correlation. The results provide credibility to the multi-attribute workspace choice utility decision model.

Chapter 9 summarizes the key findings, research conclusions, contributions to theory and practice, and discusses potential future research opportunities.

CHAPTER 2

RESEARCH DESIGN AND METHODOLOGY

2.1. Introduction

Chapter 1 provides an introduction to the research problem and discusses the need to develop a user-centered, workspace decision-making procedure. This chapter discusses the research design, which involves a five-stage approach, where each stage is designed to accomplish certain goals toward achieving the overall objective of the study. Both qualitative and quantitative research methods are used, and are driven by the specific goals of each stage and the overall research. Each stage is investigated with a specific data collection method and analysis, where robustness and validation of the methods are ensured using various techniques. The research is exploratory and empirical in nature.

2.2. Research Design and Data Collection Methods

There are three primary goals of this research study: exploration or discovery; model building; and model testing. Figure 2.1 presents the summary of the five stages of the study. Stage I is the literature review and analysis, following by Stage II that is divided into two sections. In the first section, literature on multi-criteria decision making (MCDM) techniques is analyzed and the second section is a developmental stage, where fundamental objective hierarchy for workspace choice decision model is designed. Stage III is the validation of the fundamental objective hierarchy for workspace choice and Stage IV is dedicated to the complex problem of evaluation of five workspace alternatives. Stage V validates the results of the workspace choice decision model. A brief description about each stage is provided in the next five sections of this chapter.

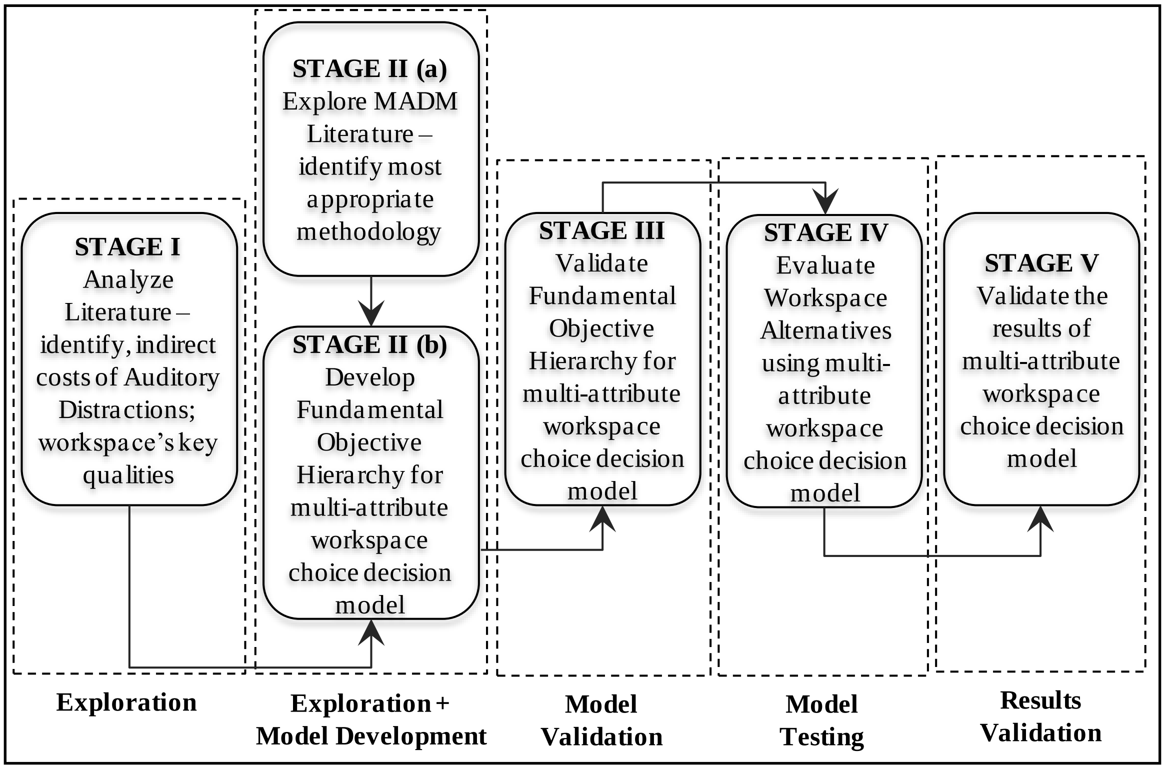


Figure 2.1 – Summary of 5 Stage Research Study

<u>2.2.1. Stage I – Literature Review and Analysis</u>

In Stage I, a comprehensive literature search is undertaken to build a theoretical background that supports the intended study rationale and appropriately places this study in the existing knowledge-base. Several literature search techniques are employed, such as forward-backward analysis, keyword search, key researchers, and key journals, to name a few techniques. The goal is to systematically understand fundamental issues of auditory distractions in open office settings and to understand the key workspace design features perceived the most critical by knowledge workers. The process reveals that the problem has been studied piecemeal in many different fields and sub-fields and covers a wide range of important factors; however, there is no single source that addressees all the issues in one place, nor is there one source that provides a systematic and holistic understanding of the issues stated above.

The literature review and analysis resulted in the following outcomes: first, it provided a holistic and systematic clarification of the fundamental issues with open office settings. Second, it highlighted the non-auditory effects of office noise and their significance for workspace decision-making. The effort resulted in a list of important factors that should be given due consideration when making workspace choice. These factors were an input to the next stage of the study. The process helped answer the following research question:

> *How does office noise, speech and sound, affect office workers, in general, and knowledge workers in particular?*

2.2.2. Stage II – Multi-Attribute Decision Making

During Stage I, the literature review showed that the traditional cost-benefit approach fails to consider many factors that are important for informed workspace decision-making, as these factors are mostly subjective in nature to which a dollar figure cannot be attached. The analysis revealed that the workspace decision problem involves multiple criteria. Therefore, during Stage II, literature on multi-criteria decision making (MCDM) techniques is analyzed to find the most appropriate methodology for this study. Multi-attribute utility theory (MAUT) is found to be the most appropriate match for this research problem as it allows analysis of both subjective and objective factors through one utility equation that provides ranking of options with rationality and consistency (Winterfedt and Edwards, 1986). Of special significance in utility assessment technology is the explicit inclusion of the preferences of the decision-maker and the treatment of the uncertainty associated with the consequences of a decision (Keeney and Nair, 1975). Consequently, development of the fundamental objective hierarchy for workspace choice (first step in MAUT process) is the next step during Stage II. The fundamental objective hierarchy is the hierarchy that arranges objectives from a broad, overarching concept at the top to lower-level, specific accomplishments or actions. Objectives are the explicit values that one desires to achieve. Objectives at the upper-levels of the hierarchy reflect broad or inclusive values and progress towards these objectives is achieved by meeting lower-level sub-objectives. The work during this stage helps answer the following research question:

> *Given that the cost effectiveness approach to selection of a workspace, i.e. open, closed, semi-closed, adaptable, and flexible, among others., is inconsistent in reference to results presented through various studies, is there a way to rationalize the decision for choice of a workspace for a particular organization?*

<u>2.2.3. Stage III – Expert-based Delphi Study</u>

The fundamental objective hierarchy developed in Stage II builds completely on the basis of the literature review, particularly the list of factors important for workspace decision-making generated in Stage I, and at the analytical discretion of the researcher. Therefore, the scientific enquiry deemed validation of the objective hierarchy. The obvious source of information and knowledge for this task is academicians and professionals who are recognized by others as experts or specialists in their field (Harman, 1975, Goodman, 1987). The areas of interest include auditory distractions, knowledge work, behavioral aspects of built environments, and corporate decision-making. Literature suggests many methods to approach experts in the field or academia, in order to seek their judgments or opinion about a topic of interest. Some of these are individual-based techniques, like face-to-face interviews or survey questionnaires, while others are group techniques. Group techniques are best suited for this study due to its inherent interdisciplinary nature, where the variables of interest are assembled from many different fields. Therefore, a group of experts are expected to provide a potentially better outcome than a single individual. The literature suggests many different methods for eliciting knowledge from expert or a group of experts. The most widely used methods - nominal group technique (NGT) and the Delphi method – are considered for this study (a detailed discussion about these methods is provided in Appendix K). Both the techniques help elicit individual judgments, combine them, and draw conclusions (Delbecq et al., 1975). Delphi method is selected for this study as it provides the advantages of independence of location, is economical, and preserves heterogeneity as individualistic factors, such as status, personality and assertiveness, do not influence the results.

2.2.4. Stage IV – Multi-Attribute Utility Analysis of Five Workspace Alternatives

Stage IV involves development of a multi-attribute workspace choice utility decision model such that multi-attribute utility evaluation is performed. Five workspace alternatives are chosen for this study; these alternatives differ in their control over distractions, support for the contrasting requirements of concentration and collaboration, and direct costs of workspace. Two groups of subjects, knowledge workers and decision-makers, are created to test if job role affects the preferences of subjects towards relative importance of attributes and satisfaction (utility) with workspace alternatives. The results help answer the following research question:

For knowledge-based organizations, is an adaptable workspace that provides user control over distractions more valuable than an open workspace for organizational productivity?

The following hypotheses are accepted or rejected in this dissertation. The verification of hypotheses H_0 to $H6_0$ is conditional to the assumptions and limitations stated in Sections 7.3.1 and 7.3.2 of the Chapter 7.

Hm_0: A structured decision-based procedure for workspace selection can be developed.

H_0: For knowledge-based organizations, an adaptable workspace is valuable over more cost-effective open office settings.

$H1_0$: Knowledge workers will have a strong agreement for attribute's relative importance for the decision problem; i.e., the inter-rater agreement index for attribute's relative importance for the decision problem will be >= 0.70.

$H2_0$: Decision-makers will have a strong agreement for attribute's relative importance for the decision problem; i.e., the inter-rater agreement index for attribute's relative importance for the decision problem will be >= 0.70.

$H3_0$: Knowledge workers and decision-makers will show similarity in their relative importance of various attributes for the decision problem.

$H4_0$: The two groups provide similar expected utilities to five workspace alternatives; i.e., the job role will not affect a subject's relative satisfaction with a workspace.

$H5_0$: Knowledge workers will have a strong to very strong agreement for the ranking of the five workspace alternatives; i.e. within group concordance coefficient for ranking of five workspace alternatives will be ≥ 0.7.

$H6_0$: Decision-makers will have a strong to very strong agreement for the ranking of the five workspace alternatives; i.e. within group concordance coefficient for ranking of five workspace alternatives will be ≥ 0.7.

2.2.5. Stage V – Validation of the Multi-Attribute Workspace Choice Decision Model

The results of Stage IV lose their scientific importance if they are not validated against some known criteria. This is the objective of Stage V of this study, which concludes this study. However, this is the beginning of a novel approach to workspace decision-making and should be explored further for application in various areas, such as evaluation of sustainable indoor environments for knowledge-enterprises and healthcare facilities, to name a few areas of exploration.

2.3. Human Subjects Review

Whenever a study involves interaction with human subjects, it requires that the participants' rights and welfare be protected. As a result, most human subject studies require approval from an Institutional Review Board (IRB) and informed consent from the research subjects. An application was prepared and submitted to the IRB at Georgia Institute of Technology for approval for the study. The following documents were attached with the application: e-mail invitation to subjects (Appendix A); consent form (Appendix B); dissertation proposal; outline of survey instruments (Appendix C, E, F(b)); and demographics information form. After receiving the approval notice from IRB, the Delphi panel members were sent an e-mail invitation. The launch of Phase I of the Delphi study contained a consent form. The consent form clearly stated that participation is voluntary and confidentiality and integrity will be maintained. The participants were also assured that no risks were involved and the data will be used for dissertation purposes only.

2.4. Summary

This chapter has provided an overview of the research methodologies used throughout this study. More specific methodological details for each phase of the study are further described in the following chapters. Chapter 3 deals with Stage I of the study, which involves developing a theoretical knowledge base for this study, as well as identification of factors that have significant implications for workspace decision-making.

CHAPTER 3

STAGE I - THEORETICAL BACKGROUND AND REVIEW

3.1. Introduction

As discussed in Chapter 1 and Chapter 2, this study draws on theories and knowledge from a number of academic disciplines, including architecture, neurology, psychology, and social science, to name a few; while these sources provide the framework for this study, they are loosely connected in the existing literature. The aim of this chapter is to create a comprehensive knowledge base that provides a holistic and systematic understanding of the issue of auditory distractions in open office settings. Furthermore, it explores the issue of fulfilling two contrasting requirements of concentration and collaboration in the same workspace and work environment at a given time, within the context of a knowledge-based economy that increasingly relies on knowledge workers. This review of the literature will address the criticality of the issue and will also guide the current research in a more scientific way, adding credibility to the study. The research goal is to establish recommendations and propositions that are in synchronization with the transforming nature of work, workers, and work environments. In this age of enterprise transformation, this require an integration of built systems with work processes and work types, rather than built systems standing alone with limited or no capability to be responsive to the dynamic functional, psychological, and physiological needs of the user [for more on enterprise transformation, see (Rouse, 2005)] .

Consequently, the literature for this study is investigated from three key perspectives, as shown in Figure 3.1. Each perspective is described in subsequent chapter sections. The goal is to provide a deeper understanding of the three key perspectives in their own context; in addition, the goal is to formulate a holistic connection in the wide theoretical base covered in this study.

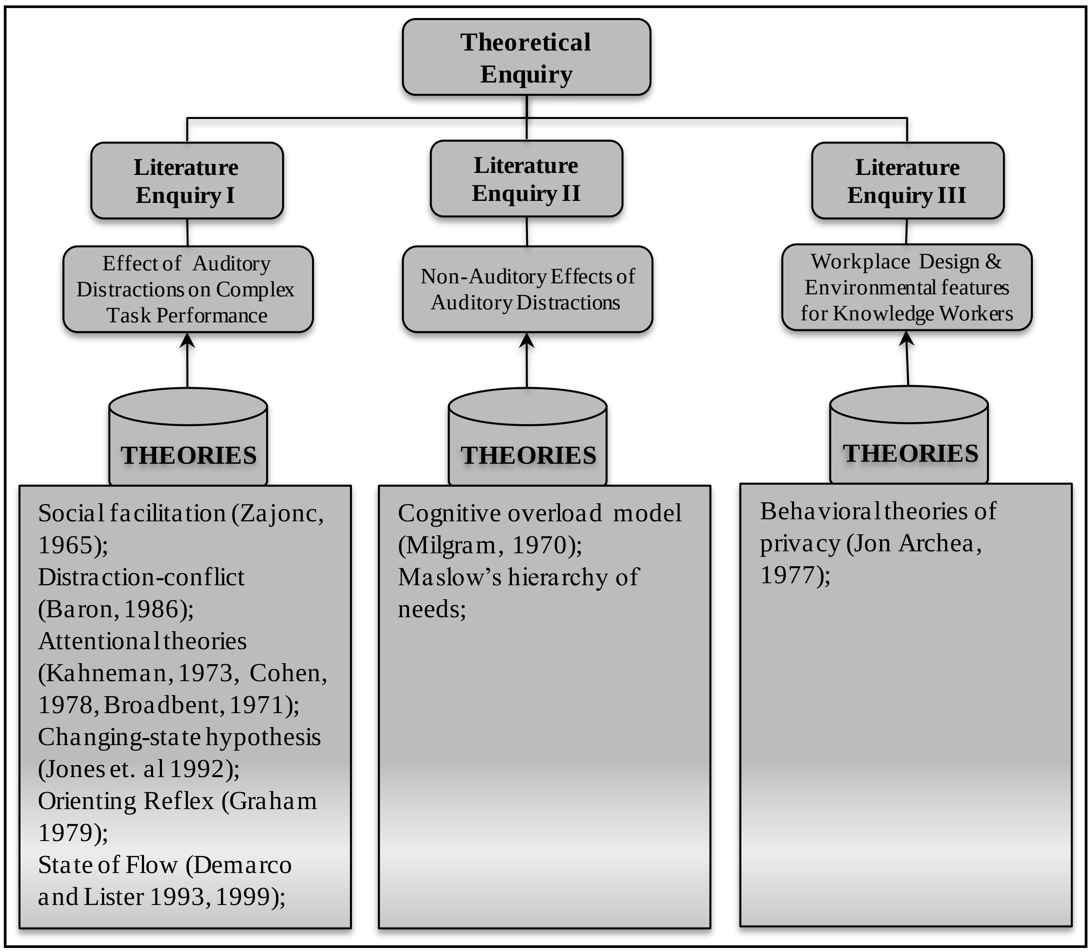


Figure 3.1 – Framework for Literature Analysis

First, literature dealing with auditory distractions, including both speech and sound, and task performance is explored in Section 3.2. The knowledge contributing domains are mainly neurology, ergonomics, architecture, and psychology. These studies are mostly laboratory experiments involving human volunteers and field studies, starting in 1958 until today. The noise parameters that have been repeatedly discussed in this literature are: intensity or level; duration of the noise; meaningfulness, such as forward speech, backward speech, random words, and sentences from news; intermittency (changing state hypothesis); periodicity; and spectrum. In addition, the types of auditory distractions are mainly irrelevant office noise containing speech and non-speech, music, tones, and babble.

The second category of literature explored in Section 3.3 involved studies on auditory distractions in open office settings. Through this literature, "non-auditory effects (Smith, 1991, p. 49)" of office noise on office workers are explored. These studies mostly address issues like job performance, environmental satisfaction, job satisfaction, stress, and privacy, to name a few concerns. The knowledge contributing domains are mainly social science and architecture. Performance effects discussed separately in Literature I are also non-auditory effects of office noise; however, these are dealt as a separate section because this area of research has received such a great deal of attention in social and psychological sciences, that it necessitates a separate enquiry.

The third category of studies involved those that focused on identification of workplace design and environmental features that are perceived as most critical to job performance and overall satisfaction; thus, these are the most desirable requirements of users from their workspace. This area of study is described in Section 3.4.

3.2. Literature I – Auditory Distractions and Task Performance

A number of distractions are occurring per second in today's work environment; such as distractions due to technology, environment, and social events, to name a few sources of distractions. The total financial impacts of these distractions are not just the actual time spent but also the time to regain the train of thought on a task, particularly complex task. Basex, a knowledge economy research and advisory firm, reports that the costs of distractions and interruptions to the U.S. economy are $588 billion per annum (Spira and Feintuch, 2005). The aim of Literature I is to understand one of the most reported forms of distractions in office settings: the auditory distractions coming from surrounding work environment and their significance for knowledge work. However, before entering into a discussion on auditory distractions, it is imperative to first discuss some important theories of distractions.

3.2.1. Theories of Distractions

Research on distractions date back to Zajonc (1965), who drove social facilitation research (first published in 1898 by Norman Tripplet) in a novel direction. Zajonc supported the fundamental concept of social facilitation, which means presence of individuals in one's environment serves as a source of arousal. Zajonc experimented on several different species that includes laboratory rats and cockroaches, where he showed that arousal increases the chances that a living-being will make well-learned responses. The social facilitation theory explains the connection between performance and arousal and discusses performance improvement on simple tasks and impairment of performance on complex tasks. This coincides with Yerkes-Dodson law, which explores the arousal-performance relationship, and states that level of arousal for performance on a task and task difficulty are inversely correlated. This means that, to achieve optimal performance on complex cognitive tasks, a lower level of arousal may facilitate concentration; whereas tasks demanding perseverance may be conducted more effectively with higher levels of arousal. In the case of complex tasks, like problem-solving, analytical reasoning or reading comprehension, effective performance requires the performer to use more cognitive processes to think and act beyond well-learned and seasoned behaviors. This exerts pressure on cognitive resources; a simultaneous increase in arousal due to social facilitation also taxes cognitive resources, thereby causing the cognitive process efficiency to drop. The hypothesis is further supported by the Groff et al. (1983) study which found that the presence of co-actors and audiences facilitate simple tasks while impairing performance on complex tasks.

Research in this area was further advanced in another direction by Baron (1986) who proposed a distraction-conflict theory to provide an attentional conflict explanation to social facilitation, rather than the arousal explanation proposed by Zjonac. Baron integrated his theory with attentional theories (Broadbent, 1971, Kahneman, 1973, Cohen, 1978) to explain why distraction and attentional conflict facilitate simple task performance and impairs complex task performance. Distraction-conflict theory states that distractions cause attentional conflict, which acts as a partial mediator to cause social facilitation or social impairment. Attentional theories state that because distractions taxes attentional capacity, it increases attentional overload. This overload causes individuals to take cognitive short-cuts, which helps them conserve their limited attentional capacity. The cognitive short-cuts result in usage of stereotypes, prior experiences, etc.; these short-cuts improve performance on well-learned or simple tasks. However, they limit an individual's cognitive exploration abilities for performance on complex tasks, which require an individual to go beyond simply putting pieces together. The phenomenon is called cognitive economy and it is more likely to occur in distracting settings that tax attentional capacity. Baron (1986) further corroborated his hypothesis by documenting that "in short, there seem to be at least 16 studies that demonstrate that distraction can either facilitate simple task performance, increase performance on tasks facilitated by other stressors, or impair complex task performance" (p. 13).

Furthermore, Cohen (1978) supported Baron's (1986) theory by stating that a complex task requires processing of a wide range of cues or stimuli at the same time. Therefore, by restricting attention to the center or by focusing the attention due to attentional overload, a performer tends to leave out crucial stimuli that must be processed for successful complex task performance. On the other hand, only a few stimuli or cues are required to perform on a simple task. Therefore, by focusing attention on the most central cues, the performer screens out non-essential stimuli that take time away from the task at hand, thereby resulting in performance enhancement.

Since these theories were initially developed, the topic of distraction has been dealt with in a number of different research domains from multiple perspectives. Several definitions of distractions and interruptions are available in the literature, as shown in Table 3.1. Some of the definitions refer to interruptions rather than distractions, as stated in Table 3.1. Both are included for real-world conditions in which either distractions or interruptions can affect work performance; for example, whether an interruption causes a distraction from a primary task or a distraction causes an interruption in an ongoing activity, both eventually result in performance impairment on complex tasks.

Many studies precisely define distraction as an annoying driver for directing the attention away from an ongoing activity; and consider interruptions as “severe attentional distractions that can place greater demands on cognitive processing resources” (Speier,et al., 1996, p.22). Because of its characteristics, interruptions can be considered more disruptive than distractions. However, the result is: whether a break from an ongoing task is due to an interruption or a distraction, a common feature in the literature is attentional capacity overload, which is shown to cause cognitive disruption.

Table 3.1 - Definitions of Distractions and Interruptions

Study	**Definitions of distractions / interruptions**
(Baron, 1986)	Distraction is a “manipulation that taxes attentional capacity leading to the organism to make priorities, take cognitive shortcuts, and ignore certain stimuli and tasks” (p. 29).
(Cohen, 1980)	Interruptions are “uncontrollable, unpredictable stressors” (p. 82) that produce “information overloads” (p. 97).
(Covey, 1989)	Interruption generally demands “immediate attention and insists on action” (p.150).
(Coraggio, 1990)	Intermittent interruption – “externally-generated, randomly occurring, discrete event that breaks continuity of cognitive focus on a primary task” (p. 19).

The next section presents discussion on various categories and types of distractions occurring in today’ work environments; the scope of distractions for this study is also highlighted.

3.2.2. Distractions in a Work Environment

Distractions in a work environment are a common phenomenon that can be caused by many factors, like noise, anxiety, stress, temperature, poor appraisal, and new organizational policies, to name a few factors. Research shows that the impact of distractions is either social facilitation caused by arousal or social impairment caused by overload. According to the literature, some of these distractions are internally generated; for instance, Mark et al. (2005) argue that checking an email as soon as it arrives – even though it may disrupt a task -- gives a person instant gratification for getting that email out of way. Other distractions are externally generated by and in the surrounding environment (Mark et al., 2005); for instance, distractions resulting from background noise, inappropriate lighting, views, and less desk space. These are generally facilitated or inhibited by workplace architecture, the built environment and its technology, and organizational policies. In addition, some distractions are voluntary, like a person leaving his chair for a short break, while others are involuntary, like a colleague stopping by a person's desk to inquire about evening plans. In any case, of all the distractions taking place in and around individuals in open office settings, auditory distractions are repeatedly shown to be of significant cause of stress, frustration, performance impairment, and anger to knowledge workers (Sanders, 1981, Moore, 1977, Baron et al., 1978, Sanders and Baron, 1975). These negative effects are a significant financial concern for knowledge-based organizations.

Based on the existing literature and the above discussion, a comprehensive workplace distraction model is prepared, as shown in Figure 3.2. The grey highlighted portion of the model presents the scope of this study which focuses on auditory distractions that originate in a knowledge worker's surroundings; these include both speech and sound. In this study, these distractions are called externally generated involuntary auditory distractions, abbreviated as EGIAD. In summation, the main characteristics of these distractions are: they originate in the workplace environment; occurrence is random, i.e., they can occur anytime; distractions are discrete, i.e., they have a start time and an end time; knowledge workers have no control over them; and typically their impact is attentional overload.

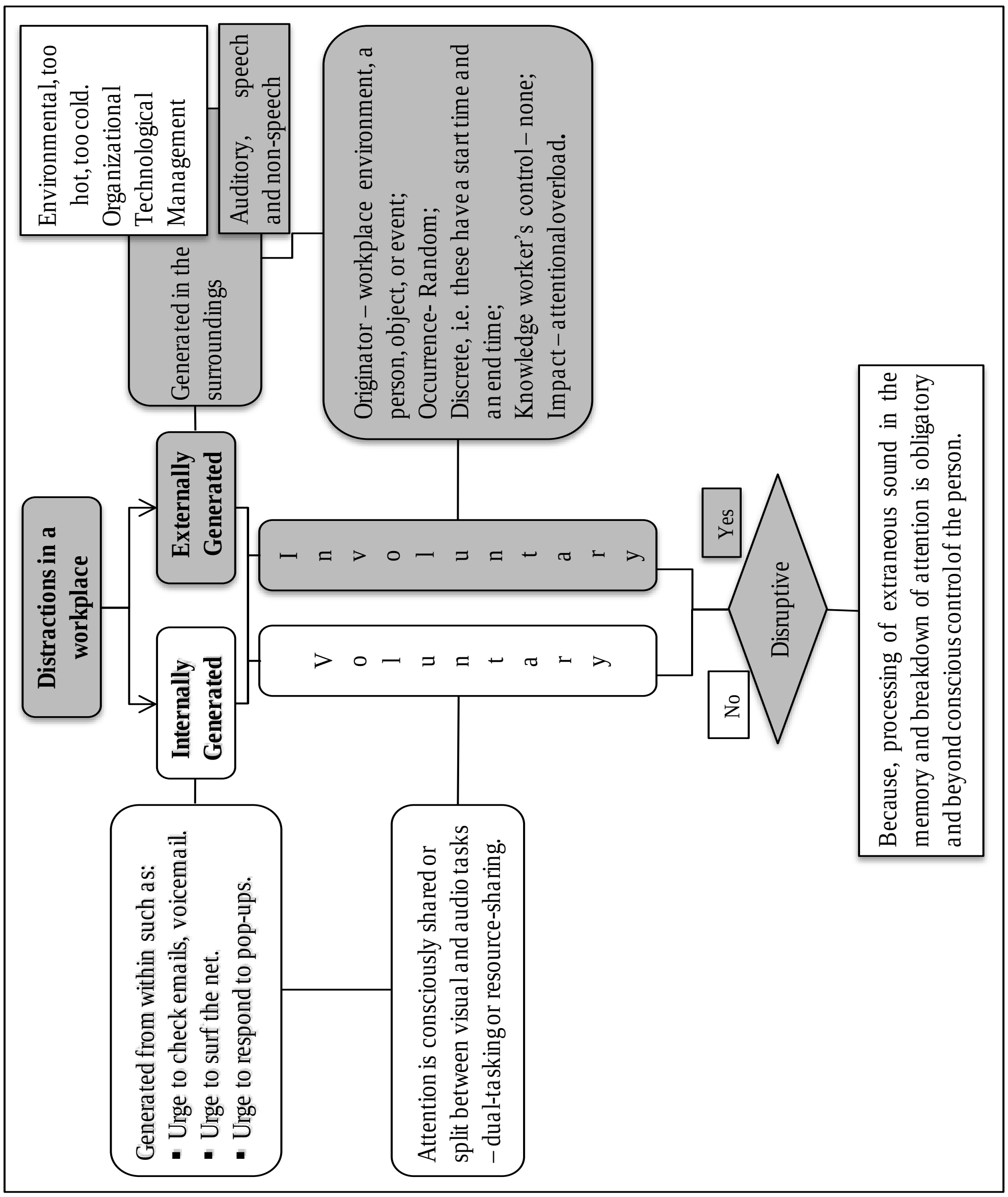


Figure 3.2 - Workplace Distraction Model

In the above discussion on distractions, it is made clear that distractions are a cause of concern for complex tasks only; distractions can facilitate simple tasks because they cause attentional focus. In order to establish a connection between this theory about distractions and knowledge workers, it is important to more clearly describe what is meant by complex tasks and to describe how knowledge worker's tasks are complex. The next section discusses complex tasks.

3.2.3. Complex Tasks

A number of studies have shown that distractions cause performance impairment on complex tasks. Since knowledge workers are generally charged with complex tasks, these complex tasks are the key link in the negative relationship between distractions and knowledge workers.

A number of studies provide definitions and models for task categorization. Campbell's (1988) task complexity model is selected because it provides a comprehensive, objective definition of task complexity. This model is formed by integrating constructs from at least three major bodies of relevant research literature, including: information-processing and decision-making literature; task and job design literature; and the goal-setting research literature. According to Campbell's model, task complexity can be defined objectively without being influenced by the subjective experiences of a task-doer. The measures of task complexity as suggested by Campbell (1988) are information load, information diversity, and the rate of information change. Any task feature that results in a high level of any of these three measures contributes to an increase in task complexity. Guided by the vast literature, Campbell (1988) identifies four basic task attributes A1 through A4, shown in Figure 3.3, that often imply high levels of information load, diversity, or rate of change. The presence of any or all the four attributes (A1 to A4) may result in additive or associative implications for the overall nature of the task. A simple task is defined as one that contains none of the four complexity attributes. Furthermore, depending on the attributes contributing to an overall task, Campbell (1988) created a typology of complex tasks; in this typology, all complex tasks can be further subdivided into total four categories namely: decision tasks, judgment tasks, problem tasks, and fuzzy tasks. The definitions and attribute contribution for each type of task is shown in Figure 3.3, which presents a consolidated model for Campbell (1988) complex task definitions, measures, and classification.

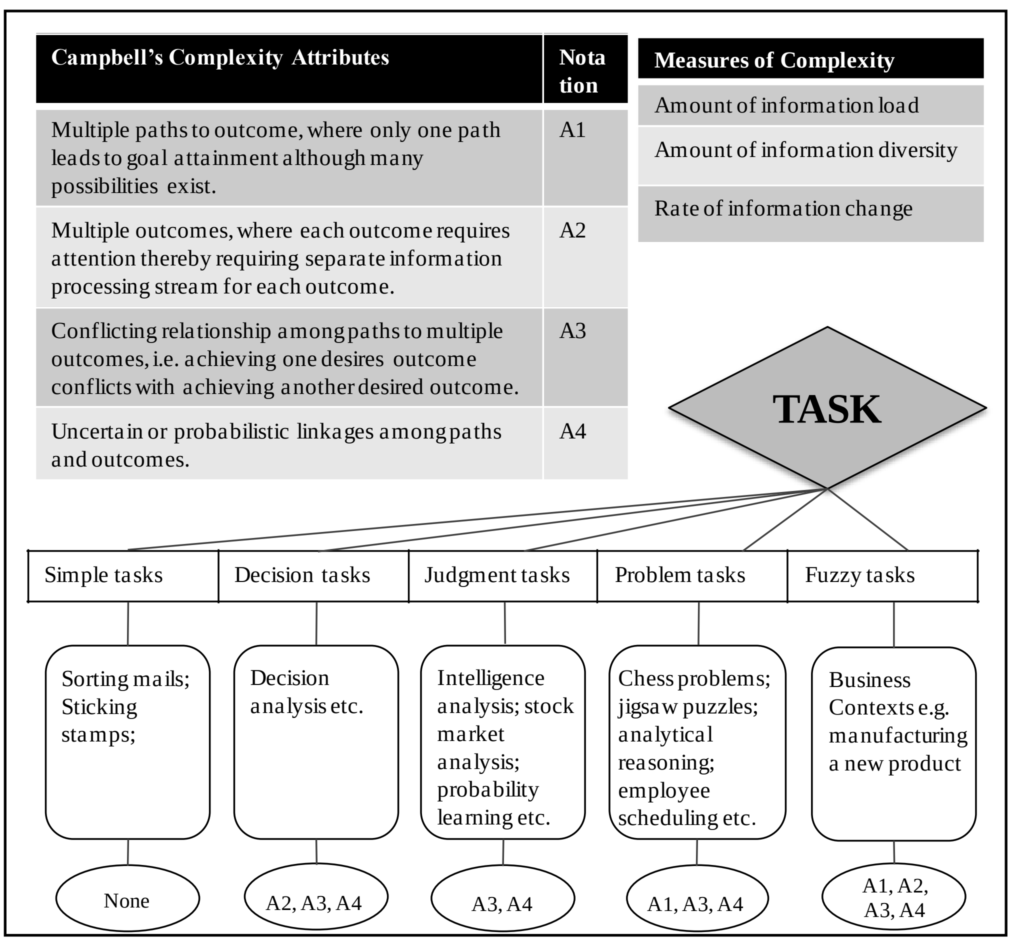


Figure 3.3 - Author's Consolidated Model for Campbell's Task Complexity

Figure 3.3 outlines the common types of tasks that knowledge workers perform in their every day work routine, depending on their role or responsibility in an organization. For instance, a stock analyst often makes judgment calls about the performance of stocks in a market, or a programmer is often engaged in a problem-solving puzzle to achieve an optimum output. In addition, it is important to mention that objective complexity of a task, as suggested by Campbell's (1988) complexity classification model, also interferes with the subjective interpretation of a task-doer. For instance, a person's familiarity with the task, resource availability or constraints, or technological limitations may moderate the relationship between objective and experienced complexity. However, Campbell's complexity classification model is comprehensive enough to categorize a knowledge worker's task as simple or complex.

Furthermore, complexity of a task should not be confused with a difficult task, as the relationship between the two is unidirectional. A complex task is, by definition, difficult, but a difficult task may or may turn out to be complex (Huber, 1985, Campbell and Ilgen, 1976, Early, 1985, Taylor, 1981). For instance, mowing a lawn is a difficult task, as it requires a lot of physical effort, but it is not a complex task. Alike, developing a decision support system for intelligent facility decisions could be a complex challenging task, but may or may not be a difficult one.

Discussion on complex tasks can still go on; however, sufficient information is provided in the above section to be able to categorize a task into a simple or a complex task. The focus now shifts to the relationship between distractions (externally generated involuntary auditory distraction) and their influence on performance of complex tasks.

3.2.4. Influence of Distractions (EGIAD) on Complex Task Performance

As stated in section 3.2.3., externally generated involuntary auditory distractions (EGIAD) are the extraneous speech and sound in ones surrounding work environment. The main characteristics of these distractions are: they originate in ones surroundings; occurrence is random, i.e. they can occur anytime; distractions are discrete, i.e. they have a start time and an end time; generally knowledge workers have no control over them; and they result mostly in attentional overload.

The literature on the disruptive impacts of auditory distractions on complex task performance has established theories and replicable validation of interference effects of sounds on cognitive processing. There is a key link between this body of research and its theoretical and practical implications for workplace architecture and the built environment. However, in spite of being apparent, this relationship has not yet been explored and analyzed scientifically, nor have the results been documented. This study fills this gap so that decisions about workplaces for knowledge-based organizations are guided by a well-established theoretical background and scientific knowledge base about costs of auditory distractions for such organizations. Figure 3.4 shows the number of studies and respective domains that provided knowledge for this section.

It is important to note that the field of Facility Management is far behind other domains, despite the fact that Facility Management is a “profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process, and technology” (IFMA). This study is a significant contribution to knowledge in the area of Facility Management.

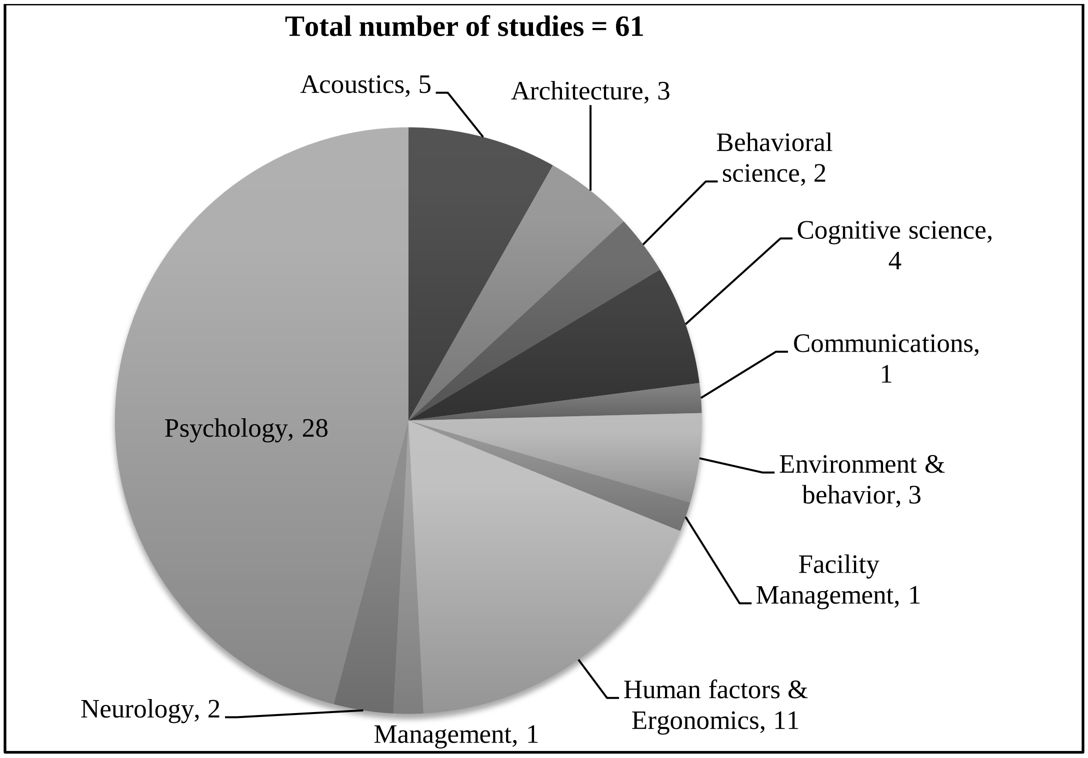


Figure 3.4 - Knowledge Imparting Domains and Number of Studies

A number of researchers discuss that the performance on complex cognitive tasks is significantly disrupted by surrounding noise, also called office noise in the literature, with people conversing in the background being the most disruptive and bothersome. In all, 61 studies were reviewed; in these studies, different types of tasks that are closely representative of real world office tasks are investigated to understand the impact of auditory distractions on performance, measured generally as the number of errors or accidents. Figure 3.5 shows the number of studies that have investigated different complex tasks. Most research has focused on memory recall tasks; however, almost all the tasks investigated involve memory and seriation at some instance during the task performance. The majority of the studies explore the same phenomenon, called irrelevant speech effect, as introduced by Colle and Welsh (1976). These are discussed in detail in the next section on irrelevant speech effect.

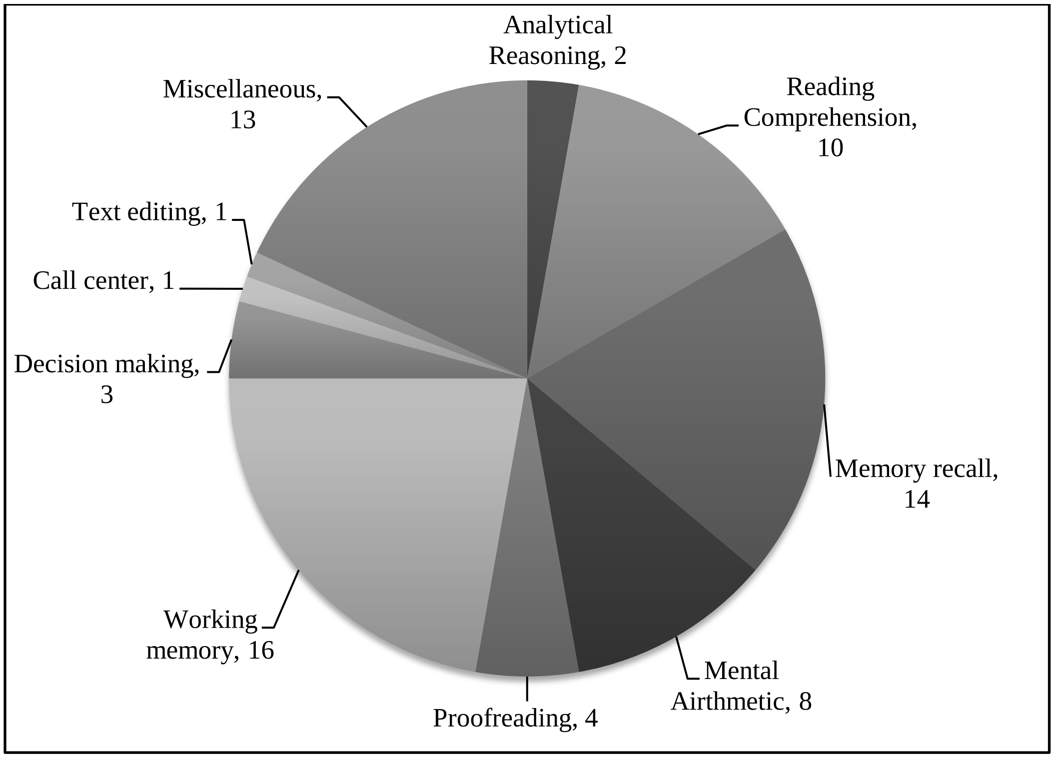


Figure 3.5 - Types of Complex Tasks Investigated in the Literature

3.2.4.1. Irrelevant Speech Effect and Complex Task Performance

Studies of irrelevant speech effect require that a short-term visual serial recall task is conducted in the presence of an auditory distraction and participants are asked to ignore any sound they hear. This is because the sound is irrelevant to the task at-hand. The impairment of the task performance, measured as errors in serial recall, validates the negative impacts of speech on performance. The results are also further validated for free recall tasks. Researchers have suggested that similar results are obtained because order (serial) information is used as a cue to remember the item information.

Consequently, because order and short-term memory are key features of knowledge work and changing auditory streams are a key feature of open office settings, it is therefore imperative and timely to understand and establish this link between knowledge work and auditory distractions in the office environment. The implications are for workspace decision-making since knowledge workers, who are mostly involved with knowledge work, are shown to be the most critical assets of knowledge-based organizations. Jones (1993) furthered this understanding by extending the scope of noise from speech to any sound coming from the surrounding work environment. He called it irrelevant sound effect. This is discussed in the next section.

3.2.4.2. Irrelevant Sound Effect and Complex Task Performance

The next set of studies in this area of research found that non-speech sounds like pure tones (Jones and Macken, 1993, Neath et al., 1998), instrumental music (Salame and Baddeley, 1989, Nittono, 1997), clicks and bangs, or pitch glides (Jones, 1993), also profoundly disrupt task performance. By incorporating the negative impacts of non-speech sound, Jones (1993) advanced the irrelevant speech effect phenomenon as irrelevant sound effect. According to irrelevant sound effect, office noise, speech or non-speech, disrupts performance of visual serial recall tasks due to the interference induced by segmented, changing states of sounds reaching one's ears. Jones et al. (1992) and LeCompte (1995) called this phenomenon changing-state hypothesis. Changing-state hypothesis states that the primary task is disrupted if there is a change in state between successive auditory streams, i.e., the more is the degree of change in the irrelevant sound sequence, the more is the disruption (Jones et al., 1992a). For instance, a rhyming irrelevant sequence, like sea, flea, key, proves to be much less disruptive than dissimilar sequence, like hat, cow, nest. In addition, Jones (1999) also showed that there is an upper limit when the degree of change in auditory stream becomes so much that, although the sequence of events are recognizable, they are so unconnected that the information about their order is relatively impoverished. This results in a diminishment of the interference of these extraneous sounds with performance on the primary task at-hand. It is clear that speech is not the only category of sound that is disruptive for performance efficiency. Music, pitch glides, and tones, which are generally adopted to mask surrounding noise, also interfere with performance on complex tasks. Thus, sound and speech alike bear financial consequences for knowledge-based organizations.

Research on validation of irrelevant sound effect is not limited to memory tasks only; several studies have explored tasks involving cognitive aptitude, like analytical reasoning, reading comprehension, mental arithmetic, and proofreading that are representative of real world knowledge work. For instance, Witterseh et al. (2004) and Evans and Johnson (2000) reported that participants performed worse on various tasks involving proofreading, addition, and creative thinking when distracted by irrelevant speech or intermittent noise, such as telephone ringing, even when they were told to ignore the source of noise. Similarly, Zijlstra and Roe (1999), in their study of the effects of interruptions on cognitive performance on text editing tasks and well-being, found that interruptions have a negative impact on emotional well-being and lead to an increase of efforts to account for performance decline. However, with an increase in the number of interruptions during a day, the resumption time, i.e. the time needed to re-start the task execution, becomes disproportionally longer. This impact is described in terms of decreasing motivation and mental fatigue. In line with this theory, Vilimek and

Hempel (2005) concluded that text memory, i.e., the memory that remembers the text to use in the task at-hand, is susceptible to background sound, regardless of whether the sound consists of speech or the music. This finding was confirmed by Vilimek and Hempel (2005) in their study of the impact of speech and non-speech sounds on short-term memory and possible implications for automobile drivers. The results indicate that long speech messages have a significantly detrimental effect on short-term memory performance, leading to longer response times and increased cognitive efforts.

It is clear that the cause of disruption in all the above discussed tasks is order information, since most of these tasks involve some form of seriation (order) or at least maintenance rehearsal (Beaman and Jones, 1997); however, it is also suggested that the extent of disruption depends on the amount of seriation involved. For instance, the effect of irrelevant speech on free recall is relatively smaller than the serial recall, and this effect is attributed to the fact that order information acts as a cue to remember the item information (Beaman and Jones, 1998, LeCompte, 1994, Richardson, 1984, Salame and Baddeley, 1990).

In addition, many studies have shown that distractions from intelligible and irrelevant conversations – for instance, people talking about sports, politics, personal relationships, or movies – are the most disturbing and are unacceptable (Keighley, 1970, Kjellberg and Landstrom, 1994). Keighley (1970) showed that distinctive sounds, i.e., sounds above the ambient level, were least acceptable to the 2,000 office workers in all 40 offices that were investigated in the study. In line with these issues, Olson (2002) showed that, on average, people spend about 25 percent of their time talking in and near individual workspaces, which disrupts the concentration of people working in adjoining workspaces. While some of the conversations are business critical, others are personal and distracting. In either case, the impact is the same – reduced ability for the adjacent workers to concentrate on the task at-hand.

Research has also shown that irrelevant sound effect occurs regardless of sound pressure level. A whisper, 48 dB(A), is as disruptive as a shout, 76 dB(A) (Colle, 1980, Ellermeier and Hellbruck, 1998, Salame and Baddeley, 1987). This is an important point to be considered in the decision-making process for workspace choice and design of built environment. Role of meaning of speech in seriation tasks is alike sound pressure level, as different kinds of meaningless manipulated speech, like forward speech, reverse speech, and foreign language speech, all are shown to produce interference in memory processing (Jones et al., 1990, LeCompte et al., 1997, Salame and Baddeley, 1987, Salamé and Baddeley, 1982). However, if tasks involve meaning, like reading comprehension, proofreading, etc., then the meaning of irrelevant speech further adds to the disruption of primary task performance (Jones et al., 1990, Martin et al., 1988). Tasks that are devoid of memory and seriation, like sentence acceptability tests (Boyle and Coltheart, 1996), and perceptual tasks (Baddeley and Salamé, 1986, Burani et al., 1991), are shown to be immune to extraneous sound disruption. Summarily, these studies suggest that the key properties of tasks that are susceptible to interference are memory and seriation.

Furthermore, a number of studies, both experimental and observational, show that irrelevant sound effects do not subdue with time and sufficient exposure (Nemecek and Grandjean, 1973b, Tremblay and Jones, 1998), i.e., habituation doesn't seem to come into play with respect to irrelevant sound effect. Although, some studies Banbury and

Beery (1998) and Morris and Jones (1990) have also shown significant habituation or reduction in interference after 20 minutes of prolonged exposure to irrelevant sound, the majority of the evidence, however, supports the non-evading characteristic of irrelevant speech effect. Studies on this topic of research, however, do not end here. A few more theories that require attention in this dissertation are noted in the next section.

3.2.4.3. Additional Relevant Theories

Additional research has further explored the affect of auditory distractions on task performance. Purcell and Thorne (1977) showed that while working on complex tasks, such as, problem solving, computation or analytical reasoning, irrelevant speech and sudden changes in noise in the background interrupts a chain of thought, resulting in performance impairment. Graham (1979) described this as an "orienting reflex"; according to which, any change in environment, for instance an onset of conversations in one's surroundings, may result in attentional response involving a redirection of the sense organs towards the source of sound and a series of physiological responses lasting one or a few seconds. Further evidence is provided by Demarco and Lister (1993, 1999): "the state of flow, which states that performance on complex tasks, such as reading, designing, decision-making, programming, writing, and editing involve a continuous and delicate state of concentration." Once concentration is disrupted, it can take 15 or more minutes to reach the same state of concentration again. This flow is easily broken by distractions such as irrelevant speech. Mark et al. (2005) reported that, because knowledge workers are mostly multi-tasking, any distraction, on average, costs at least 25 minutes before returning to the primary task or the original primary task was never returned to on the same day. The interruptions generally include: coworker visits, which increase due to the increased accessibility in open office settings; environmental distractions, such as overhearing conversations, being called away or leaving voluntarily; arrival of an email; commencing a new task on the computer; and receiving a phone call, to name a few.

All these studies are of theoretical interest because they are representative of the cognitive costs that are incurred due to extraneous variable and meaningful auditory distractions. In addition, these research studies cumulatively corroborate this study's guiding assumptions – that, in open office settings where the probability of distractions is high, there is a high probability of reduced performance and, thus, reduced net revenue.

A number of studies have documented the financial effects of auditory distractions coming from surrounding work environment on task performance. Basex reports the costs of these distractions along with other sources of interruptions as $588 billion per year. This estimate is based on an average salary of $21 per hour per knowledge worker. However, this is not the only issue; office noise is shown to cause many other non-auditory effects that are of significant concern to knowledge workers and knowledge-based organizations. This is the topic of the next section that further discusses open office settings, in order to establish the relevance of decision-based workspace selection.

3.3. Literature II –Non-Auditory Effects of EGIAD

Before beginning a discussion about the issues of auditory distractions in open office settings, a brief overview of the history of open office settings is provided. The aim is to understand how and why open office settings came into being, and why they became more of a problem rather than a profitable asset as originally envisioned.

3.3.1. Open Office Settings

In 1950, Eberhard and Wolfgang Schnelle conceived and designed the revolutionary office with movable screens, furniture, and planters, and called it 'Burolandschaft' meaning the office landscape. The motivations behind this invention were two-fold: one, to provide an extremely flexible and easily-reconfigurable work environment that can be transformed to meet the fast-paced, rapidly changing demands of organizational world. And two, to create an egalitarian system with equal working conditions for all employees. The intent is to facilitate social cohesiveness and horizontal functional communication among all levels of employees, i.e. between engineers and sales professionals, between sales and production engineers, or between top management and every subordinate work group. A number of variations of the original Burolandschaft, like cubicles, bull-pens (desks are arranged in neat rows), and shared open workspaces, etc., have evolved globally over the years; nevertheless, their shared design characteristic is an absence of a floor-to-ceiling partition.

Although several benefits have been cited for open office settings, employees working in these settings have not shared the same level of enthusiasm for this particular work environment. The most frequent and the most critical of complaints include issues with auditory distractions, such as people talking or phones ringing, which cause unnecessary stress, fatigue, annoyance, and frustration, to name a few problems. Researchers define these issues as non-auditory effects of office noise. With employees, i.e., knowledge workers, becoming the most critical assets of knowledge-based organization, these issues eventually become costs to an organization, negatively impacting their financial bottom line. Therefore, in today's organizational world, where most of the work is knowledge-based, non-auditory effects of auditory distractions, i.e., office noise containing both speech and sound, in open office settings cannot be ignored. These are discussed in detail in the following sections.

3.3.2. Non-Auditory Effects of EGIAD in Open Office Settings

Background noise, both speech and non-speech, is reported as one of the most common form of distractions in open office settings (Banbury and Berry, 1998, Boyce, 1974, Keighley and Parkin, 1981, Klitzman and Stellman, 1989, Morris and Jones, 1990). Literature on open office settings highlights the serious non-auditory implications of working in such environments. Some of the studies talk about issues in terms of short-term reactions, such as: increased distractions, both visual and auditory (Brookes and Kaplan, 1972, Brookes, 1972, Canter, 1972, Hedge, 1986, Hundert and Greenfield, 1969, Ives and Ferdinands, 1974, Manning, 1965,1966, Nemecek and Grandjean, 1973a, Oldham and Brass, 1979, Sundstrom et al., 1980); increased cognitive loading (Becker et al., 1983, Block and Stokes, 1989, Oldham and Brass, 1979); frequent interruptions by colleagues (Hedge, 1986, Hundert and Greenfield, 1969, Oldham and Brass, 1979); difficulty concentrating; increased physical stress (Brennan et al., 2002); increased psychological stress (Evans and Johnson, 2000); lower motivation (Oldham and Brass, 1979); and reduced social facilitation and interactions (Brennan et al., 2002, Cohen, 1978, Wineman, 1986, Bencivenga, 1998). Another problem with open office settings concerns lack of privacy, both visual and auditory or both psychological and architectural; research findings have shown a high correlation between architectural privacy (AP) and psychological privacy (PP), even among people with least complex jobs (Brookes and Kaplan, 1972, Brookes, 1972, Croon et al., 2005, Hedge, 1986, Hundert and Greenfield, 1969, Sundstrom et al., 1980, Sundstrom et al., 1982, Zalesny and Farace, 1987, Riland, 1970). These problems, in turn, are shown to result in long-term effects, including reduced individual performance (perceived or actual) on complex tasks (Becker et al., 1983, Brennan et al., 2002, Hedge, 1982); reduced team performance; reduced environmental, functional, and social satisfaction (Brennan et al., 2002, Croon et al., 2005, Marans and Yan, 1989, Oldham and Brass, 1979, Spreckelmeyer, 1993, Sundstrom et al., 1994, Zalesny and Farace, 1987); weak interpersonal relations; and increased health problems (Hedge, 1986). Furthermore, Sundstrom et al. (1980) showed that employees with the most demanding jobs (characteristics of knowledge work) were the ones who were most negatively affected by office noise. Brennan et al. (2002) reported that negative impacts, like increased physical stress, disturbed relations among team members, and lowered perceived job performance among others does not abate over time, suggesting that habituation doesn't take place. The finding is well-supported by a number of studies from psychological sciences that document dishabituation to irrelevant sound effects over a period of time.

On the whole, literature on non-auditory effects of office noise can be divided into three major categories: psychological effects of office noise; physiological effects of office noise; and effects of noise on social behavior. Each of these is discussed in detail in the next three sections.

3.3.2.1. Psychological Effects of EGIAD in Open Office Settings

Recent statistics suggest that disturbance from open office noise has reached epidemic proportions. In a study of 2,000 U.S. and Canadian office workers in various open plans from 58 different locations, 54 percent of workers reported that they are often bothered by some source of noise, such as people talking, ventilation systems, and office equipment (Sundstrom et al., 1994). In their study, Seal and Sylvester (1982) documented that 70% of software employees rated office noise disturbance, especially hallway conversations and telephone rings, as a significant source of dissatisfaction and requested design improvements. At least 29 studies (see Table 3.2) have talked about the negative impacts of auditory distractions in open office settings on psychological well-being of individuals, measured as increased annoyance, discomfort, stress, reduced motivation, job dissatisfaction, environmental dissatisfaction, and loss of privacy. Out of these 29, at least 15 studies provided evidence that employees prefer privacy over accessibility – the key characteristic of open office settings. Privacy is preferred because of the increase in noise, distractions, and interruptions that are experienced continuously in open settings, even when the individual is trying to concentrate or wants a quiet environment to get the job done (Becker et al., 1983, Canty, 1977, Marans and Spreckelmeyer, 1982). It is important to mention here that the term privacy has two associated components (Altman, 1975): one is the feeling of control over the amount of social contact, i.e. employees wants to have a control over when and how to be accessible to others. Sundstrom et al. (1980) called this psychological privacy. Second, is the control over the amount of information received, i.e. in order to concentrate, the employee wants to have control over what he hears or overhears. Sundstrom et al. (1980) called this architectural privacy, which is actually an environmental shield against verbal and acoustic intrusions, also called acoustical privacy in some studies.

Table 3.2 - Literature Matrix for Non-Auditory Effects of Auditory Distractions

Study		**Non-Auditory Effects of Auditory Distractions**			
Author(s)	**Year**	**Performance** (concentration, distractions, work efficiency, work effectiveness)	**Psychological well-being** (annoyance, discomfort, motivation, stress, too disturbing, too bothersome, job dissatisfaction, environmental dissatisfaction, loss of privacy)	**Physiological well-being** (fatigue, stress , mental health, sleep disturbance, musculoskeletal)	**Social behavior** (social cohesion, helping behavior, aggression, ill-judgments of others, bitterness, hostility)
Hundert and Greenfield	1969	X			
Zeitlin	1969	X			
Riland	1970		X		
Brookes	1972		X		
Brookes and Kaplan	1972	X	X		
Glass and Singer	1972		X	X	
Nemecek and Grandjean	1973	X	X		
Boyce	1974		X		
Mathews and Canon	1975				X
Donnerstein and Wilson	1976				X
Canty	1977	X			
Cohen and Lezak	1977				X
Page	1977				X
Prucell and Throne	1977		X		
Cohen	1978				X
Oldham and Brass	1979	X	X		X
Siegel and Steele	1980				X
Singer	1980		X	X	
Hedge	1980	X	X		
Louis Harris & Associates	1980	X			
Sundstrom et al.	1980		X		X
Keighley and Parkin	1981		X		
Hedge	1982	X	X		

Table 3.3 – Continued

Study		**Non-Auditory Effects of Auditory Distractions**			
Author(s)	**Year**	**Performance** (concentration, distractions, work efficiency, work effectiveness)	**Psychological well-being** (annoyance, discomfort, motivation, stress, too disturbing, too bothersome, job dissatisfaction, environmental dissatisfaction, loss of privacy)	**Physiological well-being** (fatigue, stress , mental health, sleep disturbance, musculoskeletal)	**Social behavior** (social cohesion, helping behavior, aggression, ill-judgments of others, bitterness, hostility)
Marans and Spreckelmeyer	1982		X		
Seal and Sylvester	1982		X		
Sundstrom et al.	1982		X		
Becker et al.	1983	X			
Lindstrom and Vuori	1984	X		X	X
Nemecek	1984		X		
Sundstrom	1986		X		X
Salame and Baddeley	1987	X			
Zalensy and Farace	1987		X		
Klitzman and Stellman	1989		X	X	
Bhatia et al.	1991		X		
Landstrom et al.	1991		X		
Landstrom et al.	1992		X		
Loewen and Suedfeld	1992	X	X		
Sundstrom et al.	1994	X	X		
Tafalla and Evans	1997	X		X	
Banbury and Berry	1998	X			
Evans and Johnson	2000	X	X	X	
Brennan et al	2002	X	X	X	X
Witterseh et al.	2004	X		X	
Nagar and Pandey	2006	X			
Jackson and Klein	2009	X			
Total Number of Studies		**21**	**27**	**8**	**11**

3.3.2.2. Physiological Effects of EGIAD in Open Office Settings

Workers cannot be productive if their work environment impacts their physiological (physical) health. The consequences of such impacts are not only short-term, such as lost productivity, but have long-term costs with regard to rehabilitation and health insurance claims. The literature uncovers many studies that have analyzed the impacts of noise in open office settings on physical health. These are divided into two categories: those which have examined "vegetative responses, such as respiration, heart-rate, cutaneous blood flow, constriction of the peripheral bold vessels, skin temperature, tremor, secretory function of the stomach, bowel transit, and bioelectrical activity of the brain" (Smith, 1991, p.50); and those which have examined the "biochemical effects of noise, such as blood lipid functions, bold glucose, cortisol, adrenalin, noradrenalin, dopamine, growth hormone, and magnesium and calcium levels" (Smith, 1991, p.50). Repetitive strain injuries are becoming a major health issue. Evans and Johnson (2000) showed that individuals working in open office noise conditions show high likelihood of ignoring the ergonomics features of their workstations that allows postural adjustments while working. Thus, these individuals are at much higher risks of musculoskeletal problems. In all, eight studies (see Table 3.2) were reviewed for physiological effects of auditory distractions in open office settings. Mostly these effects are measured in terms of increase in the frequency and severity of headaches, fatigue, stress, sleep disturbance, gastrointestinal problems, and musculoskeletal concerns among many others.

3.3.2.3. Effects of EGIAD on Social Behavior

The effect of noise in open office settings is an important area of concern as many activities in today's work environment involve social interactions which is affected if problems exist within the group. Research on impacts of office noise on social life shows direct impacts on communication among the individuals. In all, 11 studies (see Table 3.2) provide evidence for noise affecting social behavior, in terms of reducing social cohesion, changing helping behavior, causing aggression, ill-judgments of others, bitterness, and hostility.

Noise impairs group cohesion by building up hostility among co-workers because they feel overwhelmed by not being able to concentrate, stop neighboring conversations, whistles, laugher, etc. Researchers argue that moving into open office settings creates increased interaction only for a short period and people soon revert to earlier habits of interaction as they adapt to the less private conditions and develop ways of regulating social contact. Such surroundings are also shown to eventually result in complete isolation of an individual. Bill Sims, a Cornell University Professor of Facilities Management and Planning, explains the reduced communication effect by stating that in open settings because people have no control over communication; therefore, they actually communicate less. Heusser (1968) explains the phenomenon from the perspective of Maslow's (1943) basic human need for security. He argues that, in large open spaces, people tend to arm themselves against the political coordination, thereby resulting in a decrease of personal interest in the working sphere.

Another set of studies show that noise changes the helping attitude of humans towards their fellow humans. The results have been explained via many theoretical models including Milgram's (1970) cognitive overload model. According to the cognitive overload model, when attentional overload occurs, because of surrounding noise in this case, it results in a focusing of attention on environmental inputs that carry relevance to one's primary task, thereby neglecting other cues, social or nonsocial. All those social cues are typically ignored that carries information regarding the moods and subtly expressed needs of others. Therefore, noise results in lack of cooperation and negates helping attitudes of individuals towards their fellow co-workers, which are argued to be important components of success in knowledge work. A number of studies support the argument that a person is less likely to offer simple assistance under environmental stress (noise is recognized as a significant occupational stressor) than under comfortable ambient conditions because under stressful conditions social cues may be seen as irrelevant to the primary task and thus ignored.

3.3.2.4. Implications of Non-Auditory Effects of Auditory Distractions for Knowledge-based Organizations

The literature discussed in above three sections provides supportive evidence that the non-auditory effects of noise in open office settings are significant to be given due consideration when making decisions about workspaces for knowledge workers in knowledge-based organizations. However, this is not feasible within the existing decision-making approach to workspace selection. These decisions are mostly guided by a cost-benefit approach and it is not possible to attach a precise dollar amount to non-auditory effects of office noise, which are mostly subjective in nature. So while noise, specifically EGIAD, in open office settings are consistently shown to increase physiological and psychological stress, many companies continue to adopt open office settings primary because of the reduced initial costs and reduced annual operating costs. In contrast, companies like Microsoft, Frog Creek, Google, etc. are moving backwards to conventional enclosed or private offices because of the realization that their employees, i.e., the knowledge workers, are their most critical assets. They also acknowledge that the company's productivity is a direct result of employees' performance, which is shown to be negatively affected in open office settings.

The evidence is sufficient and significant to raise alarm for knowledge-based organizations, architects, engineers, facility decision-makers, facility managers, and research scientists, such that a more-detailed investigation about the relationship between workspace design and knowledge worker's job performance and overall (functional, environmental, and social) satisfaction, and well-being is past due. The goal is to come up with a more realistic and cost-effective workspace solutions backed by rationality and consistency.

Another area of research that is expected to add value to this theoretical background concerns studies conducted with the users of workspace, i.e., knowledge workers. These studies are an attempt to understand workplace design and environmental features that are perceived as most critical by the knowledge workers themselves for their performance and overall satisfaction. This approach is the most appropriate as the users, rather than decision-makers and architects, are the best judges of their requirements. Only a few studies exist in this area of research. These are discussed in detail in the next section.

3.4. Literature III –Workplace Design and Environment

This section reviews studies which identify workplace features that are perceived to be the most important by office workers, especially knowledge workers, for improving their job performance and increasing overall well-being and satisfaction. These studies mostly address the issue of privacy in open office settings and the need for reinventing the workspace architecture. These are the discussed in detail in the next two sections.

3.4.1. Privacy in Open Office Settings

In 1972, (Brookes and Kaplan) conducted a user perspective study to identify characteristics that an ideal office environment should have. They reported that the subjects wanted their office to be much less noisy and with greater privacy. Louis Harris & Associates (1978, 1980) reported that U.S. office workers identify the ability to concentrate without noise and other distractions and quiet as the most important office environment features for their comfort, well-being, and performance efficiency. Hedge (1982) showed that managerial staff, which constituted 44% (286 employees) of the total 649 employees in the study, expressed a strong need for quiet conditions, which were believed to be more conducive to thinking and concentration. The managerial staff reported that open conditions prevent rather than facilitate effective working conditions, resulting in an impaired performance. In addition, a number of studies have confirmed that interactions, one of the central intentions of open office settings, are facilitated not by unlimited opportunities for interpersonal contact, but by having a sense of control over those interactions as represented by a door in conventional closed offices (Altman, 1975, Baum and Valins, 1979, Glass and Singer, 1972, Loo, 1973, Proshansky et al., 1970). As Jon Archea (1977) states "privacy is not simply a matter of curtailing exposure to prevent invasions of the self. It must also include sufficient access to interpersonal opportunities and obligations to enable one to present oneself in a favorable manner…. Matching one's spatial and behavioral conspicuousness with one's intentions is a key element of privacy regulation" (p. 134). Furthermore, Altman (1975) explained this concept through his construct of "privacy as an optimization process". He states that at any moment an individual wants an optimal degree of desired access of the self to others. Deviation from this optimum results in dissatisfaction. He argues that privacy is also a dialectic process that involves shifts between a restriction of interaction and a seeking of interaction under different circumstances. These constructs about privacy raise questions about functional validity of open office settings where users possess no control over accessibility-inaccessibility or over the workspace's micro environment.

3.4.2. Reinventing Workplace Architecture

Olson (2002), in a study of 13,000 employees in U.S.-based organizations conducted over a period of six years, explored the correlation between workplace design and performance, and satisfaction of individuals and teams. The study concluded that the two most desired requirements in today's knowledge-based organizations are the ability to conduct distraction-free individual work and support for impromptu interactions anytime and anywhere in a workplace. According to the study, both the requirements must coexist for significant improvements in job performance and overall health, well-being, and satisfaction. Brill et al. (2001) corroborated Olson's findings and reported that compromise in either of the two requirements results in real costs to businesses in terms of lost productivity, higher attrition, and difficulty recruiting highly valued intellectual capital.

Heerwagen et al. (2004) conducted an ethnographic study of collaborative knowledge work environments, concluding that providing effective support for both interactive and individual work is the main issue. The purpose of the study was to understand how design can help establish a balance "between the need to interact and the need to work effectively by oneself" (Heerwagen et al., 2004, p.510). Further evidence for impact of workplace design on overall satisfaction and job performance, and, thus, organizational productivity, is provided by the case study of West Bend Mutual Insurance Company where personal environments (PE) systems from Johnson Controls were installed (Miller and Lomonaco, 2005). The PE gives the user the flexibility to adjust the micro-environment for temperature, lighting, air flow, heating, and noise masking through a desktop control unit. The study included 300 employees whose performance change was measured against established internal productivity measurement (PM) system. The Hawthorne Effect was accounted for by performing the study longitudinally over the period of 27 weeks in the old building and 24 weeks in the new building. Although distractions due to noise from the surroundings were still an issue, the study documented an overall productivity gain of 12.8%, of which the productivity increase of 2.8% was directly attributed to PE. And, based on the company's total salary of $13,000,000, the 2.8% increase, amounts to an annual savings of $260, 000.

In summation, these studies find that, for performance improvement and overall well-being and satisfaction of office workers, especially knowledge workers, the basic workspace requirement is the co-existence of support for the individual and collaborative work at the same workspace and at any time. Therefore, this requirement should be considered while choosing a workspace for an organization, specifically knowledge-based organizations, where knowledge workers are the key assets.

3.5. Summary

This chapter details the theoretical framework upon which the current research is based. This is the necessary first step in establishing an intellectual and scholarly foundation upon which new knowledge can be built. The goal is to fill in several gaps in the current research on workspace decision-making. As discussed, there are several missing links in the current literature where a number of domains contribute knowledge but do not connect to one another and provide a comprehensive examination of this issue.

Chapter 4 discusses multi-criteria decision-making and its appropriateness for this research problem. Knowledge collected in the literature review is used to develop a fundamental objective hierarchy for workspace choice. Structuring a fundamental objective hierarchy is the first step in conducting multi-attribute decision analysis, as it helps clarify goals and values such that the decision-maker makes informed decisions based on rationality and consistency.

CHAPTER 4

Stage II – MULTIATTRIBUTE APPROACH TO WORKSPACE SELECTION

4.1. Introduction

The previous chapter provided a discussion on auditory distractions, the non-auditory effects of these distractions in open office settings, and identification of important workplace design and environmental factors. It resulted in a comprehensive background and theoretical framework to build upon. A number of factors were highlighted that should be given sufficient consideration when choosing a workspace for an organization, especially knowledge-based organizations.

A cost-benefit approach fails to consider these factors because of their subjective nature; therefore, this study proposes a more robust decision-based approach to workspace selection for knowledge workers. The hypothesis is that to contain the costs of auditory distractions and costs of workspaces' must-have requirements, a structured decision-based procedure for workspace selection can be developed. It is expected that this decision-based procedure will offset the inconsistencies and limitations of the cost-benefit approach for workspace selection.

A decision-based approach is seen as an organized approach to select between workspace options under uncertainty and risk, wherein the selected workspace is maximized in terms of some expected utility. The advantages of using a decision-based approach include consideration of a multitude of decision variables, both objective and subjective, in a single equation or a model, with the ability to process these variables in a limited amount of time with rationality and consistency. It provides the basis for achieving the needed alignment between business and workspace strategy. Most importantly, a decision-based approach facilitates involvement of end users, i.e., knowledge workers, in the decision-making process without losing the objectivity of the decision problem.

This chapter begins with a discussion on multi-criteria decision-making where the appropriateness of multi-attribute utility theory (MAUT) for this decision problem is established. The discussion from Chapter 3 is extended to structure a fundamental objective hierarchy for workspace choice; the objective hierarchy will be validated with appropriate qualitative and quantitative research methods and data analysis techniques. As previously mentioned, research on auditory distractions and workplace design and environment includes several critical factors that have been previously defined or studied; however, the link between these studies is very weak. This study builds upon extant theory and integrates several streams of thought to arrive at the structure of the fundamental objective hierarchy for workspace choice. The primary goal is to facilitate a decision-maker's ability to select the most appropriate workspace while considering multiple criteria and uncertainty.

4.2. Multi-Criteria Decision-Making

The motivation for the development of decision theory derived from individuals' dissatisfaction with the choices they made. Unaided human decision-making is often accompanied by inconsistencies, irrationality, and suboptimal choices, particularly when complex trade-offs among various objectives under uncertainty must be made. To remedy these problems, decision theory was built on a set of axioms of rationality and consistency (Thurston 2001). The mathematical models explicitly capture decision-maker's preferences and risk behaviors to suggest the most-preferred option through some expected utility (satisfaction), in cases the decision-maker was consistent, rational and unbiased.

Multiple-criteria decision making (MCDM) helps decision-makers undertake preference decisions over a predetermined finite set of alternative options, typically characterized by multiple, potentially conflicting attributes (Yoon and Hwang, 1995). Attributes are also termed measures of effectiveness, performance measures, metric, evaluation measures, and others. They are measurable features of alternative options and thus should be scaled either qualitatively or quantitatively. Their definition should be clear and free from any ambiguity, and understandable to each individual involved in the decision problem. The methodology for MCDM helps the decision-maker strengthen his decision outcome, in terms of justifiability, reasonability, and accountability, which are generally seen as pre-requisites for complex and risky decisions. The processes followed for MCDM are transparent, allowing different stakeholders to see the logic of the results and enabling the inclusion of the complete range of tangible and intangible consequences.

Selection among alternatives is straightforward in a case where every attribute of one alternative is better than or equal to every attribute of another alternative. The technique is called dominance selection; however, its occurrence is rare. Other straightforward techniques are dominance elimination and Lexicographic ordering. The concern with these techniques is that such straightforward selections do not work with complex decision problems, such as those posed by this study.

For complex decision problems, such as those posed by this study, or an operations research problem, Mansfield (2007) suggests that there are two main schools of thought. One is the French school, which is based on the outranking concept, and the other is the American school, which is guided by Multi-Attribute Utility Theory (MAUT). The Outranking Method (OM) builds upon pair-wise comparisons of alternatives under study. Outranking indicates the degree of dominance of one alternative over another (Roy, 1991, Brans et al., 1986). This dominance, in turn, uses weights to give more influence to some attributes over others. One alternative will be said to outrank or dominate another if it outperforms the others with respect to a sufficient number of attributes. Eventually, all pair-wise outranking assessments are combined to suggest an overall preference ranking (Chen and Hwang, 1992, Doumpos and Opounidis, 2002). A major criticism of OM is that it is dependent on algorithms rather than axioms, which makes it very difficult for decision-makers to understand and trace back the results (Girod and Wright, 2000, Mansfield, 2007). Final ranking of options is the result of a rather complex process and difficult interpretation of results are other reasons why OM method is criticized in the literature (Mansfield, 2007). Another disadvantage is that, with large number of alternatives to evaluate, computationally OM can become "very expensive" (Mansfield, 2007, p.516). In some outranking approaches, decision-makers have faced difficulty in assessing the "degree of credibility" (Mansfield, 2007, p.532).

Multi-attribute utility theory, in contrast, is based on the idea of forming an overall utility function. It is assumed that the key components of overall utility functions, the single attribute utility functions (SAUF), are either available or these can be obtained through structured interactions. The most preferred alternative is the one which has the highest expected utility value. Multi-attribute utility theory deals with a situation where a trade-off must be made between conflicting attributes, and risk and uncertainty is integral to the decision problem (Graham and Jones, 1988, Keeney and Raiffa, 1976). It is important to note that, in multi-attribute utility theory, an independent utility function is created for each attribute of an alternative, which is then aggregated to form a multi-attribute utility function. In contrast, OM methodologies always involve a pair-wise comparison, which is made to outrank one alternative over the other. The "mathematical tractability of utility functions" is the key reason for MAUT's popularity (Mansfield, 2007, p.516).

Though MAUT has received a lot of popularity, the methodology is not completely free from limitations. MAU functions are shown to be incapable of handling intransitivity. However, MCDM literature discourages the use of intransitivity as it can result in unnecessary contradictions, and its absence simplifies the problem considerably. Also, Mansfield (2007) suggests that the lack of intransitivity results in mathematically tractable decision model, which is the major advantage of MAUT. Therefore, the limitations of MAUA actually come as an advantage.

The other disadvantage of MAUT is that the simplest form of aggregation, i.e. weighted linear sum, assumes mutual preferential independence, which is not always the case. In such a case, the MAU assessment becomes complicated since it requires solving non-linear system of equations (Greenwood et al., 1997, Keeney and Raiffa, 1976).

Given these advantages and criticisms, MAUT was adopted for this research problem mainly because of its strong axiomatic base and mathematical tractability. The decision under consideration is such that it involves a choice among several alternatives where each alternative has several important conflicting objectives. The attributes are mostly subjective in nature, rather than objective; thus, it will be necessary to develop subjective indices of measurement. Utility assessment technology allows different indices of measurement, both subjective and objective, to be combined in one aggregate utility, the number that provides ranking for alternatives. This research posits that, to prescribe a best alternative for a workspace, the subjective attributes are as critical in the analysis as the most frequently used objective attribute of cost. Johnson and Huber (1977) calls the utility assessment process a “process for quantifying human judgment” (p. 312). Furthermore, many attributes involve uncertainty in their estimation during a particular time interval, which is implicitly captured and implemented in utility assessment technology. According to Keeney and Nair (1975), of special significance in utility assessment technology is the explicit inclusion of the preferences of the decision-maker and the treatment of the uncertainty associated with the consequences of a decision. Utility values account for preferences of the decision-maker and probabilities of various possible consequences take care of uncertainty involved in a decision. For instance, to evaluate the value of particular stock, a stock analyst will express his or her preference as satisfaction with the performance of a stock, i.e. utility. The probability of various possible consequences implicitly captures risks and uncertainty involved in making such decisions.

4.3. Multi-Attribute Utility (MAU) Decision-Making for Workspace Choice

Workspace refers to a work-station assigned to a specific individual to work while he/she is in the office. It includes a chair, a table, equipment, supplies, among other items required to complete office tasks by an individual.

In general, utility assessment process involves the following tasks: identify, measure, and combine attributes; this is done so that an explicit value structure is created that forms a basis for evaluating alternative choices and making decisions. The procedures for each step are explicitly defined. In general, the problem is deconstructed into simple attributes for which the utility is evaluated or assessed separately, and then these partial utilities are aggregated into an overall utility assessment using systematic procedures.

The evaluation theme in multi-attribute utility modeling is based upon how much each alternative's attributes achieve the objective of the comparison. The first step in this methodology requires organization of objectives in a hierarchical structure to define different levels of objectives. The resulting structure is called the fundamental objective hierarchy. The fundamental objective hierarchy is the hierarchy that arranges objectives from a broad, overarching concept at the top to lower-level, specific accomplishments or actions. Objectives at the upper levels of the hierarchy reflect broad or inclusive values, and progress towards these objectives is achieved by meeting lower-level sub-objectives. The degree of achievement of an objective is measured through its attribute. Ideally, all the lowest-level objectives are measurable, either objectively or subjectively. Other terms used for an attribute are: measure of effectiveness; performance measure; metric; and evaluation measure.

Objectives tell what is important or what people want from a particular decision. Structuring objectives for any decision problem first requires clarity about the specific decision context of interest. McDaniels (2000) argues that "even slight changes in what decision is to be made can have an influence on the objectives, so a clear definition of the decision to be made is mandatory” (p. 300). The context can be strategic or tactical; in case of strategic contexts, the long-term objectives help identify and define more specific short-term objectives that are measurable, either objectively or subjectively.

The decision context defined for this study was to select a workspace for knowledge workers in knowledge-based organizations in view of the following, which has been consistently and repeatedly shown in research results:

- Knowledge workers are the key assets of knowledge-based organizations in terms of costs (salaries +benefits) to the organization and the revenue (productivity) they generate for their organization.
- Auditory distractions coming from surrounding work environment incur huge intangible costs for knowledge workers and, thus, negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because they possess the following characteristics: they originate in the workplace environment; their occurrence is random, i.e., they can occur anytime; they are discrete, i.e., they have a start time and an end time; knowledge workers have no control over them; and typically their impact is attentional overload.

Once the decision to be made is specified, a useful next step is to identify the overall fundamental objective for the decision at-hand. Because selecting a workspace from a set of alternatives is an investment decision, it is assumed that maximizing the value of this investment would be the foremost motive of an organization. Consequently, the overall objective of this decision problem is to maximize the value of a workspace for an organization. The complete objective hierarchy was then structured by using both, the top-down and the bottoms-up approach of generating and structuring objectives. The top-down approach helps narrow down the focus of the objectives. The objective becomes more specific as one move downward in the hierarchy. While moving down in the hierarchy, the following questions are asked for each objective or criterion: ‘What are the key components of this objective?’ and ‘How to achieve this objective?’ For instance, for the top level objective, ‘maximize the value of a workspace for an organization’, the following question was asked: ‘What are the key components of the value of a workspace and how can the value of a workspace be maximized?’ The value of a workspace can be maximized if its costs are minimized and benefits maximized. In view of the costs of auditory distractions and costs of workspace’s must-have requirements, both direct and indirect costs and benefits are of significance. Consequently, the value of a workspace is identified as a function of the following components: direct costs of workspace; indirect costs of workspace; and benefits of a workspace. Minimizing these costs and maximizing benefits should, therefore, maximize the value of a workspace. As a result, the top-level objective was divided into three sub-objectives: minimize indirect costs of workspace resulting due to distractions (1.0); minimize direct costs of workspace (2.0); and maximize benefits of a workspace (3.0).

On the contrary, the bottoms-up approach to structuring objectives helps widen the scope of an objective from a narrow specific value to a broader category. Therefore, while moving up in the hierarchy the following question is asked for each objective or criteria: ‘Why is the objective/criteria important?’ For instance, the objective ‘minimize the negative impacts of distractions on work efficiency’ was translated into a broader objective by asking the following question: ‘Why is it important that the negative impacts of distractions on work efficiency of knowledge workers be minimized?' A negative impact on work efficiency implies a negative impact on performance of knowledge workers. Therefore, to minimize the negative impacts of distractions on performance of knowledge workers, the negative impacts of distractions on work efficiency of knowledge workers shall be minimized; thus the objective to sub-objective relationship was established.

A word of caution was followed to not increase the number of attributes (defined to measure lowest-level objectives) beyond 15; as Edwards and Newman (1982) state that eight attributes is about right and 15 is already excessive. The technical issue that arises with a large number of attributes is that the importance weights to be assigned to the attributes will often end up very small and, thus, blunt the meaningfulness of the weights (Edwards and Newman, 1982).

The process led to development of the initial fundamental objective hierarchy for workspace choice, as shown in Figure 4.1. The factors identified in Chapter 3 as significant for workspace decision-making were categorized into five potential costs, direct and indirect, and benefits to an organization. These include performance costs, psychological costs, physiological costs, social behavioral costs, and dissatisfaction costs. To maximize the value of a workspace, the costs should be minimized and the benefits maximize, therefore the objectives 1.0 and 2.0.

It is important to mention here that the terms minimizing and maximizing objectives are standard terminologies used in the multi-criteria decision-making literature to identify the direction of achievement of an objective. In no case, does it refer to objective maximization or minimization as used in the operations research (OR) literature for optimization problems.

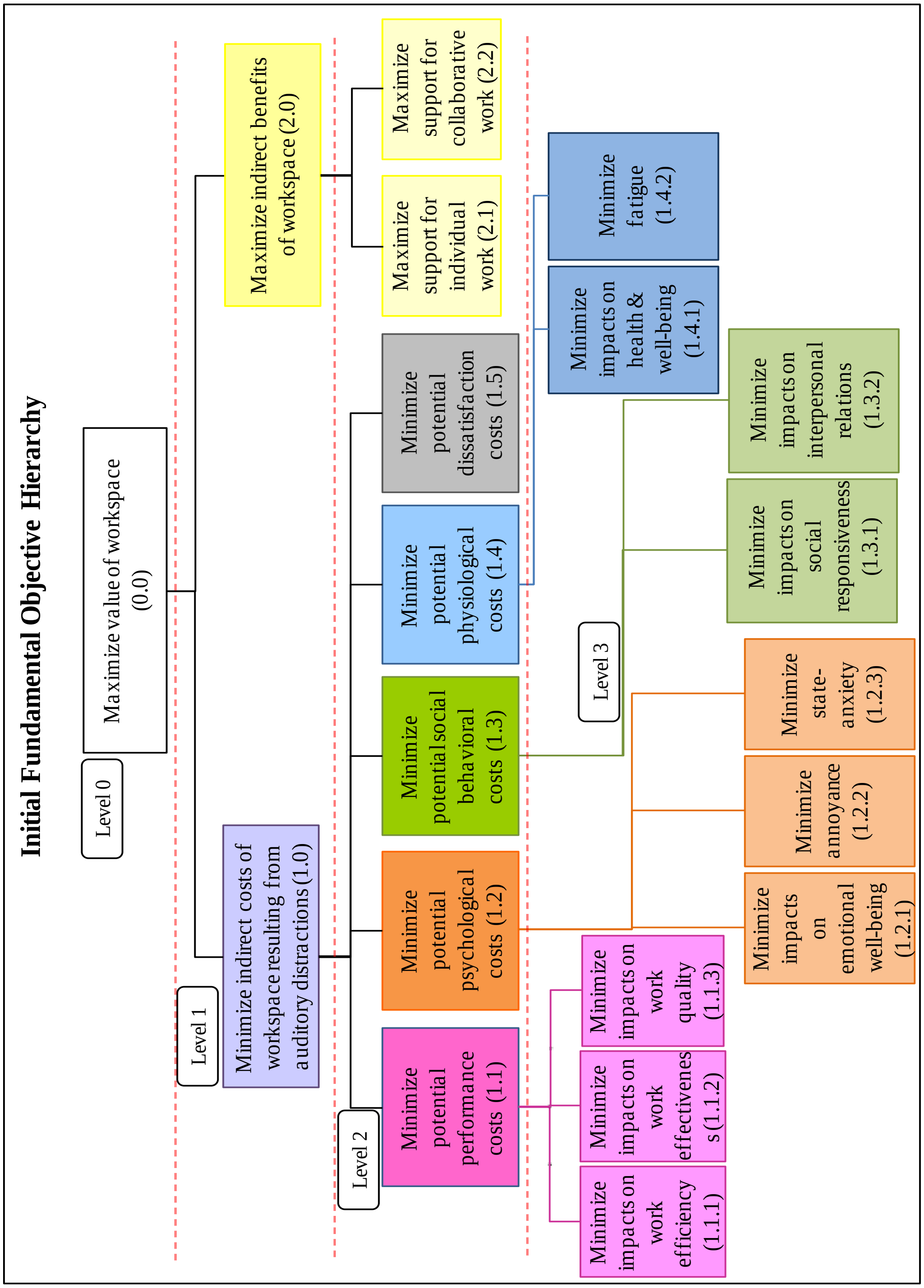


Figure 4.1 - Initial Fundamental Objective Hierarchy for Workspace Choice

Once the structure of the objective hierarchy was established and its attributes and measurement index defined, the next step was to verify and validate these. The obvious source of information and knowledge for this task was academicians and professionals who have a deep understanding of the issues of auditory distractions, knowledge work, costs and benefits of workplace environments, behavioral issues in workplaces, and corporate decision-making. These people are termed experts in their field of interest. Literature suggests many methods for eliciting knowledge from a group of experts. Two most commonly used methods, nominal group technique (NGT) and the Delphi method, were considered for this study. Delphi method was selected because of a number of advantages it provided in terms of location independence, economics, and independence from individualistic factors, such as personality, status, and assertiveness. Therefore, a Delphi study was conducted to validate the structure of the fundamental objective hierarchy and operationalization of its attributes and the measurement index. The details about the Delphi study and its legitimacy for the problem are discussed in Chapter 5.

The two-phase Delphi study resulted in revision of the fundamental objective hierarchy and its attributes and measurement index. The revised objective hierarchy is shown in Figure 4.2. Attribute definitions and respective measurement indices were revised to make them simpler and more straightforward. In the next sections, each objective, attribute and its measurement index is explained in detail, in order to provide a better understanding of the objective, attribute and measurement index, as well as explain how and why the objective-to-sub-objective relationship was established. Table 4.1 provides summary of attributes and the measurement index validated by the Delphi panel.

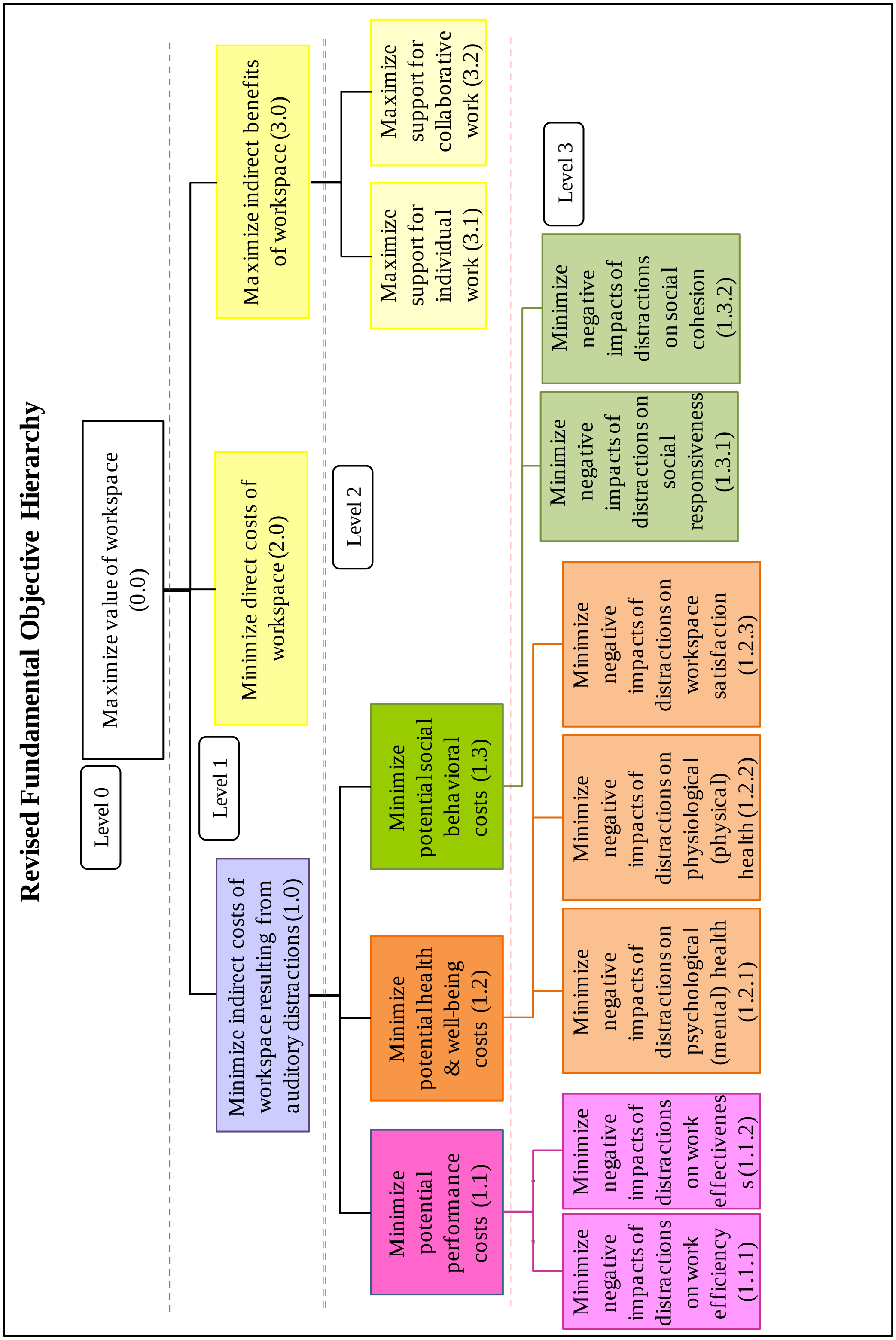


Figure 4.2 - Revised Fundamental Objective Hierarchy for Workspace Choice

Table 4.1 - Summary of Attributes for Workspace Choice Decision Model

Notation	Attribute	Items of attribute	Measurement of attribute	Measurement levels of attribute	
				Worst	**Best**
A1	Impact of distractions on work efficiency, i.e. distractions impact	Time to accomplish task	Strength of perception about impact of distractions on work efficiency	Very significant	Not at all or very little
		Ability to concentrate			
		Speed to finish task			
		Efforts to finish task			
A2	Impact of distractions on work effectiveness, i.e. distractions impact	Desirability to generate new ideas, methods, concepts etc.	Strength of perception about impact of distractions on work effectiveness	Very significant	Not at all or very little
		Desirability to explore alternatives rather than adopting routine			
		Desirability to create value for customers, organization etc.			
		Desirability to be creative and innovative.			
A3	Impact of distractions on psychological health, i.e. distractions make you feel	Sad or depressed	Strength of perception about impact of distractions on psychological health	Very significant	Not at all or very little
		Worried			
		In low spirits			
		Nervous			
		Lonely			
		Feel like crying			
		Anxious			
		Angry			
		Irritated			
		Aggravated			
		Frustrated			
A4	Impact of distractions on physical health, i.e. you feel distractions increases frequency or severity of	Headache	Strength of perception about impact of distractions on physical health	Very significant	Not at all or very little
		Backache			
		Other musculoskeletal problems			
		Easily tired			
		Unusual fatigue			
		Physical irritation			
		Gastrointestinal disturbance			
		Low in energy			
		Unusual stress			

Table 4.2 – Continued

A5	Impact of distractions on workspace satisfaction, i.e. you do not feel satisfied with	Speech privacy Privacy from auditory distractions Working in the workspace Design of workspace and micro-environment	Strength of perception about impact of distractions on satisfaction with workspace	Very significant	Not at all or very little
A6	Impact of distractions on social responsiveness, i.e. distractions impact	Willingness to help colleague Willingness to cooperate Attitude towards co-worker Behavior towards co-worker	Strength of perception about impact of distractions on social responsiveness	Very significant	Not at all or very little
A7	Impact of distractions on social cohesion, i.e. distractions impact	Free communication between colleagues Preference to work as a team rather than alone Preference to spend time outside workplace and work hours Preference to stick together after the project is over Preference to socialize often	Strength of perception about impact of distractions on social cohesion	Very significant	Not at all or very little
A8	Workspace's support for individual work , i.e., workspace supports the following items without having to find another private enclosure	On demand opaqueness from environmental distractions On demand concentration without drive-by interruptions	Strength of perception about workspace's support for individual work	Not at all or very little	Very significa nt
A9	Workspace's support for collaborative work , i.e., workspace supports the following items without having to find another collaboration space and without disturbing surroundings	Serendipitous interactions Short consultations between colleagues Brief social interactions Drive-by interruptions	Strength of perception about workspace's support for collaborative group work	Not at all or very little	Very significa nt
A10	Direct costs of workspace		Cost of acquiring and installing a workspace	Very significant i.e. $51,00 - $10,000	Very little, i.e. $100 - $500

4.3.1. <u>Fundamental Objective Hierarchy – Lowest Level Objectives and Attributes</u>

The fundamental objective hierarchy is a hierarchy that arranges objectives from a broad, overarching concept at the top to lower-level, specific accomplishments or actions. Objectives at the upper levels of the hierarchy reflect broad or inclusive values and progress towards these objectives is achieved by meeting lower-level sub-objectives. The fundamental objective is the explicit value that one desires to achieve. It is any criterion that is significant enough to be taken into account while evaluating alternatives. It is important to an individual or an organization simply because it is important.

The structure of objective hierarchy is such that how an alternative performs with respect to the lowest level objectives suggests how an alternative will perform with respect to the overall decision objective. Therefore, the lowest level objectives should be measurable, i.e., have a qualitative or quantitative attribute. For instance, while purchasing a car, if the lowest level objectives are: maximize mileage, obtain the most preferred color; and minimize cost; and the overall objective is to maximize the value of this investment, then, a car's performance in terms of all the three attributes combined with attributes weights suggests the value of this investment. This implies that the three objectives – maximize mileage, obtain the most preferred color, and minimize cost – are measurable either qualitatively or quantitatively.

4.3.1.1. Objective 1.1.1 – Minimize Possible Negative Impacts of EGIAD on Work Efficiency of Knowledge Workers When Concentrating.

Work efficiency, as suggested by many researchers, is related to utilization of resources (Tangen, 2005, Sink and Tuttle, 1989). Efficiency generates the greatest amount of output with a minimum waste of resources (see Figure 4.3). For knowledge work, some of the key input resources are knowledge worker's time, concentration, and effort spent on a particular task. Auditory distractions coming from surrounding work environment are shown to negatively impact work efficiency of knowledge workers when trying to concentrate on a complex cognitive task. Research shows that, once distracted, a person can take up to 15 minutes to reach the same state of concentration (attention and involvement) as before, thereby resulting in increased time and effort to finish the task (Demarco and Lister, 1993, 1999). It is also suggested that sometimes people do not get back to the same work until the next day. These marginal impacts are difficult to recognize; however, when these are analyzed over a period of time, they are shown to result in significant productivity losses.

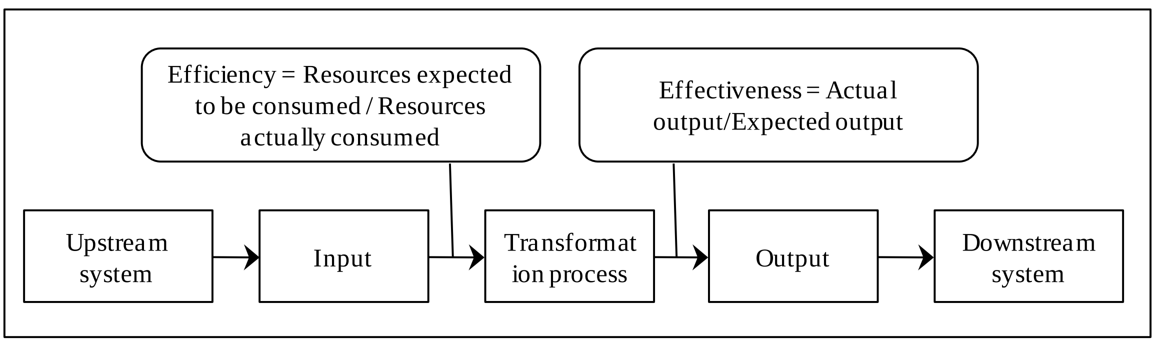


Figure 4.3 – Work Efficiency and Effectiveness (Source: Sink and Tuttle, 1989)

Attribute definition - Participant's perceptions about the strength of impacts of distractions on work efficiency. Research shows that, for knowledge work, work efficiency has been generally measured in terms of: time to accomplish task; ability to concentrate; speed to finish task; and efforts to finish task. Consequently, these are identified as the items of work efficiency (Table 4.1).

Measurement index - The measurement index for measuring impacts of externally generated involuntary auditory distractions (EGIAD) on work efficiency is shown in Table 4.2.

Table 4.2 - Measurement Index for Impacts of EGIAD on Work Efficiency

Objective	**Attribute**	**Attribute Levels / Measurement Index**		
		Response Format		**Description**
Minimize negative impacts of distractions on work efficiency	Participant's perceptions about strength of impacts of distractions on work efficiency	1	Not at all	I feel distractions have no impact on work efficiency.
		2	A little	I feel distractions have a little impact on work efficiency.
		3	Moderate	I feel distractions have a moderate impact on work efficiency.
		4	Significant	I feel distractions have a significant impact on work efficiency.
		5	Very significant	I feel distractions have a very significant impact on work efficiency.

4.3.1.2. Objective 1.1.2 – Minimize Possible Negative Impacts of EGIAD on Work Effectiveness of Knowledge Workers

Work effectiveness, as suggested by many researchers, is related to creation of value by doing the right things (Tangen, 2005, Sink and Tuttle, 1989). Sink and Tuttle (1989) states that "effectiveness, which involves doing the right things, at the right time, with the right quality etc., can be defined as the ratio between actual output and expected output" (Tangen, 2005, p.541) (see Figure 4.3). Neely et al. (1995) defines work effectiveness as the "extent to which customer requirements are met" (Tangen, 2005, p.541). Other concepts for work effectiveness include novelty, innovation, creativity, value addition, and sharing and disseminating new ideas, to name a few concepts. Auditory distractions coming from the surrounding work environment exert extra demand on cognitive abilities of a person resulting in cognitive fatigue, which reduces a person's subsequent readiness to perform. The person's attention narrows and works on easily available routine cues, rather than exploring in detail complex alternative ways to finish the task. The phenomenon is called cognitive economy. Glass and Singer (1972) showed the occurrence of the cognitive economy phenomenon through a series of experiments where they used task persistence as an after effect measurement index. Individuals exposed to uncontrollable distractions showed diminishing inclination to solve challenging puzzles. The impacts are subjective in nature depending on a number of individual criteria; however, the result is that a key characteristic of knowledge work, i.e., novelty and creativity, is compromised.

Attribute definition – Participant's perceptions about the strength of impacts of distractions on work effectiveness. Research shows that, for knowledge work, work effectiveness has been generally measured in terms of: desirability to generate new ideas, methods, and concepts, etc.; desirability to explore alternatives rather than adopting routine; desirability to create value for customers, organization, etc.; and desirability to be creative and innovative. Consequently, these are identified as the items of work effectiveness (Table 4.1).

Measurement index - The measurement index for measuring impacts of externally generated involuntary auditory distractions (EGIAD) on work effectiveness is shown in Table 4.3.

Table 4.3 - Measurement Index for Impacts of EGIAD on Work Effectiveness

<table>
<tr><th rowspan="2">Objective</th><th rowspan="2">Attribute</th><th colspan="3">Attribute Levels / Measurement Index</th></tr>
<tr><th colspan="2">Response Format</th><th>Description</th></tr>
<tr><td rowspan="5">Minimize negative impacts of distractions on work effectiveness</td><td rowspan="5">Participant’s perceptions about strength of impacts of distractions on work effectiveness</td><td>1</td><td>Not at all</td><td>I feel distractions have no impact on work effectiveness.</td></tr>
<tr><td>2</td><td>A little</td><td>I feel distractions have a little impact on work effectiveness.</td></tr>
<tr><td>3</td><td>Moderate</td><td>I feel distractions have a moderate impact on work effectiveness.</td></tr>
<tr><td>4</td><td>Significant</td><td>I feel distractions have a significant impact on work effectiveness.</td></tr>
<tr><td>5</td><td>Very significant</td><td>I feel distractions have a very significant impact on work effectiveness.</td></tr>
</table>

4.3.1.3. Objective 1.2.1 – Minimize Possible Negative Impacts of EGIAD on Psychological (mental) Health of Knowledge Workers.

Literature from the medical sciences, management sciences, and organizational and environmental psychology suggest psychological or mental health as a construct that pertains to emotional states of a person. It includes a broad range of moods, such as, feeling enthusiastic, full of energy, excited, cheerful, happy, anxious, depressed, guilty, fearful, angry, frustrated, irritated, or blue, to name a few states of mood. These states are considered good indicators of mental health at a particular moment (state quality) or as a whole (trait quality). Research on non-auditory impacts (see definition of non-auditory impacts on page 6) of office noise identifies auditory distractions coming from surrounding work environment (EGIAD) as potential stimuli for reducing psychological health of knowledge workers. The impacts are indirect, such as reduced motivation, reduced aspiration, reduced self-esteem, etc., and are subjective in nature. In addition, the intensity of impact depends on a subject's sensitivity to distractions on the whole or on a particular day. The outcomes are reduced or lost organizational productivity because of increased proneness to remain absent from work, as well as lower-quality decisions, increased turnover, and diminishing overall contributions to the organization.

Attribute definition - Participant's perceptions or feelings about the strength of impacts of distractions on psychological (mental) health. Research shows that psychological health has been generally measured in terms of feeling: sad; depressed; worried; in low spirits; nervous; lonely; prone to crying; anxious; angry; irritated; aggravated; and frustrated. Consequently, these are identified as the items of psychological health for this study (Table 4.1).

Measurement index - The measurement index for measuring impacts of externally generated involuntary auditory distractions (EGIAD) on psychological health is shown in Table 4.4.

Table 4.4 - Measurement Index for Impacts of EGIAD on Psychological Health

Objective	**Attribute**	**Attribute Levels / Measurement Index**		
		Response Format		**Description**
Minimize negative impacts of distractions on psychological health	Participant's perceptions about strength of impacts of distractions on psychological health	1	Not at all	I feel distractions have no impact on psychological health.
		2	A little	I feel distractions have a little impact on psychological health.
		3	Moderate	I feel distractions have a moderate impact on psychological health.
		4	Significant	I feel distractions have a significant impact on psychological health.
		5	Very significant	I feel distractions have a very significant impact on psychological health.

4.3.1.4. Objective 1.2.2 – Minimize Possible Negative Impacts of EGIAD on Physiological (physical) Health of Knowledge Workers.

Physiological health includes all negative impacts of distractions that pertain to the physical health of an individual. A number of studies have analyzed the impacts of noise in open office settings on physical health. Some of these studies have examined vegetative responses, e.g., "effects on respiration, heart-rate" (Smith, 1991, p.50), and others have examined the biochemical effects, e.g., "blood lipid functions, adrenalin, dopamine and calcium levels" (Smith, 1991, p.50). Evans and Johnson (2000) showed a much worse health risk of exposure to office noise. According to the study, "individuals exposed to typical, low-level open settings office noise are substantially less likely (by 50%) to adjust ergonomic work-station features that allow postural variability while working" (p. 782), thereby, putting these individuals at higher risks of musculoskeletal problems. Spurgeon at al. (1996) have discussed the negative impacts as increase in the frequency and severity of symptoms, such as "headache, backache, tiredness, memory problems, and poor concentration" (p. 362). According to Danna and Griffin (1999), the organizational costs of negative impacts on physical health of knowledge workers are in terms of lost productivity due to increased absenteeism, compensation claims, health insurance costs, and direct medical expenses.

Attribute definition - Participant's perception or feelings about the strength of impacts of distractions on physiological (physical) health. Research shows that physiological health has been generally measured in terms of the increase in frequency or severity of the following items: headache; backache; other musculoskeletal problems; easily tired; unusual fatigue; physical irritation; gastrointestinal disturbance; low energy; and unusual stress. Consequently, these are identified as the items for measurement of physiological health (Table 4.1).

Measurement index - The measurement index for measuring impacts of externally generated involuntary auditory distractions (EGIAD) on physiological health is shown in Table 4.5.

Table 4.5 - Measurement Index for Impacts of EGIAD on Physiological Health

<table>
<tr><th rowspan="2">Objective</th><th rowspan="2">Attribute</th><th colspan="3">Attribute Levels / Measurement Index</th></tr>
<tr><th colspan="2">Response Format</th><th>Description</th></tr>
<tr><td rowspan="5">Minimize negative impacts of distractions on physiological health</td><td rowspan="5">Participant's perceptions about strength of impacts of distractions on physiological health</td><td>1</td><td>Not at all</td><td>I feel distractions have no impact on physiological health.</td></tr>
<tr><td>2</td><td>A little</td><td>I feel distractions have a little impact on physiological health.</td></tr>
<tr><td>3</td><td>Moderate</td><td>I feel distractions have a moderate impact on physiological health.</td></tr>
<tr><td>4</td><td>Significant</td><td>I feel distractions have a significant impact on physiological health.</td></tr>
<tr><td>5</td><td>Very significant</td><td>I feel distractions have a very significant impact on physiological health.</td></tr>
</table>

4.3.1.5. Objective 1.2.3 – Minimize Possible Negative Impacts of EGIAD on Satisfaction with Workspace.

Satisfaction with workspace is a dimension of physical environment satisfaction, which has been identified as a significant factor affecting job satisfaction. For this study, satisfaction with workspace is specifically referring to contentment, in terms of being able to concentrate and collaborate at the same workspace, i.e., without being bothered or disturbed by auditory distractions coming from the surrounding work environment and without any fear of being overheard. Research suggests that disturbance due to EGIAD is a significant source of environmental dissatisfaction and is a potent enough source to cause job dissatisfaction. It is further argued that people who are dissatisfied with their jobs are more likely to show less commitment to their work, are more inclined towards finding another job, and experience more health problems than people who are satisfied. These affects are subjective and depends a lot on the personality of an individual; however, the resulting costs for an organization can be many, ranging from costs for hiring to costs of exit, reduced productivity because of a new employee's learning curve, and increase in absenteeism, eventually impacting the financial bottom line of an organization.

Attribute definition - Participant's feelings or perceptions about the strength of impacts of distractions on satisfaction with physical workspace. Research shows that workspace satisfaction has been generally measured in terms of: speech privacy; privacy from surrounding noise; ease to conduct a task; and design of workspace and micro-environment. Consequently, these are identified as the items for measurement of workspace satisfaction (Table 4.1).

Measurement index - The measurement index for measuring impacts of externally generated involuntary auditory distractions (EGIAD) on satisfaction with workspace is shown in Table 4.6.

Table 4.6 - Measurement Index for Impacts of EGIAD on Workspace Satisfaction

Objective	Attribute	Attribute Levels / Measurement Index		
		Response Format		Description
Minimize negative impacts of distractions on satisfaction with workspace	Participant's perceptions about strength of impacts of distractions on satisfaction with workspace	1	Not at all	I feel distractions have no impact on workspace satisfaction.
		2	A little	I feel distractions have a little impact on workspace satisfaction.
		3	Moderate	I feel distractions have a moderate impact on workspace satisfaction.
		4	Significant	I feel distractions have a significant impact on workspace satisfaction.
		5	Very significant	I feel distractions have a very significant impact on workspace satisfaction.

4.3.1.6. Objective 1.3.1 – Minimize Possible Negative Impacts of EGIAD on Social Responsiveness.

Social responsiveness is defined as the nature and degree of help offered to those who need. It is analogous to organizational citizenship behavior (OCB) in the organizational literature. OCB is a special type of individual behavior that is discretionary and is considered to promote the efficient and effective functioning of the teams and the organizations, thereby contributing to overall productivity of an organization. OCB consists of both individual and organizational components; however, this study is limited to individual components only. Research argues that noise may change the helping attitude of humans towards their fellow humans (Page, 1977, Mathews and Canon, 1975). The results have been explained via many theoretical models, including cognitive overload model and Maslow's hierarchy of needs. According to the cognitive overload model, when attentional overload occurs (because of distractions), it results in a focusing of attention on environmental inputs that are relevant to one's own goals, neglecting other cues, social and non-social alike (Cohen and Lezak, 1977, Broadbent, 1958, Broadbent, 1971, Mathews and Canon, 1975, Easterbrook, 1959). Those social cues which are typically ignored carry information concerning the moods and subtly expressed needs of others (Mathews and Canon, 1975). Therefore, distractions result in lack of cooperation and negate helping attitudes of individuals towards their fellow co-workers, which are argued to be important components of success in knowledge work. A number of studies support the argument that a person is less likely to offer simple assistance under environmental stress (noise is recognized as a significant occupational stressor) than under comfortable ambient conditions; this is because, under stressful conditions, social cues may be seen as irrelevant to the primary task and are thus ignored (Cohen and Spacapan, 1978, Cohen and Lezak, 1977, Mathews and Canon, 1975).

Attribute definition - Participant's feelings or perceptions about the strength of impacts of distractions on social responsiveness. Research shows that social responsiveness has been generally measured in terms of the following items: willingness to help a colleague; willingness to cooperate; attitude towards a co-worker; and behavior towards a co-worker. Consequently, these are identified as the items to measure impacts of distractions on social responsiveness (Table 4.1).

Measurement index - The measurement index for measuring impacts of externally generated involuntary auditory distractions (EGIAD) on social responsiveness is shown in Table 4.7.

Table 4.7 - Measurement Index for Impacts of EGIAD on Social Responsiveness

Objective	Attribute	Attribute Levels / Measurement Index		
		Response Format		Description
Minimize negative impacts of distractions on social responsiveness	Participant's perceptions about strength of impacts of distractions on social responsiveness	1	Not at all	I feel distractions have no impact on social responsiveness.
		2	A little	I feel distractions have a little impact on social responsiveness.
		3	Moderate	I feel distractions have a moderate impact on social responsiveness.
		4	Significant	I feel distractions have a significant impact on social responsiveness.
		5	Very significant	I feel distractions have a very significant impact on social responsiveness.

4.3.1.7. Objective 1.3.2 – Minimize Possible Negative Impacts of EGIAD on Social Cohesion.

The literature on social cohesion is vast as it has been a long-running subject of research in many different fields. Consequently, the term social cohesion has received many meanings and definitions that are difficult to combine. Makarem and AbouChedid (2009) argues that "one common core depiction in the extant literature is the notion of social cohesion as a bond that brings people together" (p. 2). Communication and interpersonal attraction are two important components of social cohesion. Researchers from social psychology argue that individuals communicate more when physical characteristics of buildings or settings, like absence of walls in an open plan workplace, encourage them to do so. High interaction produces interpersonal attraction, which furthers social cohesion. Friedkin (2004) argues that high levels of cohesiveness in a group results in high motivation among group members to care for the group's welfare, to work for its objectives, and to share its activities. In knowledge-based organizations, these groups are called high-performing teams. However, researchers from organizational psychology counter-argue that open office settings are high in distractions due to surrounding noise. These distractions impair group cohesion by building up hostility among co-workers because they feel overwhelmed by not being able to concentrate, stop neighboring conversations, whistles, and laughter. Researchers argue that moving into open office settings creates increased interaction only for a short period and people soon revert to earlier habits of interaction as they adapt to the less private conditions and develop ways of regulating social contact. Such surroundings are also shown to eventually result in complete isolation of an individual and a significant loss of important threads of communication between co-workers. This happens despite the fact that good communication helps to build good social cohesion, which is one among the key factors to successful knowledge work. Bill Sims, a Cornell University Professor of Facilities Management and Planning, says that "if people can't control the communications, they actually communicate less" (Bencivenga, 1998).

Attribute definition - Participant's feelings or perceptions about the strength of impacts of distractions on social cohesion. Research shows that social cohesion has been generally measured in terms of the following items: free communication between colleagues; preference to work as a team member rather than alone; preference to spend outside workplace in social gatherings; preference to stick together after the project is over; and preference to socialize often. Consequently, these are identified as the items to measure impacts of distractions on social cohesion (Table 4.1).

Measurement index - The measurement index for measuring impacts of externally generated involuntary auditory distractions (EGIAD) on social cohesion is shown in Table 4.8.

Table 4.8 - Measurement Index for Impacts of EGIAD on Social Cohesion

Objective	Attribute	Attribute Levels / Measurement Index		
		Response Format		Description
Minimize negative impacts of distractions on social cohesion	Participant's perceptions about strength of impacts of distractions on social cohesion	1	Not at all	I feel distractions have no impact on social cohesion.
		2	A little	I feel distractions have a little impact on social cohesion.
		3	Moderate	I feel distractions have a moderate impact on social cohesion.
		4	Significant	I feel distractions have a significant impact on social cohesion.
		5	Very significant	I feel distractions have a very significant impact on social cohesion.

4.3.1.8. Objective 3.1 – Maximize Workspace's Support for Individual Work

The term individual work means any work for which a person prefers to work in a private environment rather than in a social setting. This work may include a complex knowledge-based task that requires continuous concentration for creative understanding of information and creative problem-solving; it may also include a task that doesn't require continuous state of concentration, but the person requires distance from environmental distractions because of psychological, physiological, or emotional reasons. Surveys have indicated that office workers (managers, professionals, engineers, administrative) spend more than 75% of their time in their own workspace with more than half of that time spent on concentrated work (Olson, 2002). Consequently, researchers argue that one of the key requirements of knowledge workers from their workspace is to be able to perform individual work without having to look for a private enclosure.

Attribute definition - A workspace is said to be supporting individual concentrated work if, depending on the user's need, it supports one or more of following items without having to move to another space: on-demand opaqueness from externally generated involuntary auditory distractions; and on-demand concentration without drive-by interruptions. Literature suggests these as the most important requirement to provide support for individual work (Table 4.1).

Measurement index - The measurement index for measuring a workspace's support for individual concentrated work is shown in Table 4.9.

Table 4.9 - Measurement Index for a Workspace's Support for Individual Work

Objective	**Attribute**	**Attribute Levels / Measurement Index**		
		Response Format		**Description**
Maximize workspace's support for individual concentrated work	Participant's perceptions about strength of workspace's support for individual work	1	Not at all	I feel workspace provides no support for individual work.
		2	A little	I feel workspace provides a little support for individual work.
		3	Moderate	I feel workspace provides moderate support for individual work.
		4	Significant	I feel workspace provides significant support for individual work.
		5	Very significant	I feel workspace provides very significant support for individual work.

4.3.1.9. Objective 3.2 – Maximize Workspace's Support for Collaborative Work

A number of studies have argued that another key requirement knowledge workers have of their workspace is the support for communication and collaboration without having to move to another space and without disturbing neighboring co-workers (Brill et al., 2001, Chou et al., 2001, Heerwagen et al., 2004, Olson, 2002, Davies, 2005). Davies (2005) reports that typically knowledge workers are involved in conversations in and around their workspaces for 15% of the time that they spend in the office. The instances of communication may include impromptu meetings, short consultations, and short telephonic meetings with clients, to name a few forms of communication. The explanation for this requirement is that knowledge workers believe that they will be most productive when they can pursue task-related discussions with their colleagues at their own workspace without having to look for vacant meeting rooms or collaboration spaces and without disturbing their colleagues (Chou et al., 2001, Brill et al., 2001, Olson, 2002).

Attribute definition - A workspace is said to be supporting collaborative work if, depending on the user's need, it supports one or more of following items without having to move to another space and without disturbing surroundings: serendipitous interactions; short consultation between colleagues; brief social interactions; and drive-by interruptions. Literature suggests these as the most important requirements to provide support for collaborative work (Table 4.1).

Measurement index - The measurement index for measuring a workspace's support for collaborative work is shown in Table 4.10.

Table 4.10 - Measurement Index for a Workspace's Support for Collaborative Work

Objective	Attribute	Attribute Levels / Measurement Index		
		Response Format		Description
Maximize workspace's support for collaborative work	Participant's perceptions about strength of workspace's support for collaborative work	1	Not at all	I feel workspace provides no support for collaborative work.
		2	A little	I feel workspace provides a little support for collaborative work.
		3	Moderate	I feel workspace provides moderate support for collaborative work.
		4	Significant	I feel workspace provides significant support for collaborative work.
		5	Very significant	I feel workspace provides very significant support for collaborative work.

4.3.1.10. Objective 2.1 – Minimize Direct Costs of Workspace

For this study, direct cost is measured as the cost of acquiring and installing a workspace. A very conservative approach is taken because higher initial cost is suggested as one of the fundamental limitations when it comes to selling adaptable workspaces to organizations. The cost-benefit analysis does not provide the exact value of adaptable workspaces since most of the benefits are subjective in nature; this poses a problem of conversion into specific dollar figures to be included in a single cost-benefit equation. The direct costs can be further sub-divided into many sub-components, like maintenance costs, environmental costs, among others, but that is outside the scope of this study.

Attribute definition - Direct cost of a workspace is defined as the costs of acquiring and installing a workspace (Table 4.1).

Measurement index - The measurement index for measuring direct costs of a workspace is shown in Table 4.11.

Table 4.11 - Measurement Index for Direct Costs of Workspace

Objective	**Attribute**	**Attribute Levels / Measurement Index**		
		Response Format		**Description**
Minimize direct costs of workspace	Costs of acquiring and installing a workspace	1	Not at all	Cost of workspace is very little, i.e., between $100 and $1000.
		2	A little	Cost of workspace is a little, i.e., between $1100 and $2000.
		3	Moderate	Cost of workspace is moderate, i.e., between $2100 and $3500.
		4	Significant	Cost of workspace is significant, i.e., between $3600 and $5000.
		5	Very significant	Cost of workspace is very significant, i.e., > 51,00 and < $10,000.

4.3.2. Structuring the Fundamental Objective Hierarchy

The fundamental objective hierarchy is a hierarchy that arranges objectives from a broad, overarching concept at the top to lower-level, specific accomplishments or actions. Objectives at the upper levels of the hierarchy reflect broad or inclusive values and progress towards these objectives is achieved by meeting lower-level sub-objectives. Therefore, an objective hierarchy should be structured in a way that it possesses the following characteristics:

- Objectives at the upper level reflect broad values of an organization or decision-makers.

- The meaning of upper level objectives are explained and bounded by the lower level objectives directly below it.
- The structure of objective hierarchy is such that how an alternative performs with respect to the lowest-level objectives tells how an alternative will perform with respect to the overall decision objective. Therefore, lowest-level objectives should be measurable, i.e. have qualitative or quantitative attribute or measurement scale.
- Objective hierarchy should be complete, concise, and non-redundant.
    - A set of objectives in each layer is complete if all the criteria that are important to the decision problem are included in the objective hierarchy.
    - A set of objectives in each layer is concise if all the criteria that are important to the decision problem – but will not make a difference in evaluating alternatives – are excluded from the objective hierarchy.
    - A set of objectives in each layer is non-redundant if an evaluation consideration can be included in exactly one criterion. For instance, if cost is divided into three sub-objectives, such as training costs, software costs, and hardware costs, then any cost consideration within the scope of the three sub-objectives shall fall in exactly one criterion: training or software or hardware costs.

4.3.2.1. Objective 1.1 – Minimize Potential Performance Costs of EGIAD.

Performance of knowledge workers is generally measured through work efficiency and work effectiveness (Davies, 2005, Tangen, 2005). Research shows that externally generated involuntary auditory distractions (EGIAD) negatively impact both the components of knowledge worker performance, which is a key productivity ingredient for knowledge-based organizations. Therefore, it is assumed that if the possible impacts of EGIAD on work efficiency and work effectiveness are minimized, then the potential performance costs of distractions (EGIAD) can be minimized. The two objectives, minimize negative impacts of distractions on works efficiency (1.1.1) and work effectiveness (1.1.2), are thus categorized under the objective 'minimize potential performance costs of knowledge workers resulting due to EGIAD'. The initial and revised partial objective hierarchy for this relationship is shown in Figures 4.4.

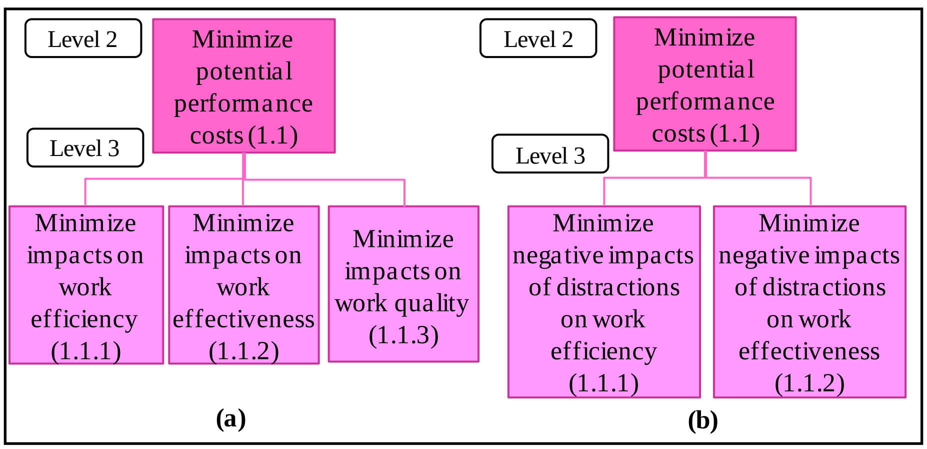


Figure 4.4 - Partial Objective Hierarchies for Objective 1.1; a) initial b) revised

4.3.2.1.1. Discussion on modifications to the partial objective hierarchy for objective 1.1

The lowest-level objective 1.1.3, minimize possible negative impacts of externally generated involuntary auditory distractions on work quality of knowledge workers, was deleted from the revised or final objective hierarchy, Figure 4.4 (b). This was at the suggestion of the expert panel, of which 52% suggested that, for knowledge work, work quality is a component of work efficiency and work effectiveness. Quality is assessed in terms of creativity and new ideas, which is encompassed in the definitions of work efficiency and effectiveness. The comment suggests that the three objectives 1.1.1, 1.1.2, 1.1.3 are not mutually exclusive, which is a requisite characteristic of fundamental objective hierarchy.

4.3.2.2. Objective 1.2 – Minimize Potential Health and Well-being Costs of EGIAD.

Danna and Griffin (1999) define health and well-being as a combination of psychological health (mental health), physiological health (physical health), and satisfaction. In the sections 4.3.1.3, 4.3.1.4, and 4.3.1.5, research studies were presented which identified auditory distractions as a potential stimulus for affecting: psychological health, like increased frustrations, stress, anger, anxiety, etc.; physiological health, through an increase in symptoms of headaches, backaches, etc; and increasing dissatisfaction with the workspace, thereby increasing the job dissatisfaction and overall dissatisfaction level of an individual. Therefore, it is assumed that if the possible impacts of distractions on a psychological state and physiological state, and satisfaction of an individual are minimized, then the potential health and well-being costs of distractions for knowledge workers can be minimized. The three objectives, minimize impacts of distractions on psychological health (1.2.1), physiological health (1.2.2), and satisfaction (1.2.3), are thus categorized under the objective 'minimize potential health and well-being costs resulting due to distractions' (1.2). The initial and revised partial objective hierarchies for this relationship are shown in Figure 4.5.

4.3.2.2.1. Discussion on modifications to the partial objective hierarchy for objective 1.2

In accordance with the expert feedback from Phase I of the Delphi study, the desirable properties of objective hierarchy (conciseness and non-redundancy), and the suggested references (Klitzman and Stellman, 1989) and (Danna and Griffin, 1999), the structure of the initial partial hierarchy for objective 1.2 was revised as follows:

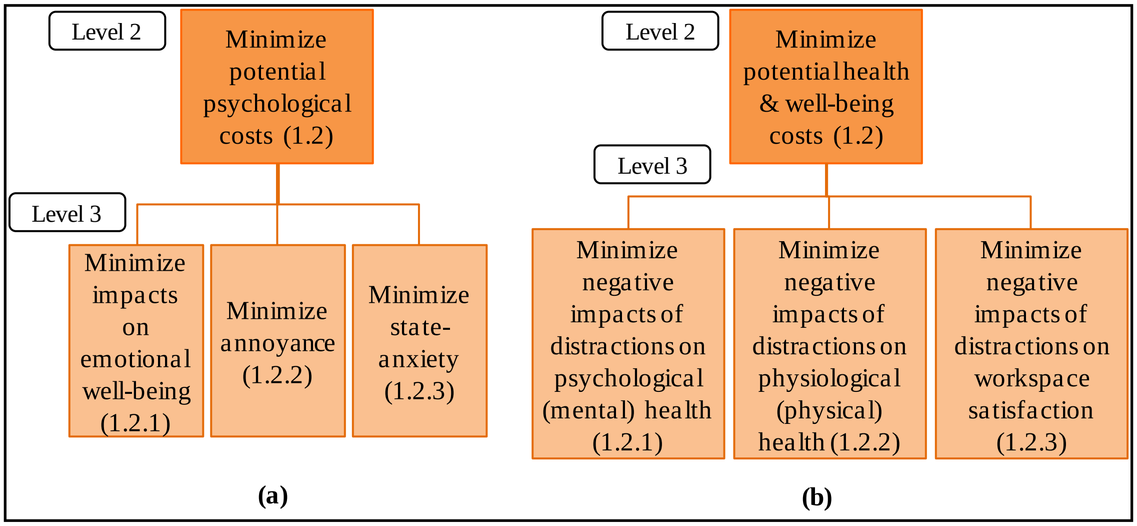


Figure 4.5 - Partial Objective Hierarchies for Objective 1.2; a) initial b) revised

The lowest level objectives, emotional well-being (1.2.1), anxiety (1.2.2), and annoyance (1.2.3), were combined under the construct psychological health (1.2.1) in the revised objective hierarchy because these were suggested as components of psychological health that are not mutually exclusive.

The lowest level objectives, fatigue (1.4.1), and health and well-being (1.4.2), were combined under the construct physiological health (1.2.2) because 1.4.1 and 1.4.2 were suggested as not mutually exclusive.

Satisfaction with workspace was suggested as a component of health and well-being (Danna and Griffin, 1999); therefore, instead of placing it parallel to potential physiological costs, it was added as a component of health and well-being.

4.3.2.3. Objective 1.2 – Minimize Potential Social Behavioral Costs of EGIAD.

Social behavior is defined as a behavior directed towards or taking place between members of the same species. Research in psychology and social sciences show that externally generated involuntary auditory distractions negatively affects social behavior of individuals, more specifically those individuals who are easily irritated by distractions. The negative bearings are mostly expressed as change in one's helping attitude towards fellow workers and building of hostility or bitterness among fellow workers. These negative impacts possess the potential to misalign human behavior and key requirements of successful knowledge work, i.e. collaboration and communication. Therefore, it is assumed that, if the possible negative impacts of distractions on helping attitude (also called social responsiveness in many studies), and interpersonal relations (also called social cohesion) are minimized, then the potential social behavioral costs of distractions for knowledge workers can be minimized. The objectives 1.3.1 and 1.3.2 are thus categorized under the objective 1.3. The initial and revised partial objective hierarchies for this relationship are shown in Figure 4.6

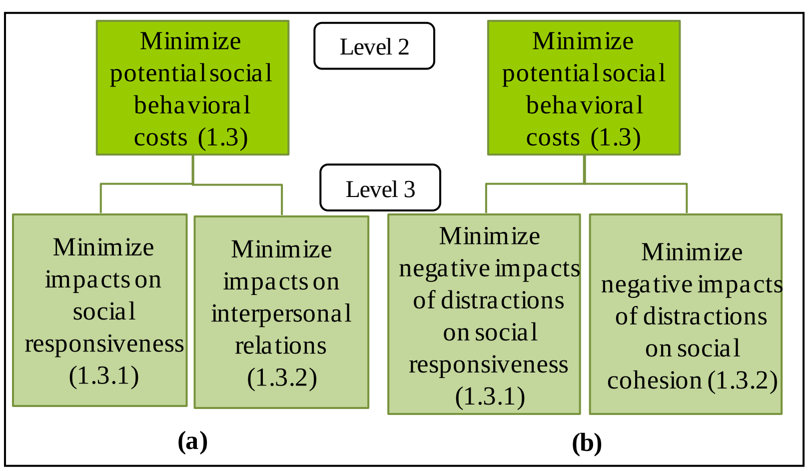


Figure 4.6 - Partial Objective Hierarchies for Objective 1.3; a) initial b) revised

4.3.2.3.1. Discussion on modifications to the partial objective hierarchy for objective 1.3

The Delphi panel suggested interpersonal relations and communications as two important dimensions of social cohesion. This knowledge was explicitly captured in the revised objective hierarchy by incorporating the two criteria under the parent objective social cohesion (1.3.2).

4.3.2.4. Objective 0.0 – Maximize the Value of a Workspace for an Organization.

Choosing a workspace is an investment decision for an organization. In accordance with investment decision theory, maximizing the value of this investment should be the key objective of decision-makers. Therefore, the top-level objective of this decision problem is: maximize the value of a workspace.

Studies show that, in knowledge-based organizations, a workspace incurs huge subjective (indirect/intangible) costs because of its negative bearings on knowledge workers, in terms of negative impacts on mood, psychology, health, and mental health, to name a few impacts. These negative impacts are subjective in nature and cannot be converted into precise dollar figures; however, they are shown to be the cause of huge productivity losses in the long run, thereby compromising the value of workspace investment for the respective organization. A strategically chosen workspace that aligns the workspace with the needs of knowledge work and knowledge workers is argued to reduce these subjective costs and increase benefits. Consequently, the value of a workspace is actually a function of the following components: direct costs of workspace; indirect costs of workspace; and benefits of a workspace. Minimizing these costs and maximizing benefits should, therefore, maximize the value of a workspace. As a result, the top-level objective was divided into three sub-objectives: minimize indirect costs of workspace resulting due to distractions (1.0); minimize direct costs of workspace (2.0); and maximize indirect benefits of a workspace (3.0). This research refers to benefits as indirect because these may occur as a result of workspace's support for knowledge work requirements. The initial and revised partial objective hierarchies for this relationship are shown in the Figure 4.7.

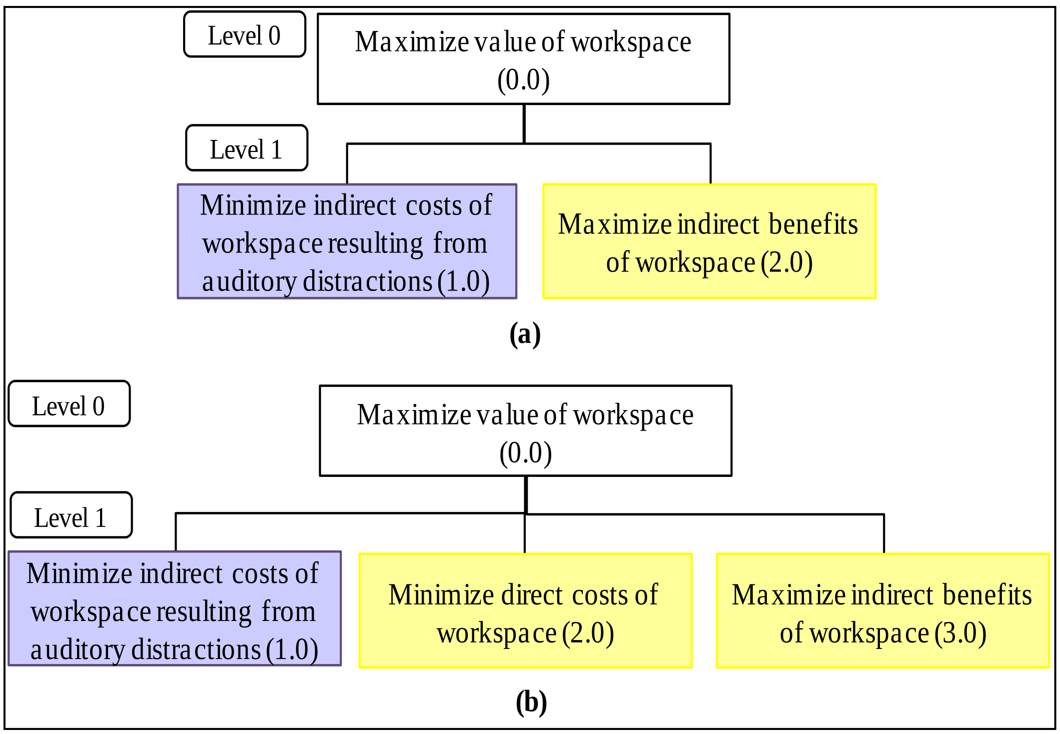


Figure 4.7 - Partial Objective Hierarchies for Objective 0.0 (a) initial, (b) revised

4.3.2.4.1. Discussion on modifications to the partial objective hierarchy for objective 0.0

To gain completeness at Level 1, sub-objective 2.0, minimize direct costs of workspace, was included in the revised objective hierarchy under the top-level objective, 'maximize value of a workspace'. It was suggested in the Delphi process that inclusion of direct costs is important in the stated decision context and it will not divert evaluators from giving necessary importance to subjective non-monetary criteria, i.e., indirect costs. Objective 2.0, the direct costs of the workspace, was not further sub-divided into various cost factors, such as maintenance costs, operations costs, etc., for two reasons. First, operations and maintenance costs are only 2% of the total annual operating costs (Administration, 1999); therefore, these are not a major factor to affect decisions about workspace. Second, further splitting of direct costs will not add any value to the objective of the decision problem; rather, it may deviate the focus of the problem to bits and pieces of costs savings here and there. The goal of this study is to help identify indirect cost factors of workspaces that are critical to knowledge-based organizations, and include them in the decision analysis for workspace choice along with the direct costs of implementing such a workspace.

4.3.2.5. Objective 1.0 – Minimize Indirect Costs of Workspace Resulting due to EGIAD.

Objectives 1.1(minimize potential performance costs of EGIAD), 1.2 (minimize potential health and well-being costs of EGIAD), and 1.3 (minimize potential social behavioral costs of EGIAD) were categorized under the objective 1.0, minimize indirect costs of workspace, because these were identified as the significant indirect cost factors (refer to Table 3.2, Chapter 3) resulting from auditory distractions in ones surroundings. The initial and revised partial objective hierarchies for this relationship are shown in the Figure 4.8.

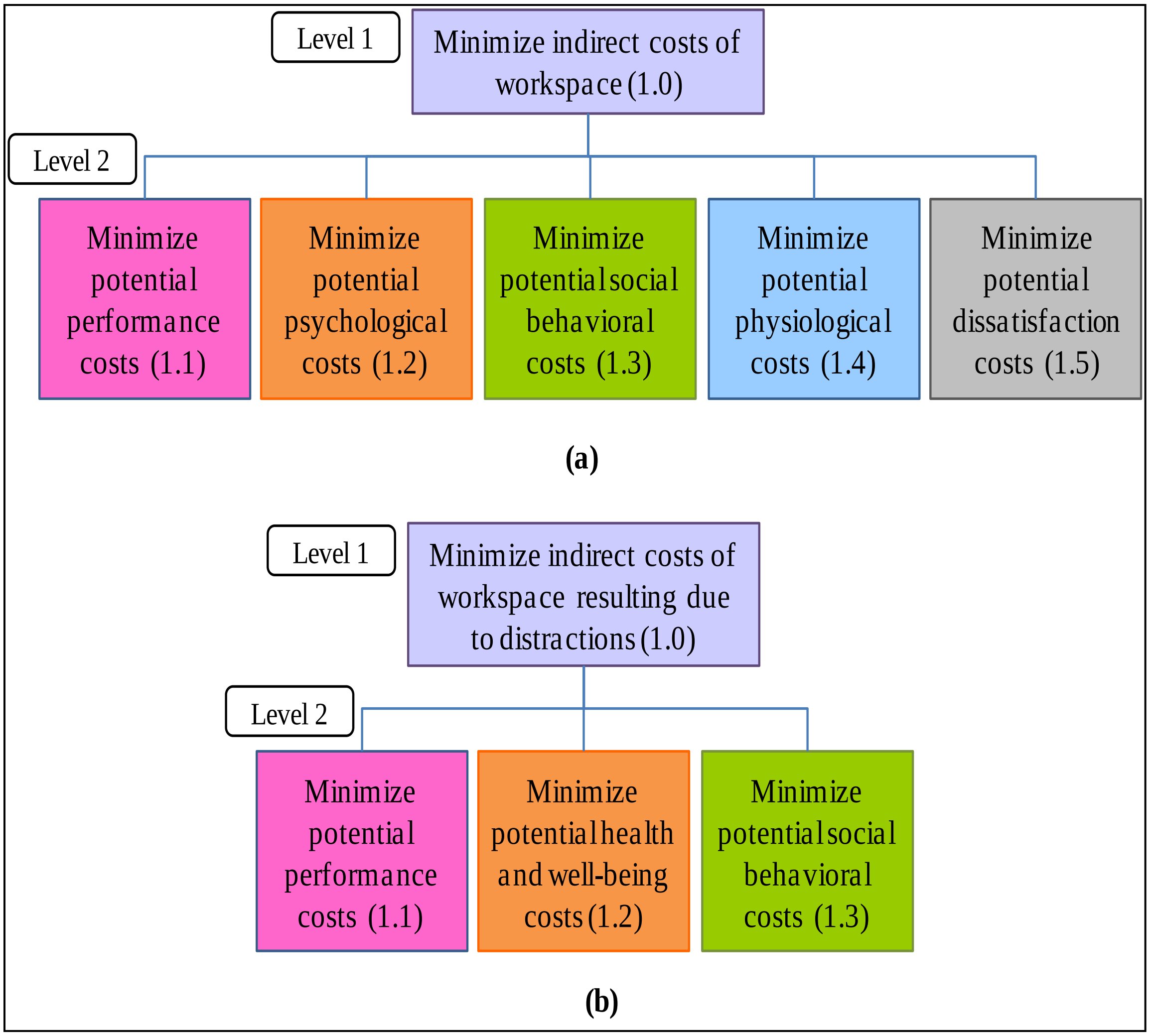


Figure 4.8 - Partial Objective Hierarchies for Objective 1.0; a) initial b) revised

4.3.2.5.1. Discussion on modifications to the partial objective hierarchy for objective 1.0

To seek conciseness and non-redundancy, the two important characteristics of fundamental objective hierarchy, objectives 1.2 (minimize potential psychological costs of EGIAD), 1.4 (minimize potential physiological costs of EGIAD), and 1.5 (minimize potential dissatisfaction costs of EGIAD) in the initial objective hierarchy were combined under the construct, 'health and well-being' in the revised objective hierarchy. These were suggested as mutually exclusive components of overall health and well-being (Danna and Griffin, 1999, Klitzman and Stellman, 1989). Further sub-categorization of psychological costs into emotional well-being, annoyance, and state-anxiety; physiological costs into health and well-being, and fatigue; and dissatisfaction costs in the initial objective hierarchy was considered redundant by the Delphi panel, as the components were described as not mutually exclusive. For instance, it was suggested that annoyance may raise the state-anxiety of a person, which may cause one's emotional well-being to drop.

4.3.2.6. Objective 3.0 – Maximize Workspace Benefits.

A number of studies (Heerwagen et al., 2004, Olson, 2002, Paul Chou, 2001, Brookes and Kaplan, 1972, Davies, 2005) have shown that the most-effective workspace design is the one that enhances support for both distraction-free individual work and impromptu interactions anywhere anytime in a workplace. According to Olson (2002), these two characteristics of a workspace have significant effects on individual performance, team performance, and job satisfaction; all these factors have a direct or indirect correlation with organizational productivity. Therefore, it is assumed that if the workspace's support for individual concentrated work and collaborative group work is maximized, then the potential benefits of a workspace can be maximized. The two objectives, 3.1 and 3.2, are thus categorized under the objective 'maximize indirect benefits of workspace' (3.0). The partial hierarchy for this parent child relationship is shown in Figure 4.9.

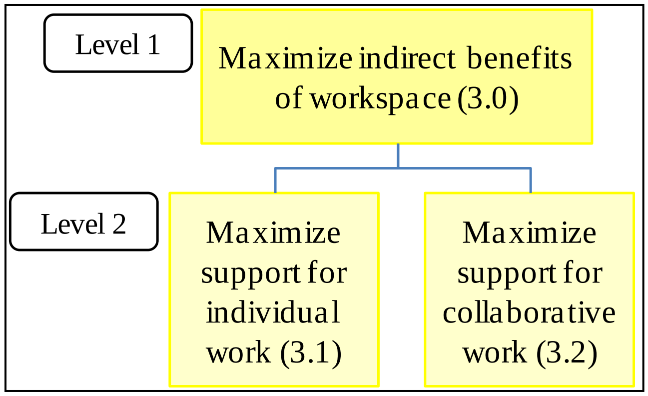


Figure 4.9 - Partial Objective Hierarchy for Objective 3.0

4.4. Summary

In this chapter, the goal was to suggest the most appropriate methodology to address the decision problem discussed in chapters 1, 2, and 3. The multi-criteria decision-making approach was then discussed and the relevancy of multi-attribute utility theory for this study was established. The first step in multi-attribute utility analysis is structuring of a fundamental objective hierarchy; several sections were devoted to descriptions of the objectives, attributes, and the measurement index, and how the fundamental objective hierarchy for a workspace choice decision model was structured. The objective hierarchy developed here drew its base from the theoretical knowledge and original research conducted in this study. A multi-method research design was then developed to validate the structure of the objective hierarchy, which is the focus of Chapter 5.

CHAPTER 5

STAGE III - VALIDATION OF THE FUNDAMENTAL OBJECTIVE HIERARCHY FOR WORKSPACE CHOICE

5.1. Introduction

The goal of Stage III was to validate the structure of the fundamental objective hierarchy for workspace choice developed in Stage II. The obvious source of information and knowledge for this task was academicians and professionals who have a deep understanding of the issues of auditory distractions, knowledge work, costs and benefits of workplace environments, behavioral issues in workplaces, and corporate decision-making. These people are termed experts in their field of interest. This chapter explains in detail the process for conducting the expert study and presents the results of the study.

5.2. Expert Study

The literature suggests many methods to approach experts in the field or academia, in order to seek their judgments or opinion about a topic of interest. Some of these are individual-based techniques, like face-to-face interviews or survey questionnaires, while others are group techniques. A group technique was best suited for this study due to its inherent interdisciplinary nature. For this study, a group of experts was expected to provide a potentially better outcome than an individual alone. The literature suggests many methods for eliciting knowledge from a group of experts. The most commonly used methods, nominal group technique (NGT) and the Delphi method, were considered for this study (a detailed discussion about these methods is provided in Appendix K). Both the techniques are effective for eliciting individual judgments, combining them, and making decisions (Delbecq et al., 1975). Delphi method was selected for this study as it provided the following advantages:

- Geographical distance between participants was a concern. Delphi does not require the participants to meet at a particular location, so the issue was resolved.
- Delphi method, in general, takes the least time of the participants, although it is more cumbersome for the one conducting the research. This was very important for this study as the questionnaire instruments were comprehensive and complex.
- Web-based Delphi is very economical for the investigator.
- Delphi preserves heterogeneity, since individualistic factors, such as status, personality and assertiveness, do not influence the results.

5.2.1. Delphi Method

The Delphi method, developed in the 1950s by Norman Dalkey of the RAND Corporation, is a mature and adaptable research method for structuring a group communication process (Linstone and Turoff, 1975). It is an iterative process until the research question is answered; for example, consensus is reached or theoretical saturation is achieved. A Delphi can be imagined as a virtual group meeting with the aim to make use of the positive aspects of interacting groups, while removing the negative aspects of individualistic factors (Okoli and Pawlowski, 2004). The Delphi method has its application in many different situations where it has been used as a tool for expert problem-solving and decision-making. Typically, three rounds are considered sufficient to reach a defined form of consensus, such as knowledge saturation and agreement. However, the literature shows the implementation and success of Delphi with two to a maximum of 10 rounds (Woudenberg, 1991). Furthermore, Dalkey et al. (1970) suggests that as the number of rounds increases from two to three or more, the accuracy of the Delphi results is compromised with each additional round. Guided by the previous findings and to account for the time required to complete each phase of the study, two rounds of Delphi were designed for this study.

5.2.2. The Expert Panel

The first step in a Delphi process is the formation of a panel of experts. Unlike experimental research designs, a Delphi study is not based on a random sample which is a statistical representative of the target population (Keeney et al., 2001). Delphi is aimed at seeking judgments from a panel of experts, where expertise of members does affect the performance of the group (Bonner et al., 2002). The respondent's expert status is argued to as an assurance for the valid results. Goodman (1987) states that "if the panelists participating in the study can be shown to be representative of the group or area of knowledge under study then content validity can be assumed" (p.713). Therefore, the selection of panel of experts is central to the success of the Delphi method (Robinson, 1991); however, the literature does not provide much support for this step (Okoli and Pawlowski, 2004). Proven experience and good performance in the past are suggested as broad guidelines. The following selection criteria were established to select a panel of experts for this study:

- Practitioners and academicians who have expertise and interests in the areas of workplace environment, human performance and organizational productivity, behavioral aspects of knowledge workers, life cycle costs of a facility, office noise and acoustics, and organizational decision-making.

- Experts who are directly, currently, or recently involved in the practice or research on topics stated above.
- International collaboration, since the subject is under close scrutiny in Europe and Canada.
- Time availability of the experts, as the questionnaire was complex and comprehensive requiring somewhere between 1.5 – 2 hours.
- Costs to the investigator.

5.2.2.1. Size of the Expert Panel

Literature on size of the expert panel provides mixed results. Most studies have used between 15 and 35 panelists (Gordon, 1994). Linstone and Turoff (1975) suggest an upper limit of 30 participants. Ferrell (1985) suggests that three to five judgments is probably sufficient in most practical cases. (Okoli and Pawlowski, 2004) suggests that group dynamics, rather than the statistical power, is a critical factor for determining consensus among experts.

A list of 10 potential Delphi panel members was selected from the literature. These were the people with key publications in the area of study. A customized individual e-mail invitation was sent to these potential members; in the same e-mail, a request was made to suggest an expert(s) in the field whom they would consider a significant participant. The sample e-mail invitation is included in Appendix A. 12 references were suggested, of which eight were selected for the study for meeting the search criteria. Individual customized e-mail invitations were sent to the chosen eight experts. All 18 individuals agreed to participate; however, after the questionnaire was distributed, only 11 panel members completed the questionnaire (response rate: 61%).

Four members left the questionnaire incomplete and three decided not to participate due to time constraints. The response rate corresponded well with Calyton's (1997) rule of thumb that 8-20 people are an adequate panel size. The composition of the final group of participants represents a balanced view of: academicians and professionals; national and international experts; and broad and specific experience and interest in workplace environments, human behavior, and office noise and acoustics. A snapshot of characteristics of experts is shown in the Table 5.1 and Figure 5.1.

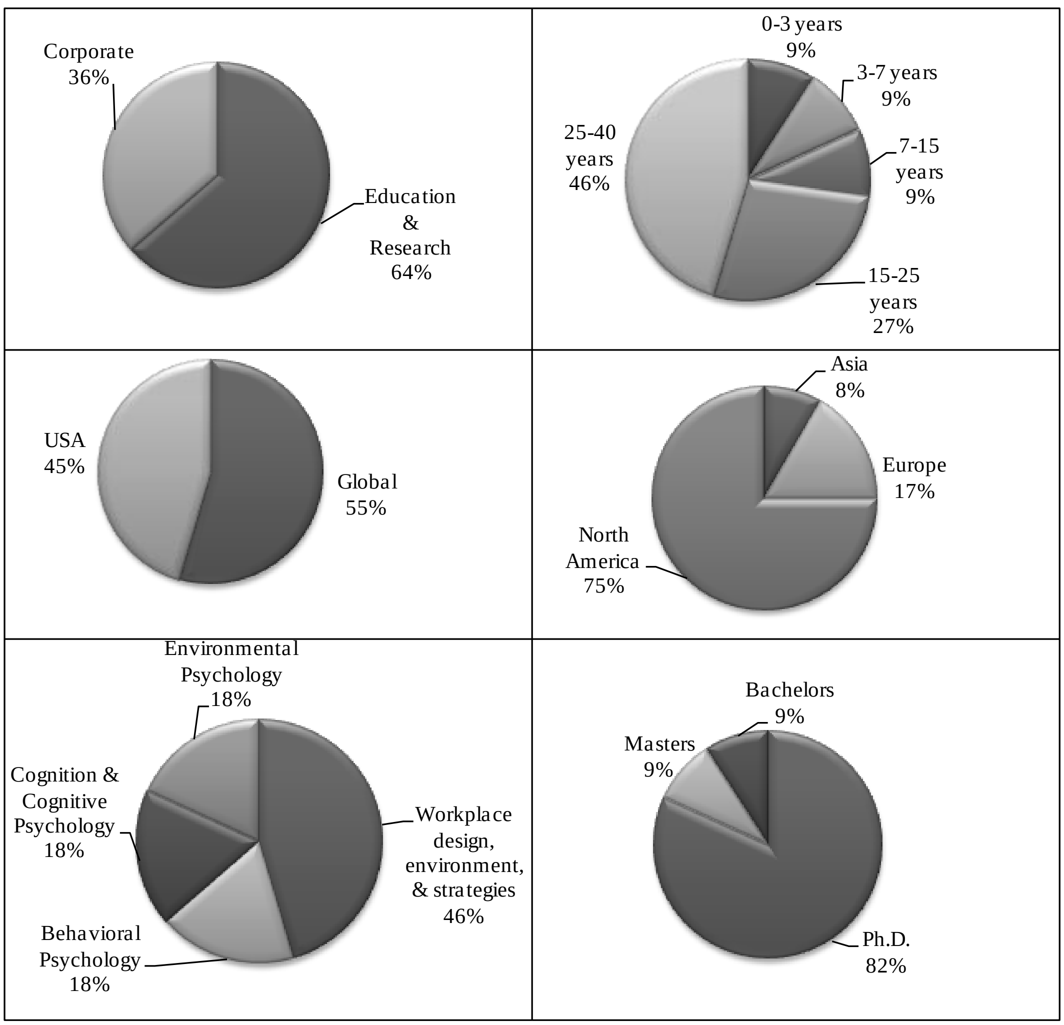


Figure 5.1 - Snapshot of Characteristics of Experts

Table 5.1 - Summary of Characteristics of Experts

Expert	Education	Job Title	Experience (years)	Areas of Expertise	Location	Industry	Areas of Research interest
1	Ph.D.	Professor and Chair	35	Workplace strategies, health and design	USA	Education	Evidence-based design
2	Bachelors	Principal	10	Office Design	Japan	Service	Workplace change management
3	Ph.D.	Retired, Director of Research	37	Evaluation of designed environments, via human behaviors and responses.	USA	Education	Human behavior, perceptions, and evaluative responses to the designed environment
4	Ph.D.	Senior Consultant	16	Cognitive Psychology	Canada	Defense	Human Factors
5	Ph.D.	Senior Research Officer	23	Environmental Psychology	Canada	Research	Effects of lighting, noise, temperature etc. on office workers' well-being, health, and performance
6	Masters	Senior Vice President	35	Workplace Strategies - general	USA	Office Furniture	Work Environments
7	Ph.D.	Full Professor	40	Behavior of Building Users	Canada	Education	Environmental Psychology
8	Ph.D.	Assistant Professor	7	Collaborative workplace, green building	USA	Education	Collaborative workplace, green building
9	Ph.D.	Applied Environmental Psychologist	25	Environmental Psychology	USA	Architecture / Interior design	Emotional response to space.
10	Ph.D.	Associate Professor	33	Corporate Real Estate management / use and experience of buildings	Netherlands	Education	Briefing and Post-Occupancy Evaluation of office buildings and other buildings.
11	Ph.D.	Associate Lecturer	12	Cognition and Emotion	Cardiff	Education	Cognition

5.2.3. Aggregation of Panel Responses

For aggregation of panel responses, Ferrell (1985) points out that complicated schemes have limited or no advantages over the simple average of scores. The reasoning is that individuals are often of equal expertise, and that the task is information limited rather than expertise limited. However, when members do not interact, the panel outcome depends solely on the mathematical synthesis of individual assessments, and mathematical aggregation plays a key role. The acceptability of the outcomes depends upon the acceptability of the rule, which, therefore, has to be selected carefully. For this study, guided by the objectives of Phase I and Phase II, different rules were established for aggregation and consensus.

The goal of Phase I was to collect suggestions and comments provided by the experts, analyze them, make recommended modifications, and state explanations for the modifications. Because the goals of Phase I were subjective and knowledge seeking rather than analytical the consensus criteria was arbitrarily set up as 80% agreement, i.e., if 80% or more experts agreed on an argument or a question it was considered a consensus.

The goal of Phase II was validation of the structure of the fundamental objective hierarchy developed in Stage II of the study. The task required consensus on the following: structure of the objective hierarchy; definitions of the attributes; and operationalization of the measurement index. Because the goals of Phase II were more analytical in nature, a more sophisticated and analytically robust five-point scale of agreement-disagreement was used to collect data, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. A mean value of 3.5 and within group inter-rater agreement index (r_{wg}) of 0.5 were set as criteria for validation and consensus, where r_{wg} is a measure of agreement among a single group of judges who have rated a target item on a single dimension (James, 1984). Inter-rater agreement index, r_{wg}, is discussed in detail in Section 7.3.5.1 of this dissertation. The values of mean and r_{wg} are based on heuristics in psychology, according to which, 0.7 is considered a valid cut point. However, for this study, Delphi experts suggested adopting a liberal consensus, r_{wg} index, with a value of 0.5 as a cut-off point. The reason given was that, since this is a novel and complex method to approach the problem, it will be a good idea to first start with liberal standards. Higher r_{wg} score will indicate stronger consensus. In general, $r_{wg} = 0.7$ suggests that there has been a 70% reduction in error variance. Therefore, only 30% of the observed variance among judge's ratings is due to random sampling. Consequently, mean value ≥ 3.5 (70% of 5.0) and $r_{wg} \geq 0.5$ will imply that experts agree with the importance of a criterion for workspace decision-making or operationalization of the attribute when they have reached consensus. Mean value < 3.5 and $r_{wg} \geq 0.5$ will imply that the experts have reached consensus on the irrelevance of the attribute for workspace decision problem, or they disagree with the measurement index of the attribute. If the mean value is ≥ 3.5 but $r_{wg} < 0.5$, the criterion will be said to have a weak agreement for its relevance or operationalization and, thus, will be flagged for further checks. If required, modifications will be made to the objective hierarchy. LeBreton and Senter (2008) suggest the following criteria to interpret the consensus results: if r_{wg} is between 0.00 and 0.30, there is a complete lack of agreement; if r_{wg} is between 0.31 and 0.50, it implies a weak agreement; r_{wg} between 0.51 and 0.70 implies moderate consensus; r_{wg} between 0.71 and 0.90 implies strong agreement; and, finally, r_{wg} between 0.91 and 1.00 implies very strong agreement.

The number of judges is critical to affect the magnitude of the r_{wg} index. James (1984) and Lindell and Brandt (1999) suggests that when the number of judges is small, r_{wg} values are attenuated. Kozlowski and Hattrup (1992) and Lindell and Brandt (1999) suggested that 10 or more judges should be used to prevent attenuation. Consequently, the sample size, 11 members of the expert panel, corresponded well with the methodological requirements of calculating the agreement index among the group of experts. Once the aggregation and consensus criteria were set up and the expert panel was established, a survey questionnaire was used to collect expert feedback.

5.2.4. Bias in the Delphi Study

Expert judgments can be biased; therefore, appropriate steps were taken in this study to minimize these potential biases. A brief description was provided for each objective, attribute, and the measurement index to facilitate similar understanding of the concept within the domain of the study. This helped reduce the possibility of systematic biases that result when experts use their own perceptions. Anonymity of experts took care of the dominance bias. Randomization was used to reverse order the Likert scale options for some questions. The goal was to perform a check for neglect bias. Furthermore, Hallowell and Gambatese (2010) suggests that “Delphi groups that were given feedback that included reasons for specific panelist responses in addition to the statistics were significantly more accurate than Delphi groups that were provided with only the latter” (p. 105). They argue that providing reasoning takes care of many biases, such as the Von Restorff effect (with this effect, subjects recognize and remember relatively extreme events more often and accurately than less extreme events), myside bias (occurs when subjects provide arguments for only one side of an issue) and collective unconscious bias (occurs when decision-makers tend to unconsciously join a popular trend). Consequently, in the Phase I of the Delphi study, experts were required to provide explanations for their answers to various Likert-based questions. In Phase II of the Delphi study, these explanations were structured and summarized to provide reasoning for changes made in the structure of the objective hierarchy, definition of the attributes, and the measurement index.

Furthermore, potential for researcher bias was minimized by deciding beforehand the appropriate consensus statistics to aggregate panel responses in both the phases of the Delphi study. Because Phase II was the final round of the study, statistics for Phase II were more stringent. Mean was used to suggest agreement or lack of agreement and the nature of the agreement was analyzed using James' (1984) inter-rater agreement index.

5.3. Data Collection and Analysis

Traditionally, Delphi studies are conducted in a paper-based form. However, for this study, a Web-based option was chosen to give the participants flexibility to respond at one's convenient time and location. In addition, costs were greatly reduced, since the study involved experts from all over the world.

Initially, the deployment strategy for the Delphi study involved the following steps:

- Launch Phase I and keep it open for two weeks.
- Close Phase I. Perform data analysis, structure results and conclusions. Prepare Phase II questionnaire.

- Launch Phase II of the Delphi study within a month from the date of closing Phase I and keep it open for two weeks.
- Close Phase II. Perform data analysis, structure results and conclusions.

However, before the launch of Phase I, many experts suggested increasing the response period from two weeks to three weeks, given the amount of time required to complete the questionnaire. Based on the suggestion, the timeline was adjusted and participants were given three weeks to complete the open questionnaire.

Launch of Phase I involved sending personal e-mails to each participant that contained a link to the URL that was generated for each specific participant by the online survey application SurveyGizmo. Participants were asked to not to forward the link to anyone else, to prevent the data from being hampered. A copy of the e-mail is shown in Figure 5.2.

At the start of each following week, a reminder e-mail was sent to those participants who had yet not responded or completed the questionnaire. In all, 11 experts completed the questionnaire for Phase I and Phase II. The layout of Phase I and Phase II were kept alike so that participants could relate to Phase I easily while working on Phase II. On top of each page of the electronic questionnaire, it was suggested that all the questions are required and once work on a page is initiated, all the questions on that page had to be answered. The button ‘go to next page’ acts as a save page. During the response period, a few rounds of e-mail communication were established between the experts and the author to answer queries. These e-mail communications included a statement to the experts that the intent is not to bias their opinion but to provide additional information.

Dear Title Last name,

This is in reference to our previous communication regarding my research study "Decisions about Workspace type and Impacts of Auditory Distractions in Knowledge–based Organizations". This email is sent your way because you accepted the invitation and agreed to participate in the study. Please accept our heartiest thanks for providing your input. It is very valuable to us.

The phase-I of the study is now ready to collect data from you. Please follow the link below to gain access to the questionnaire.
http://s-ms7xt-51062.sgizmo.com/i/7021e1182141p6223.

Note: Each page of the research instrument is in self safe mode. Once you click the "Go to the Next Page" button at the bottom of the page, the page is automatically saved. You can stop at any time to come back to the questionnaire at a later time, but once you start working on a page you are required to complete the page and hit "Go to the Next Page" button to save the changes. To get back to the questionnaire at a later time, go to the survey link provided in your email, as this is the unique link created only for your data. Flip through the pages to reach to the page where you stopped the previous time you were working on the questionnaire.

The Survey will close on July 07, 2008 at 5:00 pm EST (Eastern Standard Time).

If you have any questions, please contact me at pjuneja@ti.gatech.edu or my faculty advisors at kathy.roper@coa.gatech.edu and bill.rouse@ti.gatech.edu. We will get back to you at the earliest.

Many Thanks.
Best Regards
Parminder Juneja
Ph.D. Candidate
College of Architecture & Tennenbaum Institute
Georgia Institute of Technology

Figure 5.2 - Snapshot of E-mail Sent via SurveyGizmo

5.3.1. Pre-testing

A pilot test was conducted before the release of Phase I questionnaire. E-mails were sent to doctoral students, Georgia Tech professors, and staff working in a research environment. Five responses were received and, based on their feedback, modifications were made in the overall look and feel of the questionnaire. For instance, Times New Roman font was replaced by Arial font as it was suggested that Arial font enhances readability.

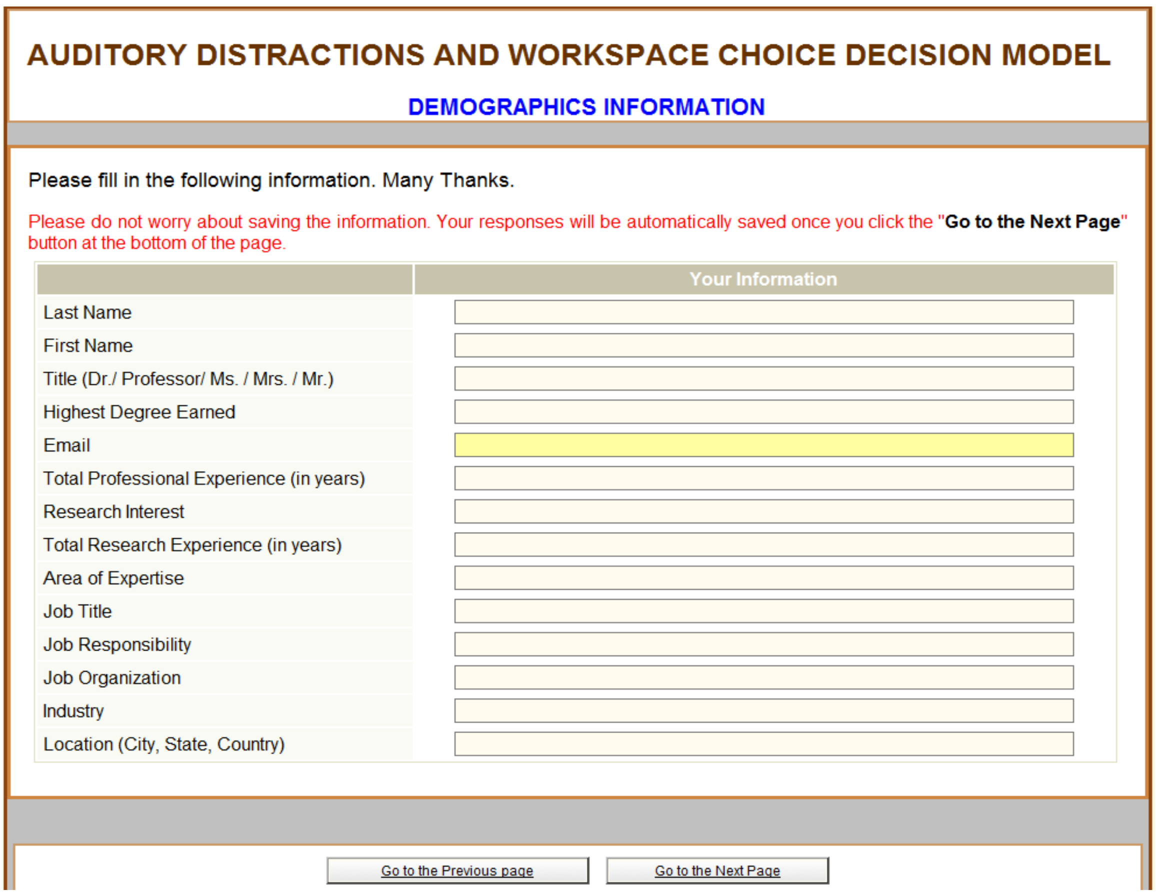
5.3.2. Web-based Delphi study, Phase I Instrument

The goals of Phase I of the Delphi study were as follows:

- Seek opinion about the relevance of each objective for workspace decision-making;
- Seek opinion about the definitions of attributes and operationalization of the measurement indices for each lowest-level objective;
- Seek opinion about the completeness of the objective hierarchy, i.e., if the objectives in the objective hierarchy include all the issues of importance within the scope of the stated decision context and the scope of this study;
- Seek opinion about the non-redundancy of the objective hierarchy, as non-redundancy ensures that the objective is not double-counted in the evaluation of alternatives; and
- Seek opinion for the structure of the objective hierarchy and request suggestions regarding modifications to the objective hierarchy.

The Web-based Delphi study was created using online survey software called SurveyGizmo. SurveyGizmo is an interactive platform for building online forms and surveys. It allows creating and managing questionnaires, online data collection, data analysis and management. Security and integrity of the data, which is one of the key concerns with online data collection, is assured through the use of Advanced Encryption Standard (AES) method and continuous 24x7 monitoring system.

The Phase I instrument was comprised of three main sections. First, a research consent form (Appendix B) was presented to make subjects aware that their participation is completely voluntary and one can drop out at any time during the process. Subjects were then forwarded to the demographics information form, where information, such as highest degree earned, total research experience, and area of expertise, etc., was collected. A snapshot of the demographics information form is presented in Figure 5.3.



AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

DEMOGRAPHICS INFORMATION

Please fill in the following information. Many Thanks.

Please do not worry about saving the information. Your responses will be automatically saved once you click the "**Go to the Next Page**" button at the bottom of the page.

	Your Information
Last Name	
First Name	
Title (Dr./ Professor/ Ms. / Mrs. / Mr.)	
Highest Degree Earned	
Email	
Total Professional Experience (in years)	
Research Interest	
Total Research Experience (in years)	
Area of Expertise	
Job Title	
Job Responsibility	
Job Organization	
Industry	
Location (City, State, Country)	

Go to the Previous page | Go to the Next Page

Figure 5.3 - Snapshot of Demographics Information Form for Phase I

The third section provided brief descriptions about each objective, attribute, measurement index, and key characteristics of the objective hierarchy. The goal was to facilitate similar understanding of the concept within the domain of the study, thereby reducing the likelihood of systematic biases that result when experts use their own perceptions to define a concept. These descriptions were followed by a set of questions regarding the following items:

- Hierarchical positioning of the objective, whether the objective-to-sub-objective relationship is a valid one;
- Importance of the objective for each layer in the objective hierarchy and for overall workspace choice decision model;
- Completeness and redundancy checks for objectives at each level of the objective hierarchy; and
- Validity of the attribute and its measurement index.

Each question was designed as a 3-point Likert scale of agreement, rather than the more sophisticated and analytically robust 5-point scale and participants were requested to provide explanation(s) for their answers. The 3-point scale was an appropriate choice because the aim was to collect ingrained knowledge and information from the experts, rather than being analytical and objective. The answers were expected to help analyze and modify the structure of the objective hierarchy, the attributes, and the measurement index. A typical set of questions that were asked throughout the questionnaire for each objective in the objective hierarchy are as follows:

1. In the stated decision context, do you agree that 'lower-level objective' is a valid sub-objective of the objective 'higher-level objective'?

For instance, question number 10 was: In the stated decision context, do you agree that minimizing potential performance costs resulting from EGIAD (1.1) is a valid sub-objective of the objective, minimize indirect costs of workspace (1.0)? The aim of this question was to seek the subject's opinion about the validity of hierarchical positioning of the objectives included in the question.

2. Do you agree that 'lower-level objective' is important to achieve the 'higher-level objective'?

For instance, question number 11 was: Do you agree that minimizing potential performance costs resulting from EGIAD (1.1) is important to minimize the potential indirect costs of workspace (1.0) for knowledge-based organizations? This question was asked to seek the subject's opinion about the importance of the lower-level objective(s) for achieving its higher-level objective?

3. In the stated decision context, do you agree that 'objective in question' should be included in the objective hierarchy?

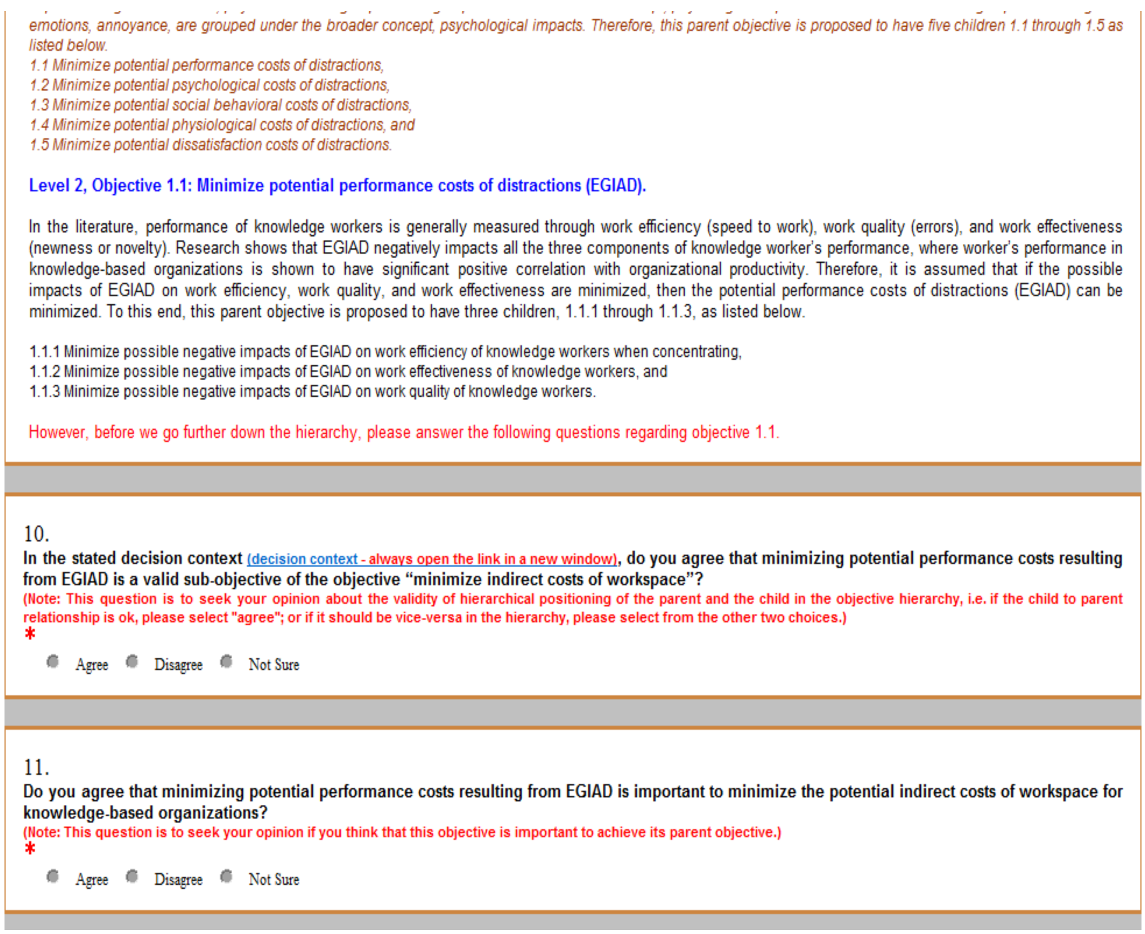
For instance, question number 12 was: Do you agree that minimizing potential performance costs resulting from EGIAD (1.1) should be included in the objective hierarchy? This question was designed to check for consistency as the response to this question should be in agreement with the response to the question directly above it.

In addition, a typical set of questions that were asked throughout the questionnaire for each attribute and measurement index are as follows:

1. Do you agree that the attribute is measuring the objective? This question intends to check the operationalization of the measurement index.
2. Do you agree with the response format for various levels, 1 through 5, of the attribute?

3. Do you agree with the description for various levels, 1 through 5, of the attribute? This question was a consistency check for operationalization of the measurement index.
4. Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective? This question was designed to check if the 5-point measurement scale was appropriate for attribute measurement.

A snapshot of the Phase I study instrument is provided in Figure 5.4. The complete study instrument is included in Appendix C.



emotions, annoyance, are grouped under the broader concept, psychological impacts. Therefore, this parent objective is proposed to have five children 1.1 through 1.5 as listed below.
1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

Level 2, Objective 1.1: Minimize potential performance costs of distractions (EGIAD).

In the literature, performance of knowledge workers is generally measured through work efficiency (speed to work), work quality (errors), and work effectiveness (newness or novelty). Research shows that EGIAD negatively impacts all the three components of knowledge worker's performance, where worker's performance in knowledge-based organizations is shown to have significant positive correlation with organizational productivity. Therefore, it is assumed that if the possible impacts of EGIAD on work efficiency, work quality, and work effectiveness are minimized, then the potential performance costs of distractions (EGIAD) can be minimized. To this end, this parent objective is proposed to have three children, 1.1.1 through 1.1.3, as listed below.

1.1.1 Minimize possible negative impacts of EGIAD on work efficiency of knowledge workers when concentrating,
1.1.2 Minimize possible negative impacts of EGIAD on work effectiveness of knowledge workers, and
1.1.3 Minimize possible negative impacts of EGIAD on work quality of knowledge workers.

However, before we go further down the hierarchy, please answer the following questions regarding objective 1.1.

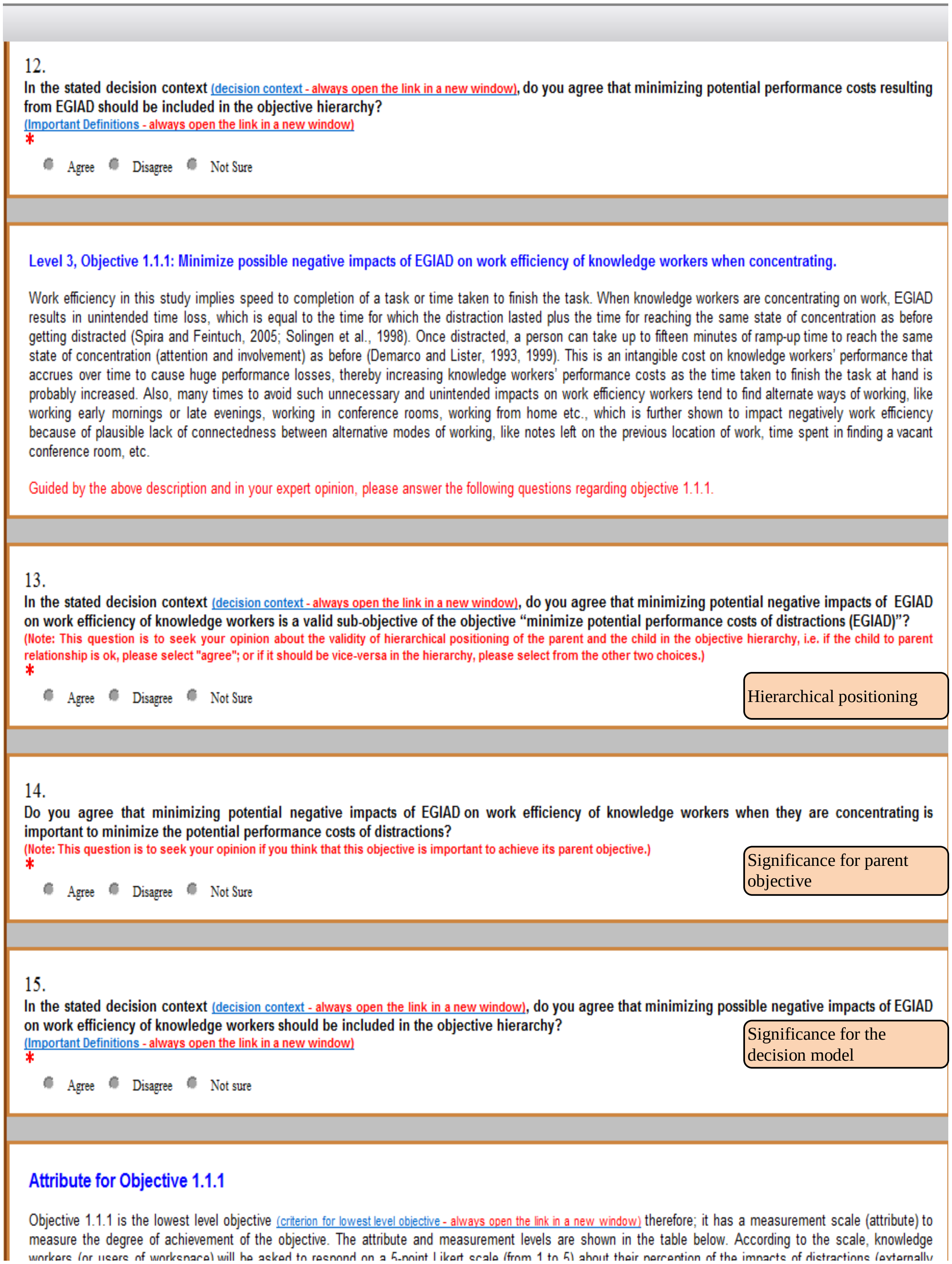
10.
In the stated decision context (decision context - always open the link in a new window)**, do you agree that minimizing potential performance costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

11.
Do you agree that minimizing potential performance costs resulting from EGIAD is important to minimize the potential indirect costs of workspace for knowledge-based organizations?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

Figure 5.4 - Snapshot of Study Instrument for Phase I



12.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing potential performance costs resulting from EGIAD should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*
Agree Disagree Not Sure

Level 3, Objective 1.1.1: Minimize possible negative impacts of EGIAD on work efficiency of knowledge workers when concentrating.

Work efficiency in this study implies speed to completion of a task or time taken to finish the task. When knowledge workers are concentrating on work, EGIAD results in unintended time loss, which is equal to the time for which the distraction lasted plus the time for reaching the same state of concentration as before getting distracted (Spira and Feintuch, 2005; Solingen et al., 1998). Once distracted, a person can take up to fifteen minutes of ramp-up time to reach the same state of concentration (attention and involvement) as before (Demarco and Lister, 1993, 1999). This is an intangible cost on knowledge workers' performance that accrues over time to cause huge performance losses, thereby increasing knowledge workers' performance costs as the time taken to finish the task at hand is probably increased. Also, many times to avoid such unnecessary and unintended impacts on work efficiency workers tend to find alternate ways of working, like working early mornings or late evenings, working in conference rooms, working from home etc., which is further shown to impact negatively work efficiency because of plausible lack of connectedness between alternative modes of working, like notes left on the previous location of work, time spent in finding a vacant conference room, etc.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.1.1.

13.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing potential negative impacts of EGIAD on work efficiency of knowledge workers is a valid sub-objective of the objective "minimize potential performance costs of distractions (EGIAD)"?
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*
Agree Disagree Not Sure

Hierarchical positioning

14.
Do you agree that minimizing potential negative impacts of EGIAD on work efficiency of knowledge workers when they are concentrating is important to minimize the potential performance costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*
Agree Disagree Not Sure

Significance for parent objective

15.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on work efficiency of knowledge workers should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*
Agree Disagree Not sure

Significance for the decision model

Attribute for Objective 1.1.1

Objective 1.1.1 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) to measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowledge

Figure 5.4 - Snapshot of Study Instrument for Phase I

5.3.3. Data Analysis and Results, Phase I Delphi Study

The data collected in Phase I was both qualitative and quantitative. A 3-point Likert scale provided the number of experts that agreed, disagreed, or were not sure with a particular issue. Eighty percent (80%) agreement was considered a consensus. The statistics for each question are shown in Appendix D.

Based on the qualitative remarks and the statistics, modifications were made to the initial objective hierarchy; these are discussed below. For reference, the initial and revised fundamental objective hierarchies are shown in Figures 5.5 and Figure 5.6. All the subjects were consistent throughout for their answers to questions 2 and 3 for each objective, and questions 1 and 3 for each attribute and measurement index.

- The three components of performance costs - work efficiency, work effectiveness, and work quality -- were not regarded as mutually exclusive. Experts suggested that, for knowledge work, work quality is a component of work efficiency and work effectiveness. Therefore, to achieve non-redundancy, a key characteristic of the objective hierarchy, objective 1.1.3, minimize impacts on work quality, was deleted from the objective hierarchy. A set of objectives in each layer is non-redundant if an evaluation consideration can be included in exactly one criterion.
- All the 10 attributes and their measurement index were redefined and restated to make sentences simple and language straightforward; most of the experts suggested that the measurement index was too complex to respond because of complex language, lengthy text, and use of complex sentences.

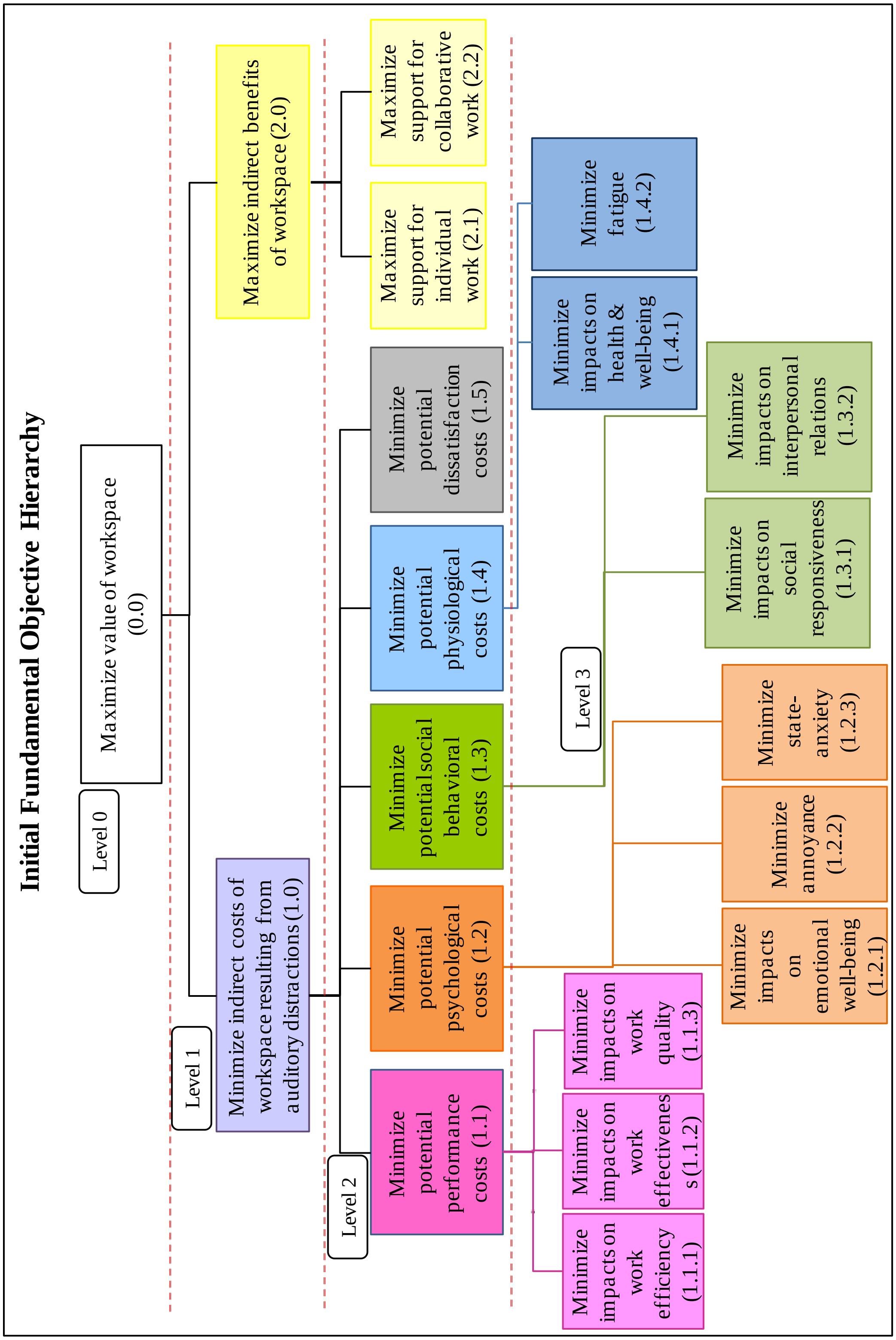


Figure 5.5 - Initial Fundamental Objective Hierarchy

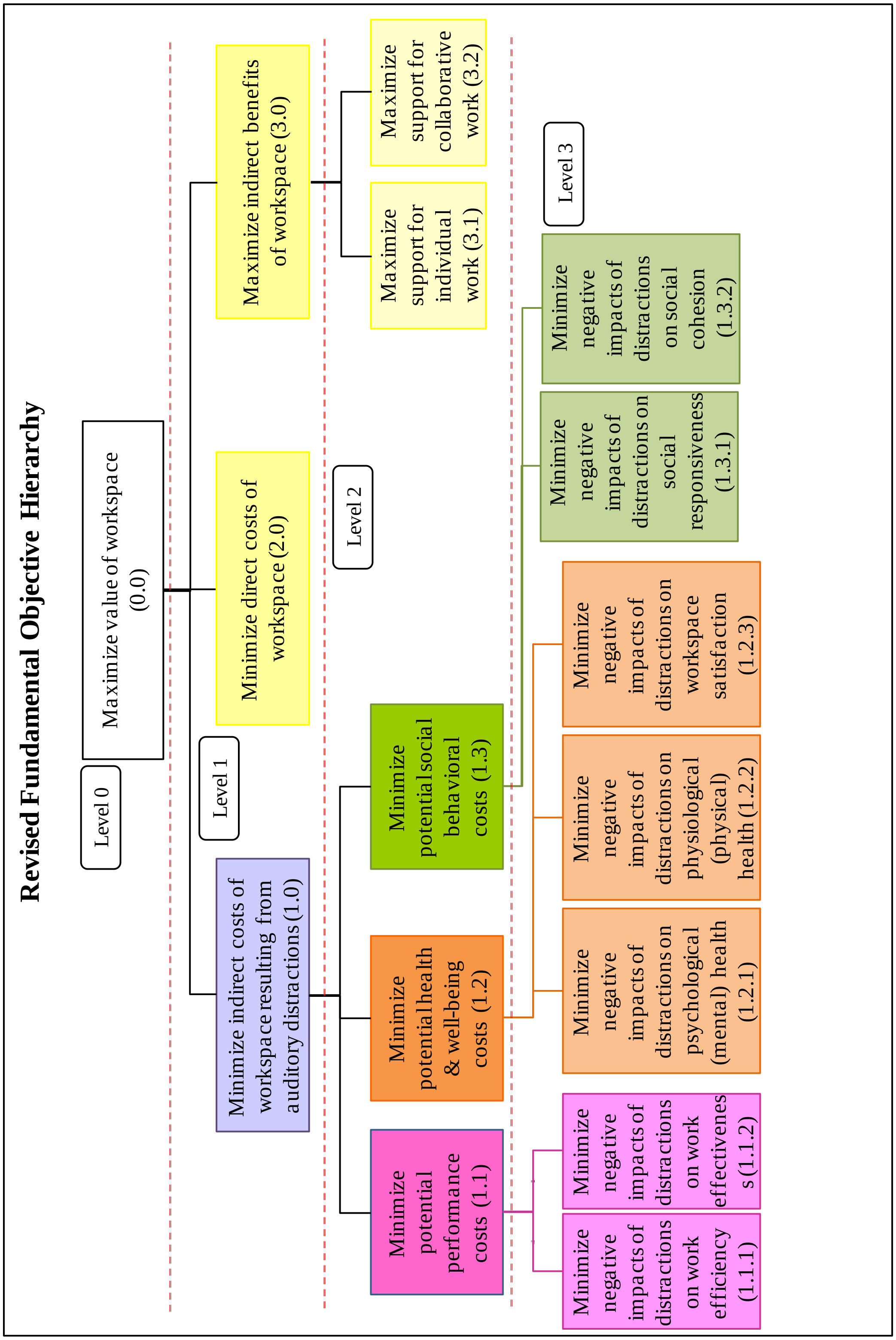


Figure 5.6 - Revised Fundamental Objective Hierarchy

- The three components of psychological costs – emotional well-being, annoyance, and state-anxiety – were regarded as not mutually exclusive. It was suggested that state-anxiety can affect emotional well-being and sometimes may cause annoyance, and vice-versa. Therefore, to achieve non-redundancy, the lowest-level objectives 1.2.1 (minimize impacts on emotional well-being), 1.2.2 (minimize impacts on annoyance), and 1.2.3 (minimize impacts on state-anxiety) were deleted from the objective hierarchy.
- The two components of physiological costs – health and well-being and fatigue – were regarded as not mutually exclusive. It was suggested that an increase in fatigue can affect a person's health and well-being or vice versa. Therefore, to achieve non-redundancy, the lowest level objectives 1.4.1 (minimize impacts on health and well-being) and 1.4.2 (minimize fatigue) were deleted from the hierarchy.
- The concepts psychological costs, physiological costs, and dissatisfaction costs were suggested as components of the concept, health and well-being (Danna and Griffin, 1999, Klitzman and Stellman, 1989). Therefore, these were categorized under objective 1.2, minimize potential health and well-being costs of EGIAD.
- It was suggested that, within the scope of this decision problem, social cohesion is a more appropriate term rather than interpersonal relations. Therefore, the change was implemented in the revised objective hierarchy.
- Completeness is a key requirement of the fundamental objective hierarchy. A set of objectives in each layer is complete if all the criteria that are important to the decision problem are included in the objective hierarchy. The initial objective hierarchy was suggested as incomplete at Level 1, as experts suggested that direct costs of

workspace should be included along with indirect costs. They stated that inclusion of direct costs is important in the stated decision context and it will not divert evaluators from giving necessary importance to subjective non-monetary criteria. To maximize the value of a workspace, direct costs shall be minimized; therefore, objective 2.0, 'minimize direct costs of workspace' was added to the objective hierarchy at Level 1. Further sub-categorization of direct costs was not done, as it was not required by the scope of the decision problem.

- The titles of the objectives were restated to make them more specific. For instance, the objective title, 'minimize negative impacts on work efficiency', was renamed 'minimize negative impacts of distractions on work efficiency'.

There were some changes that were not made; the rationale was then explained to the experts. They were as follows:

- It was suggested to specifically define or delete the term "potential" used in the titles of objectives. An explanation was provided as follows: Potential is used in the objective titles to represent uncertainty or possibility, i.e., it may or may not happen, but the possibility exists. For instance, there is a possibility of impacts of distractions on work efficiency, thereby, causing performance costs, but it may or may not happen.
- Stress was recommended as a very important component of health and well-being to be included in the decision model. However, it was not included because stress was already identified as an item in physiological well-being.
- Privacy was recommended to be included in the decision model; however, it was already an item in workspace satisfaction.

5.3.4. Web-based Delphi Study, Phase II Instrument

The conclusion of Phase I led to the launch of Phase II of the Delphi study. All the modifications were highlighted and explanations were summarized to provide reasoning for changes in the revised objective hierarchy. The goals identified for this phase were as follows:

- To reach consensus on criteria (objectives in the objective hierarchy) to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations;
- To reach consensus on the structure of the objective hierarchy; and
- To reach consensus on the attributes and measurement index for all the lowest-level objectives.

E-mail invitations, shown in Figure 5.7, for launch of Phase II were sent personally to each individual participant through SurveyGizmo. The invitation contained a link to the URL that was generated for each participant by SurveyGizmo. The author suggested the participants to use their own link only, to prevent data hampering. At the start of each following week, a reminder e-mail was sent to those participants who had either not responded or had not completed the questionnaire. All 11 experts who had completed Phase I of the Delphi study completed the questionnaire for Phase II.

In addition, three experts who wanted to participate in Phase I but could not do so because of time constraints were again invited to participate in Phase II. All three experts denied the request by stating that they do not find the effort fruitful, nor results helpful.

A snapshot of the Phase II instrument is shown in Figure 5.8. The complete instrument is included in Appendix E.

Dear Title Last Name,

This is in reference to the research study "Decisions about Workspace type and Impacts of Auditory Distractions in Knowledge–based Organizations". This email is sent your way because you completed the phase-I of the study. Please accept our heartiest thanks for providing your input. It was very valuable.

The phase-II of the study is now ready to collect data from you. Please follow the link below to gain access to the questionnaire.
http://s-97vsm-54008.sgizmo.com/i/8607e1182134p8494.

Note: Each page of the research instrument is in self safe mode. Once you click the "Go to the Next Page" button at the bottom of the page, the page is automatically saved. You can stop at any time to come back to the questionnaire at a later time, but once you start working on a page you are required to complete the page and hit "Go to the Next Page" button to save the changes. To get back to the questionnaire at a later time, go to the survey link provided in your email, as this is the unique link created only for your data. Flip through the pages to reach to the page where you stopped the previous time you were working on the questionnaire.

The Survey will close on August 18, 2008 at 5:00 pm EST (Eastern Standard Time).

If you have any questions, please contact me at pjuneja@ti.gatech.edu or my faculty advisors at kathy.roper@coa.gatech.edu and bill.rouse@ti.gatech.edu. We will get back to you at the earliest.

Many Thanks for being there.
Best Regards
Parminder Juneja
Ph.D. Candidate
College of Architecture & Tennenbaum Institute
Georgia Institute of Technology

Figure 5.7 - Snapshot of Email Invitation for Launch of Phase II

3.

Do you agree that "negative impacts of distractions on work effectiveness of knowledge workers" is an important evaluation criterion to be considered when evaluating workspace alternatives in knowledge-based organizations?

Work effectiveness as suggested by many researchers is related to "creation of value by doing the right things". Other concepts include novelty, innovation, creativity, sharing and disseminating new ideas etc. Auditory distractions coming from surrounding work environment exert extra demand on cognitive abilities of a person resulting in cognitive fatigue, which reduces person's subsequent readiness to perform. The attention narrows down and works on easily available routine cues rather than exploring in detail complex alternative ways to finish the task. The phenomenon is called cognitive economy. The impacts are subjective in nature depending on a number of critierions, however the result is that a key characteristic of knowledge work, i.e. novelty, creativity, is compromised.

Statistics from Phase I - 90% agreement

Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

4.

Measurement index

Guided by the comments from phase I, the measurement index for impact on work effectiveness is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Minimize negative impacts of distractions on work effectiveness ***	Participant's perception about strength of impacts of distractions on work effectiveness ***	1	Not at all	I feel distractions have no impact on work effectiveness.
		2	A little	I feel distractions have a little impact on work effectiveness.
		3	Moderate	I feel distractions have a moderate impact on work effectiveness.
		4	Significant	I feel distractions have a significant impact on work effectiveness.
		5	Very significant	I feel distractions have a very significant impact on work effectiveness.

*** Measure of work effectiveness	Description of items
Work effectiveness is related to	Generating new methods, idea, concepts.
	Exploring alternatives rather than adopting routine.
	Creating value for customers, organization.
	Creativity
	Innovation

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on work effectiveness are difficult to recognize, subjective in nature, and their significance depends on a number of factors like work type, mood of a person, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to

Figure 5.8 - Snapshot of Phase II Study Instrument

A typical set of questions that were asked throughout the Phase II questionnaire for each objective and attribute, measurement index, and structure of the objective hierarchy are as follows:

1. Do you agree that ‘objective’ is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?

For instance, question number 1 was: Do you agree that the objective ‘negative impacts of distractions on work efficiency of knowledge workers’ is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations? The aim of this question was to seek subjects’ opinion about importance of the criterion for the workspace decision-making problem.

2. Do you agree with the measurement index for ‘attribute’?

For instance, question number 2 was: Do you agree with the measurement index for impacts of distractions on work efficiency? The questions aimed to check the operationalization of the attribute.

3. Do you agree that the ‘lower-level objective(s)’ are sufficient to capture key aspects of the ‘upper-level objective’?

For instance question number 6 was: Do you agree that negative impacts of distractions on work efficiency and work effectiveness are sufficient to capture key performance costs resulting due to EGIAD? The question was a check for completeness of the structure of objective hierarchy.

4. Do you agree that the ‘lowest-level objectives’ are mutually exclusive evaluation criteria?

For instance question number 7 was: Do you agree that negative impacts of distractions on work efficiency and work effectiveness are mutually exclusive evaluation criteria? The question was a check for non-redundancy of the structure of objective hierarchy.

5.3.5. Data Analysis – Phase II Delphi Study

The goals of Phase II were objective in nature, leading to finalization of the fundamental objective hierarchy, definition of attributes, and the measurement index. Therefore, a more robust 5-point Likert scale of agreement-disagreement was used to verify the validity of the objectives, attributes, and the measurement index, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. A mean value of 3.5 and within group inter-rater agreement index (r_{wg}) of 0.5, were set as criteria for validation and moderate consensus. Further details on panel aggregation criteria are provided in Section 5.2.3. Complied and structured results for Phase II are shown in the Tables 5.2 to 5.5.

5.3.6. Discussion of Results - Phase II Delphi Study

An inter-rater agreement index, $r_{wg,}$ is a ratio of observed variance within a group to the expected variance (refer to Equation 5, Chapter 7) (James, 1984). The lower the observed variance, i.e., the more the subjects think alike, the stronger is the agreement and higher the inter-rater agreement index will be. To calculate the r_{wg} indices, an estimate of the expected variance when there is a total lack of agreement is needed. James (1984) suggests that for a 5-point discrete scale as used in Phase II, the complete lack of agreement is best represented by a uniform distribution; the expected error variance for such a distribution is 2.0 (LeBreton and Senter, 2008).

Table 5.2 – Statistics for Importance of criteria for Workspace Evaluation

Do you agree with the importance of objective for evaluating workspace alternatives?		**Statistics**	
Objective No.	**Attribute**	**Group Mean**	**r_{wg} index**
1.1.1	Minimize impacts on work efficiency	4.73	0.79
1.1.2	Minimize impacts on work effectiveness	4.73	0.89
1.2.1	Minimize impacts on psychological health	4.55	0.86
1.2.2	Minimize impacts on physiological health	4.55	0.86
1.2.3	Minimize workspace dissatisfaction	4.45	0.86
1.3.1	Minimize impacts on social responsiveness	4.55	0.86
1.3.2	Minimize impacts on social cohesion	4.64	0.87
3.1	Maximize workspace's support for concentration	4.36	0.57
3.2	Maximize workspace's support for collaboration	4.18	0.52
2.0	Minimize direct costs of workspace	3.64	0.67

Table 5.3 – Statistics for Measurement Index

Do you agree with the Measurement Index of Attributes?		**Statistics**	
Notation	**Attribute**	**Group Mean**	**r_{wg} index**
A1	Work efficiency	3.64	0.67
A2	Work effectiveness	3.91	0.55
A3	Psychological health	3.82	0.62
A4	Physiological health	3.91	0.84
A5	Workspace satisfaction	4.18	0.52
A6	Social responsiveness	3.91	0.55
A7	Social cohesion	4.00	0.60
A8	Support for concentration	3.73	0.69
A9	Support for collaboration	3.91	0.55
A10	Direct costs of workspace	3.64	0.57

Table 5.4 – Statistics for Sufficiency of Objectives

Are the sub-objectives sufficient to capture the objective?		**Statistics**	
Objective	**Sub-objectives**	**Group Mean**	**r_{wg} index**
Performance costs	Work efficiency Work effectiveness	4.36	0.77
Health and well-being costs	Psychological health Physiological health Workspace satisfaction	4.18	0.52
Social behavioral costs	Social responsiveness Social cohesion	4.09	0.85
Indirect benefits of workspace	Support for concentration Support for collaboration	4.00	0.60
Indirect costs of workspace	Performance costs Health and well-being costs Social behavioral costs	3.73	0.79
Value of workspace	Indirect costs of workspace Direct costs of workspace Indirect benefits of workspace	3.91	0.55

Table 5.5 – Statistics for Non-redundancy of Objectives

Are the sub-objectives of the objective mutually exclusive?		**Statistics**	
Objective	**Sub-objectives**	**Group Mean**	**r_{wg} index**
Performance costs	Work efficiency Work effectiveness	3.73	0.79
Health and well-being costs	Psychological health Physiological health Workspace satisfaction	3.82	0.42
Social behavioral costs	Social responsiveness Social cohesion	3.64	0.67
Indirect benefits of workspace	Support for concentration Support for collaboration	4.00	0.80
Indirect costs of workspace	Performance costs Health and well-being costs Social behavioral costs	3.73	0.79
Value of workspace	Indirect costs of workspace Direct costs of workspace Indirect benefits of workspace	3.64	0.67

Table 5.2 shows that all 10 lowest-level objectives fetched mean values between 3.64 and 4.73. The r_{wg} indices ranged from moderate (0.5 to 0.7) to strong (0.71 to 0.90) agreement; this suggests that experts moderately to strongly agreed that all 10 lowest-level objectives are important to be considered when evaluating workspace choices for knowledge-based organizations. The group mean for measurement index ranged between 3.64 and 4.18; and r_{wg}, ranged between 0.52 and 0.84. The results are shown in Table 5.3. The mean and r_{wg} values suggest that the experts agreed moderately to strongly with the measurement index of the attributes. For the objective hierarchy to be complete (Table 5.4) and non-redundant (Table 5.5), mean is greater than 3.64 and r_{wg} values range from moderate (0.52) to strong (0.85) agreement; this implies experts moderately to strongly agreed that the objective hierarchy possess both the properties. Mean of 3.82 and r_{wg} = 0.42 for non-redundancy of health and well-being costs suggest that experts have agreed that the sub-objectives physiological costs, psychological costs, and satisfaction are mutually exclusive; however, their agreement is weak, implying that there is a 58% chance that the mean of 3.82 is obtained by chance. The implication of redundancy for evaluation of alternatives is the double counting of the objective in the overall MAU evaluation. Multi-attribute utility analysis suggests different aggregation techniques in case the objective or attributes fails to pass the redundancy test. Therefore, the redundancy check was planned for Phase III also; aggregation model was chosen in accordance with the verification results.

Furthermore, r_{wg} of 0.72 and mean of 3.82 for the overall structure of the objective hierarchy suggests that there was a strong agreement among experts for the structure of the revised objective hierarchy for workspace choice. The results of Phase II included finalization of the structure of the objective hierarchy for the workspace choice decision model, with a mean greater than 3.5 and a strong expert agreement; and the measurement index for all 10 attributes, with a mean greater than 3.5 and a moderate expert agreement.

5.4. Summary

This chapter presented the data collection, data analysis, and results for a two-phase, Web-based expert study on validation of the fundamental objective hierarchy for the workspace choice decision model. The validation criteria were established and necessary statistical techniques helped achieve the goals set for the expert study.

Phase II of the Delphi study was followed by Phase III of the research study. The fundamental objective hierarchy for workspace choice developed and validated in Stage II and Stage III of this study was used to design the multi-attribute workspace choice utility model. This step concluded the development part of this research study. This model was then used to evaluate the value of five workspace alternatives. Details of these workspace alternatives are provided in Chapter 6.

CHAPTER 6

WORKSPACE ALTERNATIVES FOR MAU EVALUATION

6.1. Introduction

Auditory distractions and its effects are a subjective phenomenon. Therefore, achieving a fixed level of speech privacy or speech intelligibility in an office environment may or may not work. Furthermore, research on indoor environments shows that providing personal controls into user's hands is more satisfactory and productive rather than having a fixed control installed at a particular location. Issues of control are shown to be related to subjective assessment of these distractions. Graven (1975) argued that perception of noise as necessary or unnecessary significantly affects individuals' averseness to noise (Graeven, 1975). For instance, it is shown that when speech from a neighboring cubicle contains primary task-related information, it is perceived as necessary and wanted, rather than speech containing social event information, which is perceived as unwanted and distraction by the listener. Uncontrollable sounds are considered stressful and aversive (Kjellberg and Landstrom, 1994). Building Owners and Management Association (BOMA) and the University of Maryland, in their study on 400 business managers, showed that providing a noise control into users hand acts as a stimulus for productivity improvements, which can go as high as 26% (Moeller).

In another stream of research, scientists have shown that quiet, individual work and frequent informal interactions are the two most time-consuming workplace activities in today's knowledge-based organizations. These are the activities that most frequently and naturally occur in or near individual workspaces and both are critical to accomplishments of tasks. Table 6.1, (excerpted from Olson, 2002, p.38), shows the average time spent by managers, professional, engineers, and administrative staff on various tasks during a particular day and Figure 6.1, (excerpted from Olson, 2002, p.38), shows the average time spent by these individual in their own workspace. The person dataset contained 13,000 subjects (Olson, 2002).

Table 6.1 – Time Spent at Various Tasks (%) (Source: Olson 2002)

Job Type	Quiet work	Phone	Meet in workspa ce	Informal interacti ons	In Meeting rooms	Break	Chores, lab work	Other
Managers	48	15	15	5	11	3	0	4
Professionals	62	11	9	4	6	3	6	0
Engineers	64	6	10	3	6	3	9	0
Administrative	61	19	6	3	3	3	6	0

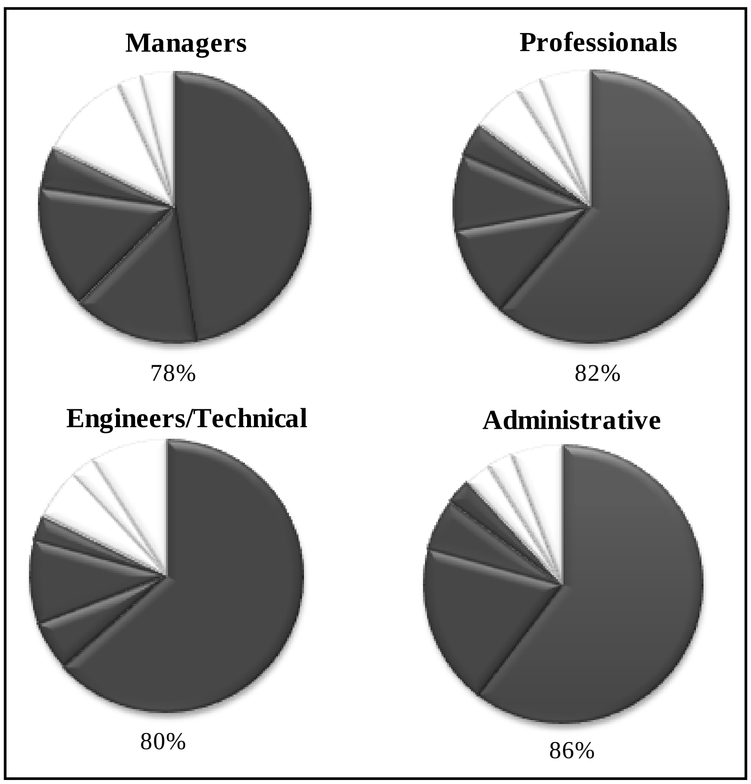


Figure 6.1 - Average Time Spent in Own Workspace (Source: Olson, 2002)

The numbers in Figure 6.1, (excerpted from Olson, 2002, p.38), justify the importance of a workspace for an individual, where, on average, a worker spends around 80% of the daily time when he or she is present in the office. And over half of this time spent in one's workspace is spent doing quiet work and around 35% is spent on some form of interaction in the workspace. Therefore, scientists in this field of research suggest that key workspace requirements for knowledge workers involve support for, both, concentration and collaboration without having to move from one's workspace (Chou et al., 2001, Heerwagen et al., 2004, Olson, 2002). Olson (2002) argues that "effective workspace design can, both, enhance support for these two most important activities by themselves, and allow them to coexist effectively within the same workspace" (p. 31).

Consequently, based on the previous research on workspace design, auditory distractions in open office settings, controllability and predictability, this study hypothesizes that there are five workspace alternatives, W1 through W5, that align with the five measurement levels for all 10 attributes. The control over externally generated involuntary auditory distractions varies from none or very little to a very significant control, where the user of the workspace can completely block out the auditory distractions coming from surrounding work environment. These alternatives also provide varied support for individual work and collaboration at the same workspace, where the support varies from none or very little support to very significant support. A summary of these workspaces is provided in Table 6.2. The objective of this research study is to find out which alternative seeks highest expected utility and, thus, is most preferred for knowledge-based organizations. Each of these five workspace alternatives is discussed in detail in the next five sections.

Table 6.2 - Workspace Alternatives

Workspace Alternative	Type of control over auditory distractions; support for individual, collaborative work; Costs	Example
W1	None or very little	Open plan workspace
W2	A little	Noise cancellation headphones
W3	Moderate	Personal sound masking system
W4	Significant	Flexible acoustic screens
W5	Very Significant	BlueSpace; Attentive Office Cubicle

6.2. Workspace Alternatives

6.2.1. Workspace W1 – Workspace with None or Very Little Control over EGIAD

A workspace is said to provide none or very little control over externally generated involuntary auditory distractions (EGIAD), if it doesn't provide any means to filter out the auditory distractions coming from the surrounding work environment. An open office setting is the most appropriate illustration of such a workspace. Generally categorized by absence of walls and partitions, an open office setting can be anything, like modular workstations, cubicles, team spaces, or bull-pens, to name a few designs. Propagation of speech and noise is inevitable in such workspaces. Open office settings are predominant (more than 60%) in North America and Canada (IFMA, 1996, Veitch et al., 2004). Despite the fact that open office designs are not recommended for jobs involving undisturbed concentration, they have enjoyed considerable popularity since their birth in the 1950s; open offices started replacing enclosed offices in the 1960s, and have experienced exponential growth over the past few decades.

6.2.2. Workspace W2 – Workspace with a Little Control over EGIAD

A workspace is said to provide a little control over externally generated involuntary auditory distractions (EGIAD), if it allows its user to trade-off unwanted sound, especially speech, with more acceptable sound, such as music. This workspace option is suggested to provide only a little control into the user's hand since research shows that noise and music both have equally negative effects on complex cognitive tasks. While music can be as distracting as a noise on complex cognitive tasks, it is more acceptable than unwanted chatter (Furnham and Strbac, 2002).

A noise-cancelling headphone is an appropriate illustration for such a control. It cancels noise, unwanted sound, with equal and opposite waveforms. Listening to music turns out to be a pleasurable experience with these headphones. The technology is good for predictable, low-frequency sounds, such as airplane engine noise; however, it does not work effectively at voice frequencies. Practically, the effect is often more like a tone control adjustment, and not a complete deletion of distracting voice.

6.2.3. Workspace W3 – Workspace with Moderate Control over EGIAD

A workspace is said to provide moderate control over externally generated involuntary auditory distractions (EGIAD), if it allows the user to exercise masking of unwanted sound, especially speech. Sound masking is based on the phenomenon of adding a low-level background noise to an environment, so that intruding speech and noises become less intelligible. Technically, sound masking systems are said to be using the white noise to achieve speech privacy; although, in actuality, these systems do not use white noise. The motivation behind the invention of sound masking was the realization that speech privacy is simply a matter of achieving speech unintelligibility. That is, if one cannot understand what the other person is saying, speech privacy is achieved - even though we may still see each others in the surroundings and to, some extent, hear others voices.

The phenomenon of sound masking involves making the speech unintelligible by filling a person's surroundings with a barely perceptible low-level noise sound. The sounds are generally like typical office air conditioning noise; so that it is not considered another source of irrelevant sound causing irrelevant sound effect.

A personal sound masking system for use in an individual workspace is an appropriate illustration for a workspace that provides moderate control over auditory distractions coming from the surrounding workspace. This option is considered as a moderate control because the user cannot obtain complete quietness, since there is a trade-off, in which artificial, meaningless sound provides a cover to unwanted sounds. The key goal of sound masking is to mask speech sounds, because speech is suggested as the most bothersome, annoying, and disruptive office noise. Speech along with being unpredictable and uncontrollable, contains information which may result in information overload (Sundstrom and Sundstrom, 1986).

A personal sound masking system works on the principle of delivering a sound masking signal that specifically matches the individual user's location, and its physical relationship to the surrounding workspaces, thereby it creates an optimized acoustic background environment. Generally, such systems use multiple loudspeakers and multiple mutually incoherent channels, so that a desired degree of diffuseness is reached. A user-operable volume control is also included in the system, so that the user can adjust the sound masking level to meet his or her individual requirements.

6.2.4. Workspace W4 – Workspace with Significant Control over EGIAD

A workspace is said to provide a significant control over externally generated involuntary auditory distractions (EGIAD), if it allows its user to block out auditory distractions coming from the surrounding work environment. An appropriate illustration is a workspace with a control to exercise flexible acoustic screens that creates an acoustic shadow either by absorbing (high sound absorption coefficient) or deflecting the sound. An acoustic shadow refers to an area which restricts the through propagation of sound waves due to obstructions, such as atmospheric, topographical, or due to disruption of the waves caused by phenomenon, such as, wind currents. An illustration of acoustics shadow is shown in Figure 6.2.

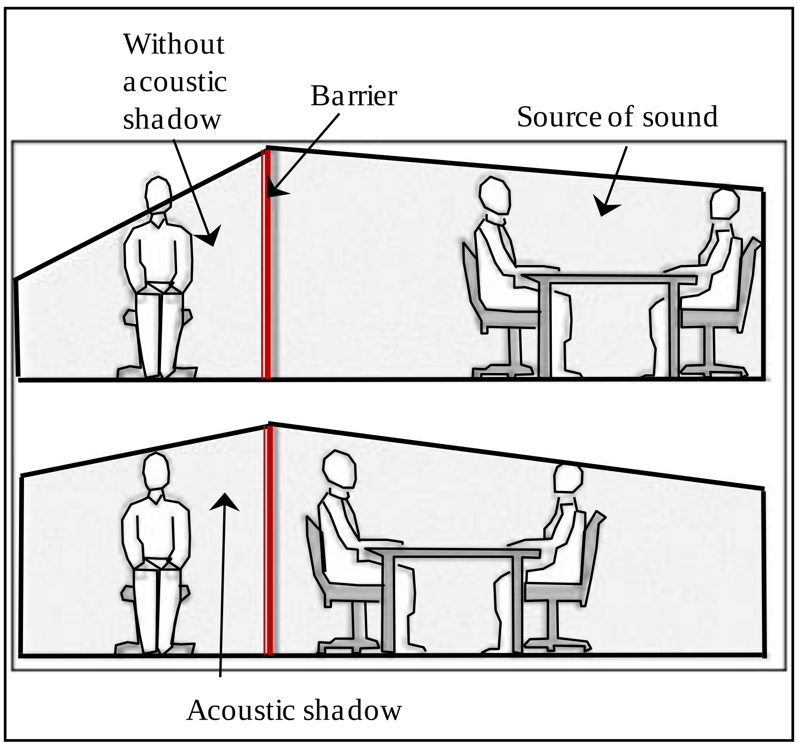


Figure 6.2 - Acoustic Shadow Illustration (source: Screens at Work)

6.2.5. Workspace W5 – Workspace with Very Significant Control over EGIAD

A workspace is said to provide very significant control over externally generated involuntary auditory distractions (EGIAD), if it allows its user to block auditory distractions coming from the surrounding work environment, as well as informs the surroundings about a person's current status towards socialization. The appropriate illustrations are IBM's BlueSpace (IBM, 2001b) and Queen University's (AOC) Attentive Office Cubicle (HML, 2004). In this study, these workspaces are referred to as adaptable workspace (for definition, see Appendix L).

BlueSpace, also called a "next-generation" (IBM, 2001a) office prototype, is a workspace that is designed with the goal of increasing knowledge workers' productivity by precluding unwanted distractions and interruptions, and improving team awareness and communications. It is a combination of novel hardware and software advancements, "sensors, actuators, displays, and wireless networks" (IBM, 2001a) that allows its user to exercise control over workspace's micro-environment. The seamless integration of built space and technology allows the user to adjust the surrounding environment to complement functional and psychological needs of collaboration, concentration, and personalization. A summarized sketch of the BlueSpace is shown in Figure 6.3.

An attentive office cubicle is a workspace that mediates visual and auditory interactions between office co-workers. Developed by Queens University's Human Media Laboratory, it works by blocking noise and visual distractions when an individual is trying to concentrate, and then opens communication channels when an individual is ready to socialize. A summarized picture of attentive office cubicle is presented in Figure 6.4.

Figure 6.3 - Summarized Sketch for IBM's BlueSpace (source: ibm.com\research)

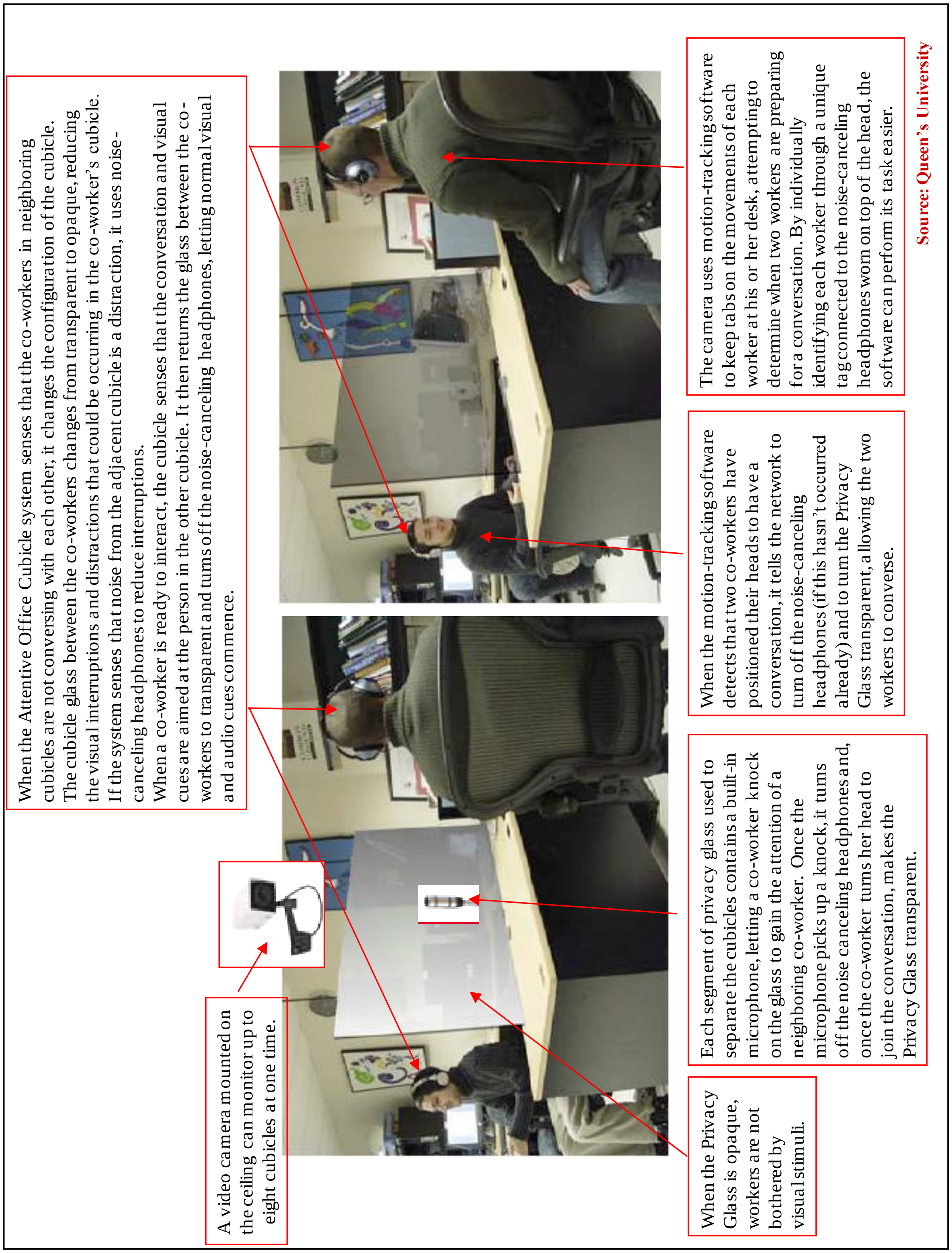


Figure 6.4 - Summarized Sketch for Attentive Office Cubicle [Photograph source: Queens University; (Schurman)]

6.3. Summary

This chapter presented a discussion of five workspace alternatives that are chosen to match the five measurement levels of the measurement index. For instance, W1 was identified as a workspace that provides none or very little control over externally generated involuntary auditory distractions (EGIAD); its support for distractions-free individual work and collaborative work is none or very little; and its costs are also very little.

In the next chapter, a multi-attribute utility evaluation of these alternatives will be conducted. The fundamental objective hierarchy for workspace choice will form a basis to design the multi-attribute workspace choice utility decision model. This model will then be used for evaluation of the workspace alternatives discussed in this chapter. The hypothesis is that a structured decision-based procedure for workspace selection can be developed. It is expected that this decision-based procedure will offset the inconsistencies and limitations of the cost-benefit approach for workspace selection.

CHAPTER 7

STAGE IV - MULTI-ATTRIBUTE UTILITY ANALYSIS FOR WORKSPACE CHOICE

7.1. Introduction

In this chapter, the fundamental objective hierarchy for workspace choice developed and validated in the previous stages of this research study is used to develop the multi-attribute workspace choice utility decision model. This model will be used to evaluate the value of following five workspace alternatives: W1, open workspace; W2, open workspace with noise cancellation headphones; W3, open workspace with personal sound masking system; W4, open workspace with flexible acoustic screens; and W5, adaptable workspace. Discussion on these five workspaces was provided in the previous chapter. The objective is to find out which alternative seeks the highest expected utility and, therefore, is considered the most preferable for a knowledge-based organization. This study argues that, an adaptable workspace (W5) will be rated as the most preferred workspace, and an open workspace (W1) will be rated the least preferred workspace. This decision analysis is performed in order to facilitate the eventual selection of better alternatives. The hypothesis is that a structured decision-based procedure for workspace selection can be developed. It is expected that this decision-based procedure will offset the inconsistencies and limitations of the cost-benefit approach for workspace selection.

Knowledge workers are one of the key stakeholders in the workspace choice problem since they are the main users of the workspace. Consequently, two groups were formed for workspace alternatives evaluation: knowledge workers and corporate decision-makers. The aim was to compare and analyze differences in the two groups for attributes preferences, risk attitudes, and workspace preferences such that the decisions for workspace can be facilitated.

This chapter presents the research instrument for multi-attribute workspace choice utility model, which was designed to collect data for multi-attribute utility analysis of workspace alternatives. Appropriate statistical techniques are used for data analysis and explanation is provided for the choice of statistics. Discussion of findings and implications for workspace decision-making follows the data analysis. The chapter concludes with a consolidated summary of findings.

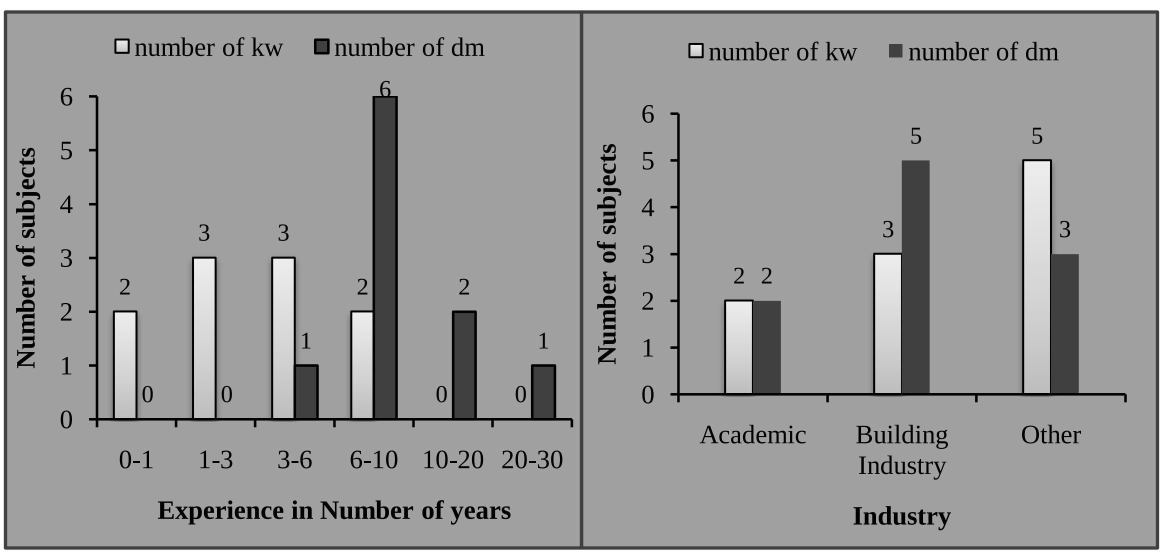
7.2. Data Collection

To collect the desired data for this stage of the study, design and launch of a Web-based questionnaire was initially planned. Traditionally, this stage is run as face-to-face interviews because of the complexity of questions and difficulty that subjects face while imagining the hypothetical scenarios. Therefore, to find the best approach, a few members of the Delphi Panel, described in Chapter 5, were asked for their suggestions. All the members suggested conducting interviews for this stage, as they found the questions complex and difficult to grasp. However, interviews were limited to local subjects only.

7.2.1. Sample

The research strategy was to run this stage of the study with two groups of subjects, knowledge workers and decision-makers, since they are the key stakeholders. The goal was to see if the two groups were similar or differed significantly in their preferences for various attributes, risk attitudes, and preference for workspace alternatives. This will help understand the differences in satisfaction with workspace between the users and the decision-makers. Consequently, it becomes simple to align the workspace decisions with business bottom line of organizations. Davies (2005) writes that "the standard office solution of open-plan is no longer suitable for the productive office knowledge worker. They need to be involved in design decisions and allowed a degree of control over their individual worksetting" (p. 449).

A list of eight subjects, who were either involved in workplace decision-making in their organization or were known to be active members of International Facility Management Association (IFMA), was prepared. It was assumed that these subjects will be interested in participating in this research study. A personalized e-mail was sent to each of the eight subjects to invite them to participate in a one-to-one interview. The interview could be scheduled anytime and at any location for the one month period during which the study was open for data collection. It was told that the participation is completely voluntary and the subject can withdraw from the study at any time during the course of the study. The research objective was clearly defined and subjects were told that it may take 45 minutes to 3 hours to complete the questionnaire. None of the subjects replied. At this point, a decision was made to invite students in graduate-level classes in Georgia Tech's Building Construction Program to participate in the study. Because most of these students had experience and expertise in decision-making and others would appropriately fit in the role of knowledge workers, they were deemed qualified to participate in this portion of the study. A demographic information sheet was distributed in the class to collect primarily professional information, such as highest degree earned, total professional experience, current job role and responsibilities, industry, and experience as a decision-maker, particularly if they have been involved in workplace-related decisions. The demographics information form is included in Appendix F(a). The objective was to be able to identify each subject for the role of a knowledge worker or decision-maker. A snapshot of characteristics of subjects who eventually completed the questionnaire (response rate = 45%, n=20) is shown in Table 7.1 and Figure 7.1 (a,b). As shown in Table 7.1, of the 20 students, four were in academia full-time and 16 worked in the building or other industry, such as retail, sales, non-profit, and software, defense, and telecom; the group averaged eight years experience. A subject was assigned the role of a decision-maker if he or she had at least three years of professional experience and also had experience or expertise in workplace-related decision-making. A bar graph is presented in Figure 7.1 (a,b) to show the experience level and industry affiliation of the student subjects.



(a) (b)

Figure 7.1 - Snapshot of Sample Characteristics

Table 7.1 – Summary of Sample Characteristics

Subject	Education	Job Title	Experience - years	Areas of Expertise	Industry	Experience - workplace decisions
kw1	Masters	Student	1.5	Architecture	Academic	Yes
kw2	Masters	Student	8	Landscape architecture & land planning	Academic	No
kw3	Masters	Mac specialist	0	Sales	Retail	Yes
kw4	Masters	Project Specialist	4	Indoor Environment	Building	No
kw5	Masters	Student	6	Project Management	Non-profit	No
kw6	Masters	Student	3	Sustainability	Building	No
kw7	Masters	Associate broker	4	Buyer representative	Sales	No
kw8	Masters	Project Manager	10	Management	Building	No
kw9	Masters	Student	2	Software	Software	No
kw10	Masters	Student	0	n/a	n/a	No
dm1	Masters	n/a	10	Architecture, Construction & FM	Building	Yes
dm2	Masters	Vice President	6	Commercial Real estate	Real estate	Yes
dm3	Masters	n/a	9	Project Management	Real estate	Yes
dm4	Masters	Project Manager	8	Aviation, Healthcare	Academic	Yes
dm5	Masters	Student	8	Construction & Bridging	Defense	Yes
dm6	Masters	Project Manager	20	Project Management	Telecom & Nuclear Power	Yes
dm7	Masters	Student	8.5	Military Engineering, maintenance, & planning	Defense	Yes
dm8	Masters	Interior designer	9	Interior design	Academic	Yes
dm9	Masters	Vice President	26	Commercial & Healthcare	Design	Yes
dm10	Masters	n/a	12	Construction project management	AEC	Yes

A different strategy was undertaken to approach this potential sample. A PowerPoint presentation was given to the students to introduce them to the objective of the research and their role in completing the questionnaire. The subjects were told that the participation is completely voluntary and there are no incentives for participation. The presentation was followed by distribution of the questionnaire handout in class, in order to provide them an opportunity to review the questionnaire before an interview date is scheduled. Following the presentation, a customized e-mail invitation was sent to each subject to participate in a one-to-one interview. Out of 44 potential student subjects, 21 (Response Rate: 48%) participated in the interview. Each interview lasted between 45 minutes to 2.5 hours, depending on the subject's comfort level with playing gambles that were used to assess single attribute utility functions. One subject couldn't proceed beyond the utility elicitation phase because of time constraints; therefore, his data is not included in the study. The response rate corresponded well with Pitz and McKillip's (1984) rule of thumb that 3-5 people are an adequate sample for estimating multi-attribute utility functions (MAUF). The composition of the final group of participants represents a balanced view of knowledge workers and decision-makers, with 10 subjects in each group. As shown in Figure 7.1 (a), most subjects in the decision-maker role had an average of 6-10 years of professional experience, with all the subjects falling within the range of 3-30 years of experience. Knowledge workers show a normal distribution for experience in years with all the subjects falling within the range of 0-10 years of experience. Most of the selected subjects, 16 out of 20, are professionals in the building or related industry. Therefore, they were the appropriate sample for conducting this stage of the study.

7.2.2. Research Instrument - Multi-Attribute Utility Analysis

The utility assessment process is dynamic, and is guided by the responses of the person whose preferences are being assessed. At a point where the assessor feels that the questions were misunderstood and hence wrongly answered, the assessor reframes and repeats the question to verify their intuition and seek a more appropriate response. In spite of these dynamics, the utility assessment process can be streamlined to seek the following information:

- Assess single attribute utility function;
- Assess trade-off among attributes;
- Assess probabilities for the possible consequences; and
- Verify the assumptions of independence concerning preferences.

These were the goals of Stage IV of the research study. Each sub-section below is dedicated to describing the methods, techniques, and processes that were used to accomplish the above goals.

7.2.2.1. Assessment of Single Attribute Utility Functions

Meyer and Booker (2001) states that: “Elicitation is the process of gathering the expert judgment through specially designed methods of verbal or written communication” (p. 9).

A critical step in multi-attribute utility analysis is the method used to construct single attribute utility functions which formalize the decision-makers’ preferences over the attribute. Single attribute utility functions are essential components of multi-attribute utility function. Under various utility independence conditions, discussed later in this chapter, multi-attribute decision-making can be described as an aggregation of a set of single attribute utility functions (SAUF).

Keeney and Raiffa's (1976) procedure for eliciting single attribute utility functions entails proposing a series of simple lotteries to the subject, where the choice is between a sure offer and a gamble. There are two approaches. One occurs in which the probabilities of the gamble outcomes are fixed at 0.5, but the outcomes of the gamble are changed to determine the indifference point. This method is called the certainty equivalence method. In the second approach, probabilities are varied by the subject to create indifference between a sure offer, called the certainty equivalent, and fixed outcomes. This approach is called the probability equivalence. The probability equivalence method can be applied to any set of evaluation objects, whether they form a dense set or consist of only a few elements, and whether or not they have a natural physical scale; thus it was appropriately suitable for this study. Certainty equivalence method requires continuous scale and, therefore, was not suitable for this decision problem.

7.2.2.1.1. Specifying quantitative restrictions for utility functions

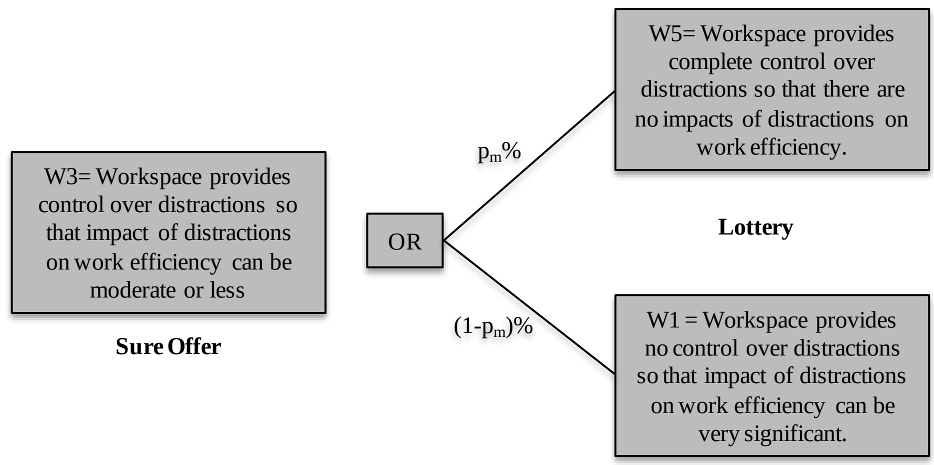
Assessment of utility functions requires that some quantitative restrictions are applied to a few particular points on the utility functions. The technique begins by defining the utility of best consequence as 1 and the utility of worst consequence as 0. Generally, a 5-point scale is considered appropriate to obtain the utility function. Consequently, a 5-point -- x_0, $x_{1/4}$, $x_{1/2}$, $x_{3/4}$, and x_1 -- utility assessment procedure was established. x_0 was the least preferred consequence that matched the worst level on the 5-point measurement index of attributes. $x_{1,}$ the most preferred consequence matched the best level on the 5-point measurement scale. The utility of x_1 was set to 1, $u(x_1) = 1$ and the utility of x_0 was set to zero, $u(x_0) = 0$. A decision-maker is then asked to specify the value p such that he or she is indifferent between taking $x_{1/2}$ for sure or a p chance of getting x_1 versus (1-p) chance of getting x_0. The following equation, Equation 1 (Keeney and Raiffa, 1976), is then used to calculate the utility of $x_{1/2}$:

$$U(x_{1/2}) = (p)*u(x_1) + (1-p)*u(x_0) \tag{1}$$

This general outline was adopted for all 10 attributes; in turn, single attribute utility functions, called workspace utility functions, were determined by plotting the utility values for x_0, $x_{1/4}$, $x_{1/2}$, $x_{3/4}$, and x_1. The complete set of gambles designed for all 10 attributes is provided in Appendix F(b). A snapshot of gambles designed for Attribute A1 is shown in Figure 7.2 to Figure 7.4.

Figure 7.2 is designed to seek the marginal utility of the subject at $x_{1/2}$. Two options are given: one, workspace W3 is offered for sure. Two, the subject is presented with a lottery in which there is a p% chance to win workspace W5, the best workspace alternative, and (1-p)% chance to end up with workspace W1, the worst workspace alternative. Subjects are asked to fill in the p such that one is indifferent between the sure offer and the lottery. At this point, the expected utility of the lottery equals the expected utility of the sure offer, Equation 1. This is the marginal utility of the subject at $x_{1/2}$. The process is repeated for the measurement level of $x_{1/4}$ with x_0 and $x_{1/2}$ as worst and best workspace alternatives (Figure 7.3); and $x_{3/4}$ with $x_{1/2}$ and x_1 as the worst and best workspace alternatives (Figure 7.4). These steps provide a subject's marginal utilities at $x_{1/4}$ and $x_{3/4}$. This process is repeated for all 10 attributes such that each subject's marginal utility for each level of the measurement index is obtained. These marginal utilities are then plotted to seek each subject's single attribute utility function for each attribute. These are further discussed in Section 7.3.4.

Attribute A1: GAMBLE 1

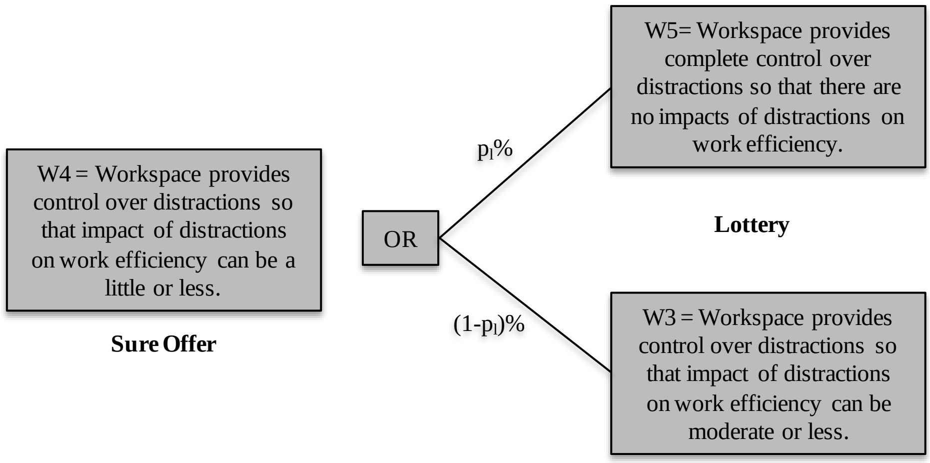


Please answer the following questions regarding Gamble 1 for attribute A1.

Question	Answer
What is the smallest value of p_m (p_{m1}) for which you will definitely prefer lottery to the sure offer (W3)? (i.e. if the chance of winning the best workspace (W_5) in the lottery is at least p_{m1}%, then you will definitely go for the lottery).	
What is the largest value of p_m (p_{m2}) for which you will definitely prefer the sure offer (W3) to the lottery? (i.e., if the chance of getting the best workspace (W5) in the lottery is only p_{m2}% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p_{m1} and p_{m2} for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Figure 7.2 - Gamble 1 for Attribute A1

Attribute A1: GAMBLE 2

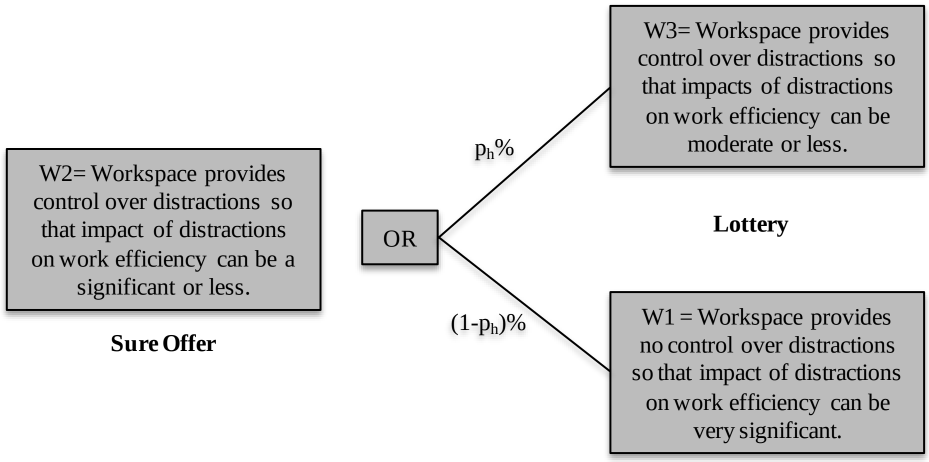


Please answer the following questions regarding Gamble 2 for attribute A1.

Question	Answer
What is the smallest value of p_l(p_{l1}) for which you will definitely prefer lottery to the sure offer (W4)? (i.e. if the chance of winning the best workspace (W5) in the lottery is at least p_{l1}%, then you will definitely go for the lottery).	
What is the largest value of p_l (p_{l2}) for which you will definitely prefer the sure offer (W4) to the lottery? (i.e., if the chance of getting the best workspace (W5) in the lottery is only p_{l2}% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_l in between p_{l1} and p_{l2} for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_l?	
Do you think your value of p_l (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_l (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Figure 7.3 - Gamble 2 for Attribute A1

Attribute A1: GAMBLE 3



Please answer the following questions regarding Gamble 3 for attribute A1.

Question	Answer
What is the smallest value of p_h(p_{hl}) for which you will definitely prefer lottery to the sure offer (W2)? (i.e. if the chance of winning the best workspace (W_3) in the lottery is at least p_{h1}%, then you will definitely go for the lottery).	
What is the largest value of p_h (p_{h2}) for which you will definitely prefer the sure offer (W2) to the lottery? (i.e., if the chance of getting the best workspace (W3) in the lottery is only p_{h2}% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p_{h1} and p_{h2} for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Figure 7.4 - Gamble 3 for Attribute A1

7.2.2.2. Assessment of Trade-offs Among Attributes – Attribute Weights

For a given decision context and a decision situation, it is expected that all the attributes are unlikely to be considered equally important. The function of attribute weights in this context is to express the relative importance of each attribute to the overall decision problem.

Weights are scaling constants and, provided that the attributes do not overlap, i.e., attributes are mutually exclusive, they express the relative contribution of one attribute to the overall evaluation of alternatives, i.e., they adjust the units of qualitatively different attributes with respect to their value (Borcherding et al., 1995). Keeney and Raiffa (1976) underlines that the attribute weights are not importance weights for attributes; rather, they are re-scaling factors that provides consistency to the overall multi-attribute utility evaluation.

Techniques to elicit attribute weights include: direct point allocation; Edwards' (1977) SMART; Winterfedt and Edwards' (1986) swing method; and Keeney and Raiffa's (1976) certainty scaling and probabilistic scaling. For a review, see (Stewart, 1992, Keeney and Raiffa, 1976, Weber and Borcherding, 1993). A non-hierarchical swing weighing methodology was used to elicit weights in this study. Literature on attribute weighing suggests that swing weighing counteracts the criticisms of using extraneous and perhaps even distorted importance judgments; and non-hierarchy takes care of the splitting bias involved with an unbalanced structure of the objective hierarchy (Poyhonen, 1998). An illustration of difference between hierarchical and non-hierarchical weighing is shown in Figure 7.5. Hierarchical weighing requires elicitation and normalization of weights within each level and branch. Multiplication of these weights down the value tree provides the final attribute weights (Figure 7.5 left). Non-hierarchical weighing requires simultaneous elicitation of all the lowest-level weights (Figure 7.5 right).

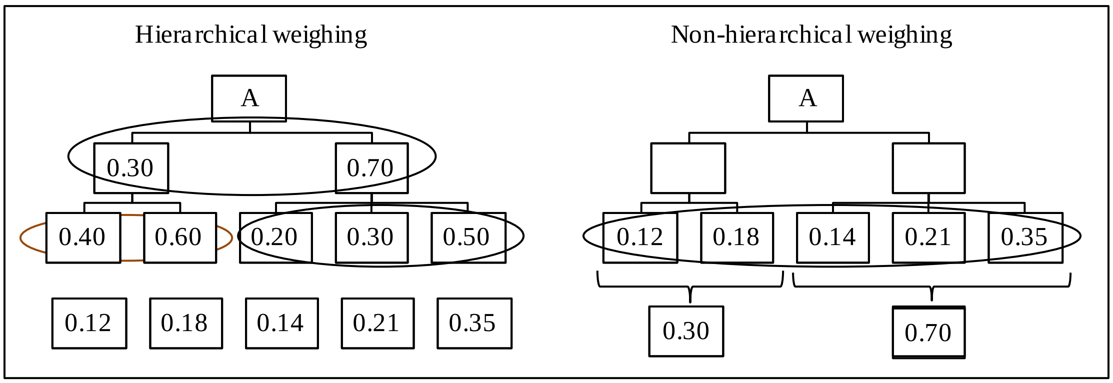


Figure 7.5 - Hierarchical vs. Non-hierarchical Weighing (source: Poyhonen, 1998)

7.2.2.2.1. Swing weighing for attribute weights

Swing weighing doesn't use the concept of importance. In this technique, the subject is asked how much an attribute contributes to the overall value of the consequences. Typically, the subject compares consequences that swing between the worst and best levels in each attribute. The subject estimates which swing contributes more in overall value and assigns rank and rate to each consequence. Swing weighing preserves the ratio scale properties of the decision-maker's judgments. The process for swing weighing used in this study is as follows.

Eleven hypothetical consequences were designed, as shown in Table 7.2. Each row in the table represents a consequence in which one of the 10 attributes is swung to its best level while all other attributes are fixed at their worst level. For instance, in row 2, the attribute impact of distractions on work efficiency is swung to its best level, implying there is none or very little impact of distractions on work efficiency, whereas all other attributes are fixed at their worst level. Similarly, in row 3, the attribute impact on work effectiveness is swung to its best level and all other attributes are kept at their worst level, and so on.

Table 7.2 - Hypothetical Consequences for Swing Weight Assessment

No.	Attribute swung from worst to best	Consequences	Rank (R)	Ratin g (r)	Weight (r/∑r)
1	(Benchmark)	A1 - A10 are at worst level.	11	0	0
2	A1 - Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level			
3	A2 - Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level			
4	A3 - Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level			
5	A4 - Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level			
6	A5 - Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level			
7	A6 - Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level			
8	A7 - Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level			
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level			
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level			
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level			

Assuming that subjects differ in their preference for importance of an attribute towards the decision problem, they were requested to rank and rate the consequences in rows 2 to 11. The following was suggested: if the consequence in row 5, none or very little impact of distractions on physical health, is the most important, then assign rank 1 to this consequence in column 4 (Rank) of Table 7.2. Repeat the process for next important consequence and the next, so that all the consequences in rows 2 – 11 are ranked from 1 to 10. Row 1 represents a benchmark consequence where all the attributes are at their worst level; therefore, this is the worst possible consequence with rank 11.

Next, subjects were requested to rate the consequences between 0 and 100. In this technique, the rating for the benchmark consequence (row 1 in Table 7.2) is default to 0; and the rating for the highest ranked consequence is default to 100. The ratings for the other nine consequences must fall between 0 and 100 and should follow the rankings, i.e., row with rank 2 must have equal or higher rating than row with rank 3, and so on. The rating of x% for a consequence actually means that improving the respective attribute from worst to best is worth x% of the value that is accomplished by improving the best consequence from worst to best. For example, if row 10 is ranked 1, then a rating of 100 is assigned to the respective consequence. A rating of 80 for row 4 will mean that by improving the attribute A3, from its worst level to its best level, 80% of the value is achieved that would have been achieved by improving the highest ranked consequence from its worst level to best. Table 7.3 shows the rankings and ratings provided by the subject kw1. Structured data for all 20 subjects is provided in Appendix G. The weight column in Table 7.3 is derived by normalizing the rating values. The standard normalization equation is shown below, Equation 2 (Clemen, 1997):

$$w_i = \frac{r_i}{\sum r_i} \tag{2}$$

where, w_i is the weight of attribute i, $0 \leq w_i \leq 1$, r is the rating provided by the subject, and $\sum w_i = 1$.

Table 7.3 - Swing Weights for Subject kw1

No.	Attribute swung from worst to best	Consequences	Rank (R)	Ratin g (r)	Weight (r/∑r)
1	(Benchmark)	A1 - A10 are at worst level.	11	0	0
2	A1 - Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	90	.153
3	A2 - Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	2	85	.144
4	A3 - Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	5	20	.034
5	A4 - Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	4	100	.169
6	A5 - Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	6	70	.119
7	A6 - Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	65	.110
8	A7 - Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	7	60	.102
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	3	50	.085
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	8	40	.068
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	10	.017
	Total			590	1.000

7.2.2.3. Probability Assessment for Possible Consequences

The nature of attributes for this decision problem is such that uncertainty is an integral part of the consequences for attributes A1 through A9. Therefore, the model was designed to evaluate the expected utilities of various workspace alternatives, W1 through W5. The expected utility theory states that the best alternative is the one with highest expected utility. To accomplish this, subjects were also requested to assign probabilities to various possible consequences of the decision problem. A five-level consequence space from best scenario to worst scenario was designed for each alternative. A snapshot of the total consequence space for workspace alternative W1 (open workspace) is shown in Figure 7.6.

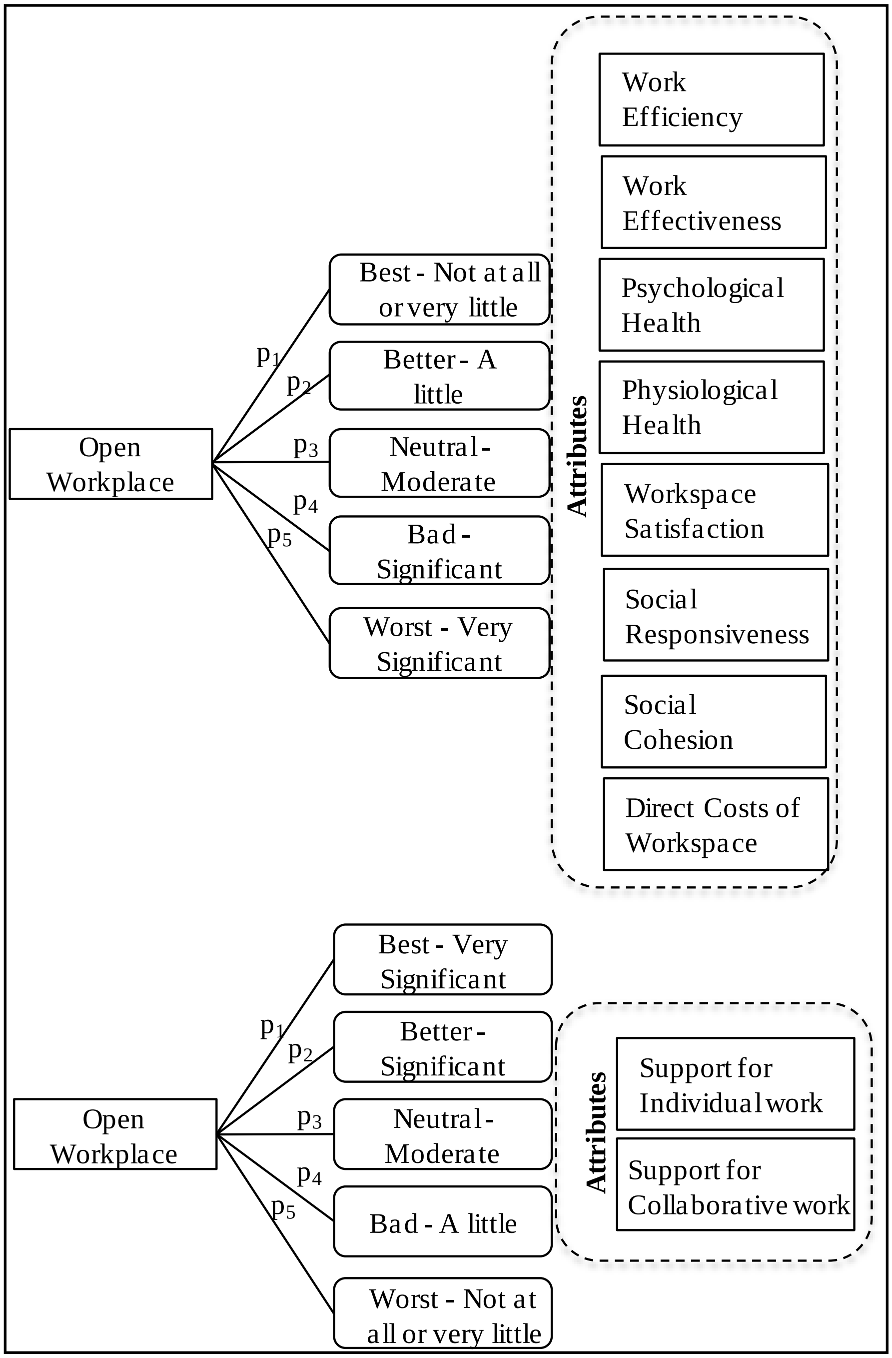


Figure 7.6 - Total Consequence Space for Workspace Alternative W1

Subjects with the assigned role of knowledge worker were asked to answer such questions with respect to each hypothetical consequence: With workspace alternative "*W1 (open workspace)*", what is the likelihood of getting "*not at all or very little*" impact of distractions on your "*work efficiency*"? Another question type was: With workspace alternative "*W1 (open workspace)*", what is the likelihood of getting "very significant" support for individual work? Subjects with the assigned role of decision-maker were asked to answer such questions with respect to each hypothetical consequence: With workspace alternative "*W1 (open workspace)*", what is the likelihood of getting "*not at all or very little*" impact of distractions on "*work efficiency*" of knowledge workers? Italics in quotations are changed for each different consequence, i.e., workspace alternative, consequence, and attribute. Table 7.4 shows the probability assignments for various consequences by the subject kw1. Figure 7.6 shows that the consequence space is the result of five consequences per attribute; because, in all, there are 10 attributes, this makes 50 possible scenarios per workspace alternative. With five workspace alternatives for evaluation, the total consequence space becomes 250 in number. A similar table for each subject is provided in Appendix H. It is important to mention here that, out of the 20 subjects who participated in the interviews, only 16 completed the probability assignment task; the remaining four subjects stated that they were not comfortable with the idea of assigning probability judgments.

Table 7.4 - Probability Assignments by Subject kw1

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.05	0.10	0.30	0.05	0.10	0.10	0.10	0.10	0.25	0.40
	Better - A little	0.05	0.15	0.25	0.05	0.10	0.15	0.10	0.15	0.20	0.20
	Neutral - Moderate	0.15	0.15	0.20	0.10	0.20	0.15	0.15	0.20	0.20	0.15
	Bad - Significant	0.25	0.20	0.15	0.30	0.20	0.25	0.20	0.25	0.25	0.15
	Worst - Very Significant	0.50	0.40	0.10	0.50	0.40	0.35	0.45	0.30	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.05	0.10	0.35	0.10	0.10	0.10	0.10	0.15	0.30	0.10
	Better - A little	0.10	0.10	0.20	0.10	0.20	0.15	0.15	0.15	0.20	0.10
	Neutral - Moderate	0.20	0.20	0.15	0.15	0.20	0.15	0.15	0.20	0.15	0.20
	Bad - Significant	0.30	0.30	0.10	0.30	0.20	0.25	0.30	0.20	0.20	0.30
	Worst - Very Significant	0.35	0.30	0.20	0.40	0.30	0.35	0.30	0.30	0.15	0.30
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.15	0.10	0.15	0.15	0.30	0.15	0.10	0.20	0.20	0.15
	Better - A little	0.15	0.15	0.25	0.15	0.25	0.15	0.20	0.20	0.20	0.25
	Neutral - Moderate	0.20	0.20	0.30	0.20	0.15	0.30	0.20	0.25	0.25	0.30
	Bad - Significant	0.20	0.20	0.20	0.20	0.10	0.20	0.25	0.20	0.20	0.20
	Worst - Very Significant	0.30	0.35	0.10	0.30	0.20	0.20	0.25	0.15	0.15	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.20	0.25	0.40	0.15	0.25	0.30	0.25	0.40	0.40	0.05
	Better - A little	0.25	0.25	0.30	0.15	0.25	0.25	0.25	0.30	0.30	0.05
	Neutral - Moderate	0.25	0.25	0.15	0.25	0.20	0.25	0.20	0.10	0.15	0.10
	Bad - Significant	0.20	0.15	0.01	0.25	0.15	0.10	0.15	0.10	0.10	0.30
	Worst - Very Significant	0.10	0.10	0.05	0.20	0.15	0.10	0.15	0.10	0.05	0.50
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.30	0.35	0.45	0.25	0.40	0.30	0.35	0.40	0.45	0.00
	Better - A little	0.25	0.25	0.25	0.25	0.25	0.30	0.25	0.30	0.25	0.05
	Neutral - Moderate	0.25	0.20	0.20	0.20	0.20	0.20	0.25	0.15	0.20	0.15
	Bad - Significant	0.10	0.10	0.05	0.10	0.10	0.10	0.10	0.10	0.05	0.30
	Worst - Very Significant	0.10	0.10	0.05	0.10	0.05	0.10	0.05	0.05	0.05	0.50
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

7.3. Data Analysis, Results, and Discussion

This section is dedicated to analysis of the data collected using the research instrument described in the previous section. Appropriate statistical methods are used to test research hypotheses. Results are compiled and implications discussed for workspace decision-making. However, before the research findings are discussed it is imperative to mention here that these findings are valid within the scope of the following assumptions that were made for the MAU decision model and the limitations that were observed for collecting data.

7.3.1. Assumptions of the Multi-Attribute Workspace Choice Utility Decision Model

The key assumptions for evaluation of workspace alternatives using the multi-attribute workspace choice utility model are as follows:

- The subjects who will complete the MAU evaluation process are representative of rational thinkers.
- Corporate executives and management is positively determined to facilitate knowledge workers in achieving the best performance and satisfaction.
- Knowledge workers are self-motivated to increase the net productivity of an organization.
- The utility assessment procedure is costly in terms of time required from decision-makers and the time for which they are expected to concentrate on difficult questions. Therefore, it is assumed that the subjects will not rush through the process without understanding so that the likelihood of inconsistencies and biases is minimized.

7.3.2. Limitations of the Workspace Evaluation Using Multi-Attribute Workspace Choice Utility Model

The MAU evaluation of workspace choices as discussed in the next few sections is a structured enquiry that provides consistent and rational results to a complex problem of workspace decision making within the scope of the decision-context stated in Section 4.3 of Chapter 4. However, these results are guided by certain limitations that were faced while conducting this study and the limitations of MAU evaluation process. These limitations are stated below:

- The results of MAU evaluation are not one size fits all, i.e., the MAU evaluation performed for one organization may or may not fit another organization. The reason is that MAU results are based on a number of individualistic preferences, where an individual could be a single decision-maker, a group of decision-makers representing a particular organization, or an industry. Consequently, the findings of this study are not generalizable; however, they can act as a quick guide or best practice.
- The subjects involved in this research study were from Atlanta; therefore, the research findings are guided by SouthEastern thinking.
- With a wider group of decision-makers, the problem of workspace selection becomes a problem of individuals' competing priorities. The assumption is that all the decision-makers share a common goal of selecting the most-appropriate workspace. However, it is important to acknowledge that these decision-makers may be influenced by specific competing forces within their corporations. Therefore, the question of fairness between decision-makers is not relevant if they come from a wider group. For instance, a decision-maker from Google may place a higher

preference on physiological health of knowledge workers, whereas, a decision-maker from McDonald's may place a higher reference on cost of workspace. Addressing these types of differences between team members' preference functions is the central problem of group decision-making in MAU evaluation.

7.3.3. Single Attribute Marginal Utilities

Gamble questions discussed in Section 7.2 (an illustration shown in Figures 7.2 – 7.4), provided the indifference points of the subjects for attribute measurement levels at $x_{1/2}$, $x_{1/4}$, and $x_{3/4}$ (see column 4 in Table 7.5). The first step in multi-attribute utility analysis is to process the indifference values to assess single attribute marginal utilities of the subject. Single attribute marginal utilities are then plotted to obtain single attribute utility functions (SAUF). According to the multi-attribute utility technique, for a five-point measurement scale, three indifference values are sufficient (Keeney and Raiffa, 1976). The best (x_1) and the worst (x_0) levels of the measurement index are assigned utility values of 1 and 0. The utility value at the middle level is then calculated using Equation 3 (Keeney and Raiffa, 1996):

$$u(x_{1/2}) = (p\%) * u(x_1) + (1-p)\% * u(x_0) \tag{3}$$

To better understand the utility calculation method, imagine a gamble, as shown in Figure 7.7, where one choice is to enter into a lottery to win \$10,000 or lose to zero, and the other choice is take \$2000 for sure. Suppose that \$10,000 is the best possible outcome (x1), zero is the worst possible outcome, and \$2000 is the middle point ($x_{1/2}$). According to the multi-attribute utility assessment methodology, utility of \$10,000 is 1 (best case) and utility of zero is zero (worst case). If the probability p% for which you will play the lottery is 75%, then using Equation 3, the utility of amount \$2000 will be 0.75.

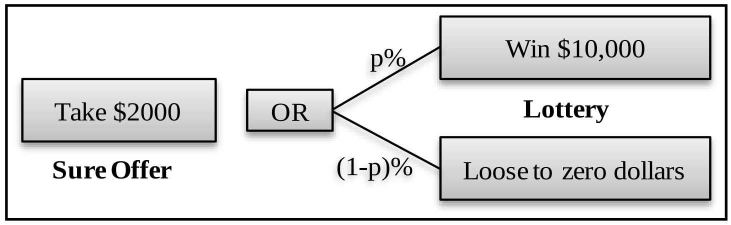


Figure 7.7 - Illustration of a Gamble

This procedure is then repeated to calculate the marginal utilities at levels $x_{1/4}$, and $x_{3/4}$. Column 5 in Table 7.5 presents single attribute marginal utilities for the subject kw1. Consequently, single attribute utility functions are plotted; such functions for the subject kw1 are shown in Figure 7.8.

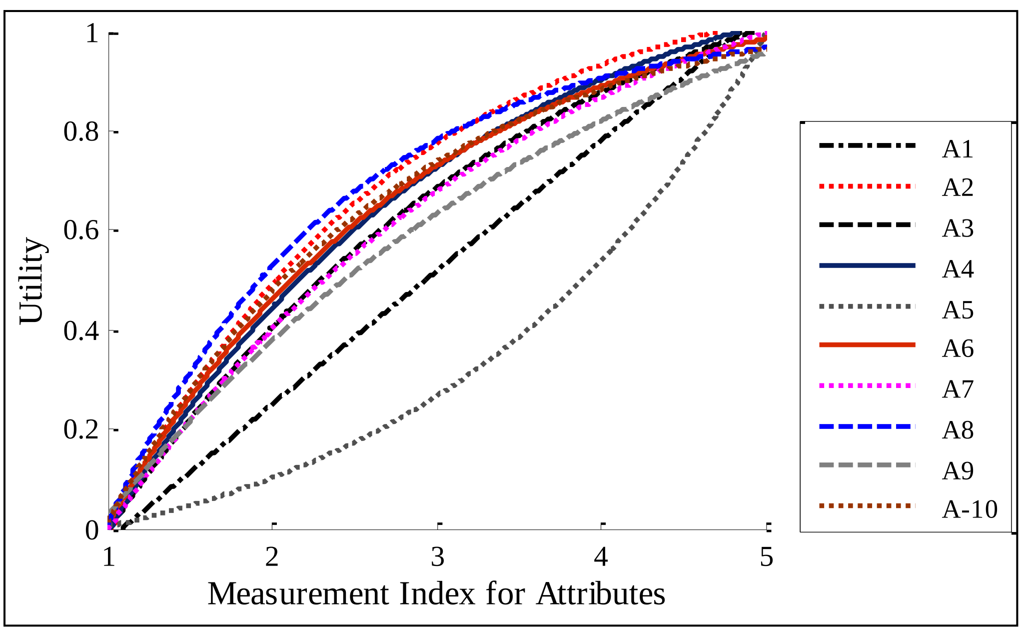


Figure 7.8 – Single Attribute Utility Functions for Subject kw1

The shape of the curves in Figure 7.8 clearly depicts that kw1 is risk averse (concave curve) towards most of the attributes except for attribute A5, satisfaction with workspace, for which kw1 is risk prone (convex curve) and risk neutral (straight line) towards attribute A1, work efficiency. In multi-attribute decision-making such curves carry special importance as these are effective means for performing quick analysis of stakeholder's preferences. Similar table and utility functions for all 20 subjects is presented in Appendix I (A and C). The next section talks about these functions in more detail.

Table 7.5 - Single Attribute Marginal Utilities for subject kw1

Attribute Name	**Attribute levels (x-axis)**	**Attribute weight w(x)**	**Indifference value**	**Marginal utility $u_i(x_i)$ (y- axis)**	**Utility u(x) = w(x) * $u_i(x_i)$**
Work Efficiency	5 (Best)	0.18		1.000	0.153
	4		0.45	0.725	0.111
	3		0.50	0.500	0.076
	2		0.35	0.175	0.027
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.15		1.000	0.144
	4		0.30	0.580	0.084
	3		0.40	0.400	0.058
	2		0.20	0.080	0.012
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.1		1.000	0.034
	4		0.30	0.615	0.021
	3		0.45	0.450	0.015
	2		0.25	0.113	0.004
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.12		1.000	0.169
	4		0.55	0.730	0.124
	3		0.40	0.400	0.068
	2		0.25	0.100	0.017
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.085		1.000	0.119
	4		0.50	0.750	0.089
	3		0.50	0.500	0.059
	2		0.30	0.150	0.018
	1 (Worst)			0.000	0.000

Table 7.5 – Continued

Social Responsiveness	5 (Best)	0.054		1.000	0.110
	4		0.60	0.800	0.088
	3		0.50	0.500	0.055
	2		0.35	0.175	0.019
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.075		1.000	0.102
	4		0.55	0.708	0.072
	3		0.35	0.350	0.036
	2		0.50	0.175	0.018
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.14		1.000	0.085
	4		0.50	0.750	0.064
	3		0.50	0.500	0.042
	2		0.30	0.150	0.013
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.06		1.000	0.068
	4		0.55	0.753	0.051
	3		0.45	0.450	0.031
	2		0.35	0.158	0.011
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.045		1.000	0.017
	4		0.60	0.760	0.013
	3		0.40	0.400	0.007
	2		0.40	0.160	0.003
	1 (Worst)			0.000	0.000

7.3.4. Qualitative Properties of Single Attribute Utility Functions

Risk characteristics and monotonicity are two key qualitative properties of single attribute utility functions that imply certain attitudes of a decision-maker with regard to his preferences for consequences and lotteries. Monotonicity means either more is always better, or more is always worse; this implies that there will be only one peak or one trough in the SAUF. Multiple peaks or troughs in a SAUF suggest changing states of more is better and more is worst, and vice versa. Monotonicity substantially simplifies the single-attribute evaluation. If non-monotonicity occurs at this stage, it is advisable to restructure the attribute set. Review of the single attribute utility functions plotted in Appendix I (C) shows that all 20 subjects, 10 knowledge workers and 10 decision-makers, have shown monotonic behavior towards the 10 attributes. Therefore, the attributes set was kept the same. In addition, monotonicity is required to perform additive aggregation of single attribute utility functions (SAUF).

Risk aversion, risk neutrality, and risk proneness are three risk attitudes that preference among lotteries, or between lotteries and sure things, often exhibit. If interpreted in terms of the shape of the utility function, these properties imply a certain functional form. A decision-maker is called risk averse if, he or she prefers the expected value of a gamble over playing the gamble; the functional form for risk aversion is concave. A decision-maker is risk neutral if, he or she is always indifferent between the expected value of a gamble and the gamble itself; the functional form for risk neutrality is a straight line. A decision-maker is risk prone if, he or she always prefers the gamble to its expected value; the functional form for risk proneness is convex. The forms of utility functions for these three characteristics are shown in Figure 7.9.

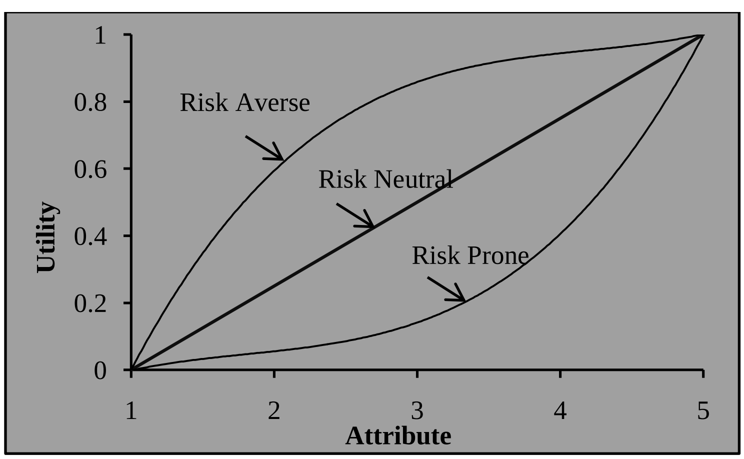


Figure 7.9 - Shapes of Utility Functions

7.3.4.1. Choosing a Utility Function

The functional form of a utility function can be specified by using functions of polynomial, logarithmic, exponential, or linear, where each functional form illustrates a different risk behavior. Multi-attribute utility analysis literature favors the negative exponential function, which is suggested as a fairly robust function that would not result in any serious errors. The explanation is that slight differences in risk attitude do not affect multi-attribute utility evaluations, as compared to variations in attribute weights and the general shape of the utility functions. Therefore, the exponential function, shown in Equation 4, was adopted for this study. This function suggests risk aversion; which means that, the decision-maker prefers the sure offer to the lottery. The exponential function as suggested by (Keeney and Raiffa, 1976) is given as:

$$u_i(x_i) = a + (-be^{-cx}) \tag{4}$$

where, $u_i(x_i)$ is the single attribute utility function for the attribute x, and a, b, and c are coefficients. The coefficient c is called the risk aversion coefficient. A positive value of c implies risk averse behavior, while a negative value of c will imply risk-seeking behavior.

7.3.4.2. Curve Fitting

Matrix Lab (MATLAB), the advanced mathematics software application, was used to fit Equation 4 to obtain the best-fit utility functions. Goodness of fit statistics, sum of squares due to error (SSE), and R-square were observed for the nature of the fit. SSE determines the total deviation of the response values from the fit, where a value approaching zero suggests that the function has a smaller random error component, and that the fit possess good prediction properties. R-square called the coefficient of determination is a statistic measure of how well the regression line approximated the real data points. R-square can take on any value between 0 and 1. As R-square approaches unity, the regression approaches a perfect fit; this indicates that a greater proportion of variance is accounted for by the model. For instance, an R-square value of 0.725 will imply that the best-fit curve explains 72.5% of the total variation in the data about the average. The best-fit single attribute utility functions (SAUF) with their equations and Goodness of fit statistics for kw1 are provided in Table 7.6 and shown in Figure 7.10. Such functions and Goodness of Fit statistics for all the 20 subjects are provided in Appendix I(C). Because, all the R-squares are between 0.90 and 1.0 and all the SSEs are below 0.1, this implies the best-fit SAUF nearly represents the actual data points and the model is good for prediction of risk attitudes.

Table 7.6 – SAUF Equations and Goodness of Fit Statistics

Attributes	**f(x) = a-b*exp(-c*x)**			**Goodness of fit**	
	Equation Parameters				
	a	**b**	**c**	**R-Square**	**SSE**
A1	11.620	11.920	0.024	0.987	0.010
A2	1.133	2.053	0.580	0.985	0.011
A3	1.291	1.895	0.380	0.999	0.001
A4	1.202	1.928	0.466	0.997	0.002
A5	-0.143	-0.087	-0.513	0.997	0.002
A6	1.128	1.874	0.515	0.997	0.002
A7	1.281	1.872	0.377	0.998	0.001
A8	1.026	2.071	0.712	0.993	0.004
A9	1.328	1.781	0.313	0.978	0.013
A10	1.070	1.884	0.578	0.990	0.006

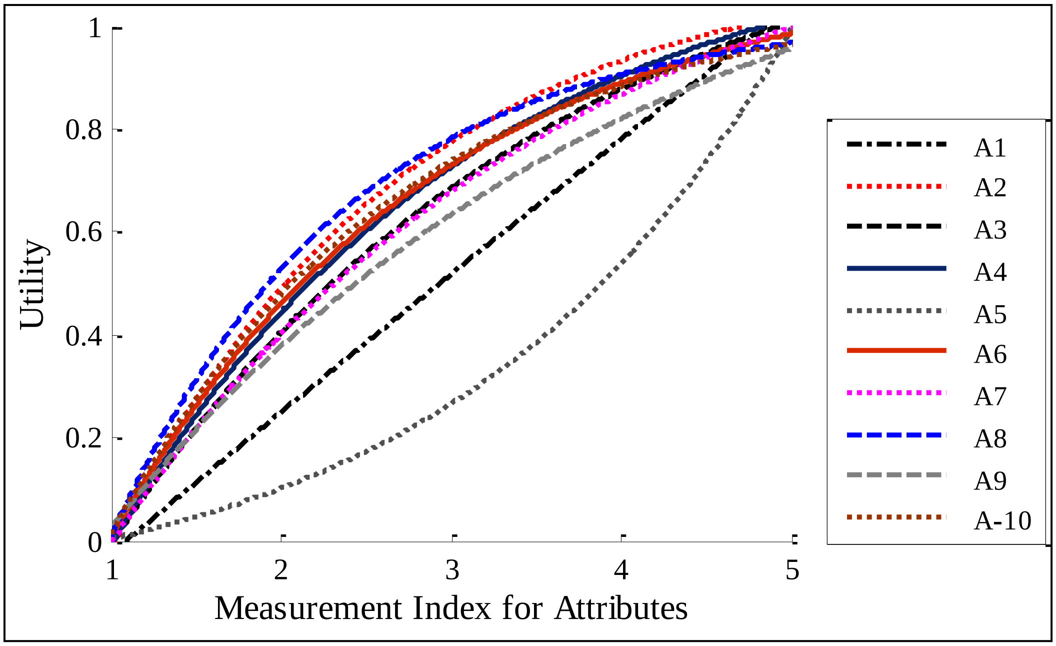


Figure 7.10 – SAUF for Subject kw1

7.3.4.3. Risk Attitude Categorization

Based on the examination of the risk aversion coefficient, c, obtained for all 20 subjects in two groups, the 10 knowledge workers and 10 decision-makers were placed in one of the three risk categories. If $c \geq .09$, the individual is risk averse (RA) over the entire range; if $c \leq -0.09$, the individual is risk prone (RP) over the entire range; and if $-0.09 < c < 0.09$, the individual is risk neutral over the entire range (RN). The values of 0.09 for risk neutral categorization are based on the fact that with $c <= \pm 0.09$ the curve tends to approach a straight line, which depicts the risk neutral behavior. In addition, it was assumed that a little lower or a little higher cut off point for c will not affect workspace rankings in any way. This is because of the robust nature of the exponential equation, where a little more or little less of risk behavior doesn't affect the overall utility of an alternative. Table 7.7 provides the number of subjects that belong to each category for all 10 attributes.

Table 7.7 - Number of Subjects in Three Risk Categories

Attribute	Subjects	Risk Attitude			Attribute	Subjects	Risk Attitude		
		RA	RN	RP			RA	RN	RP
A1	KW	7	3	0	A6	KW	6	2	2
	DM	5	1	4		DM	3	2	5
A2	KW	5	4	1	A7	KW	7	1	2
	DM	4	2	4		DM	4	0	6
A3	KW	9	0	1	A8	KW	8	2	0
	DM	3	1	6		DM	6	0	4
A4	KW	8	2	0	A9	KW	8	1	1
	DM	2	2	6		DM	5	2	3
A5	KW	3	4	3	A10	KW	2	6	2
	DM	5	1	4		DM	4	3	3

Figures 7.11 – 7.20 presents best-fit single attribute utility functions and summary of subjects in each risk category for all 10 attributes, as obtained for knowledge workers and decision-makers. Analysis of this risk information provides important information for the two groups, which is discussed in the next section.

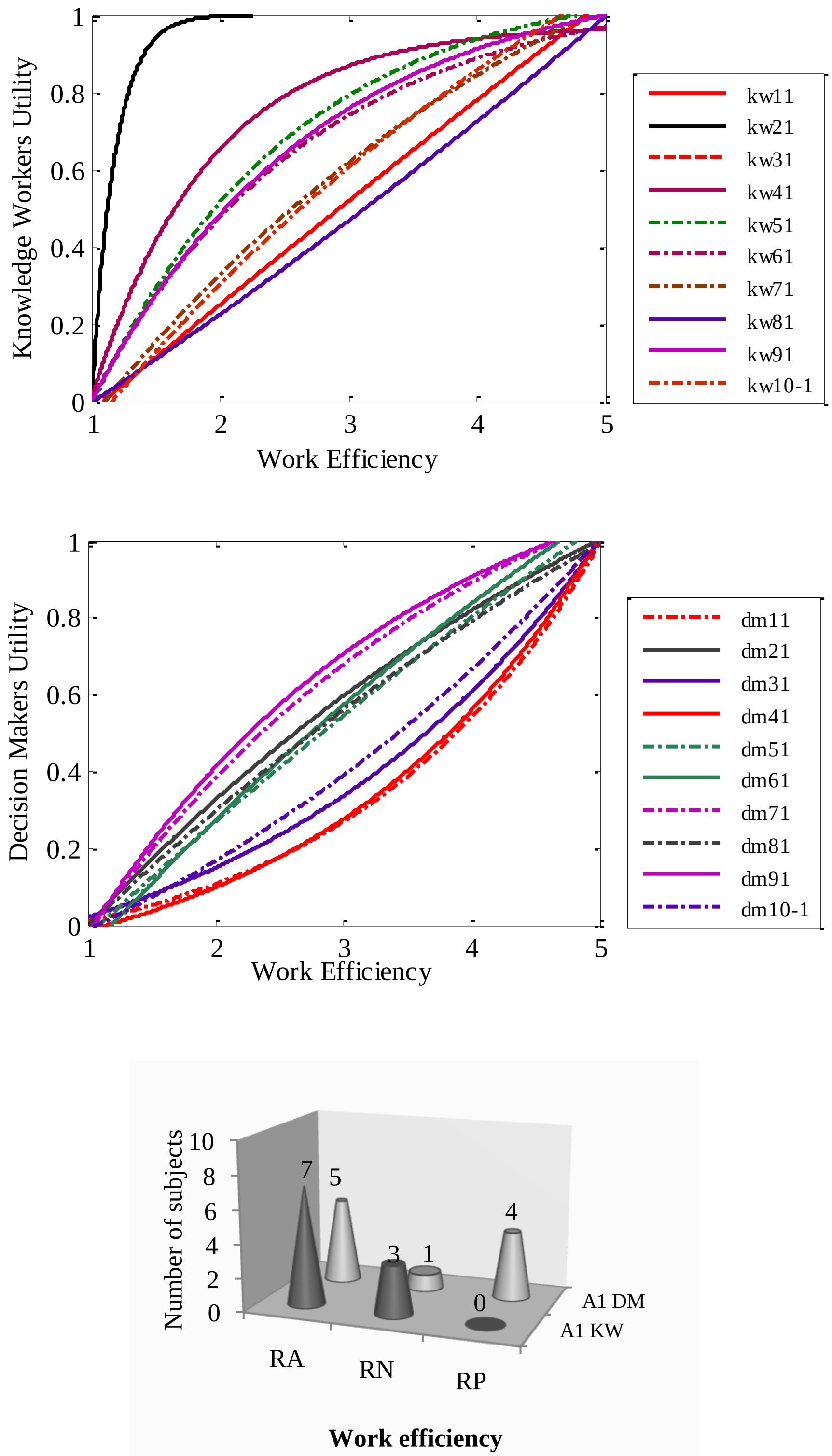


Figure 7.11 – SAUF for Attribute A1; top – knowledge workers, middle – decision makers, bottom – risk categorization summary

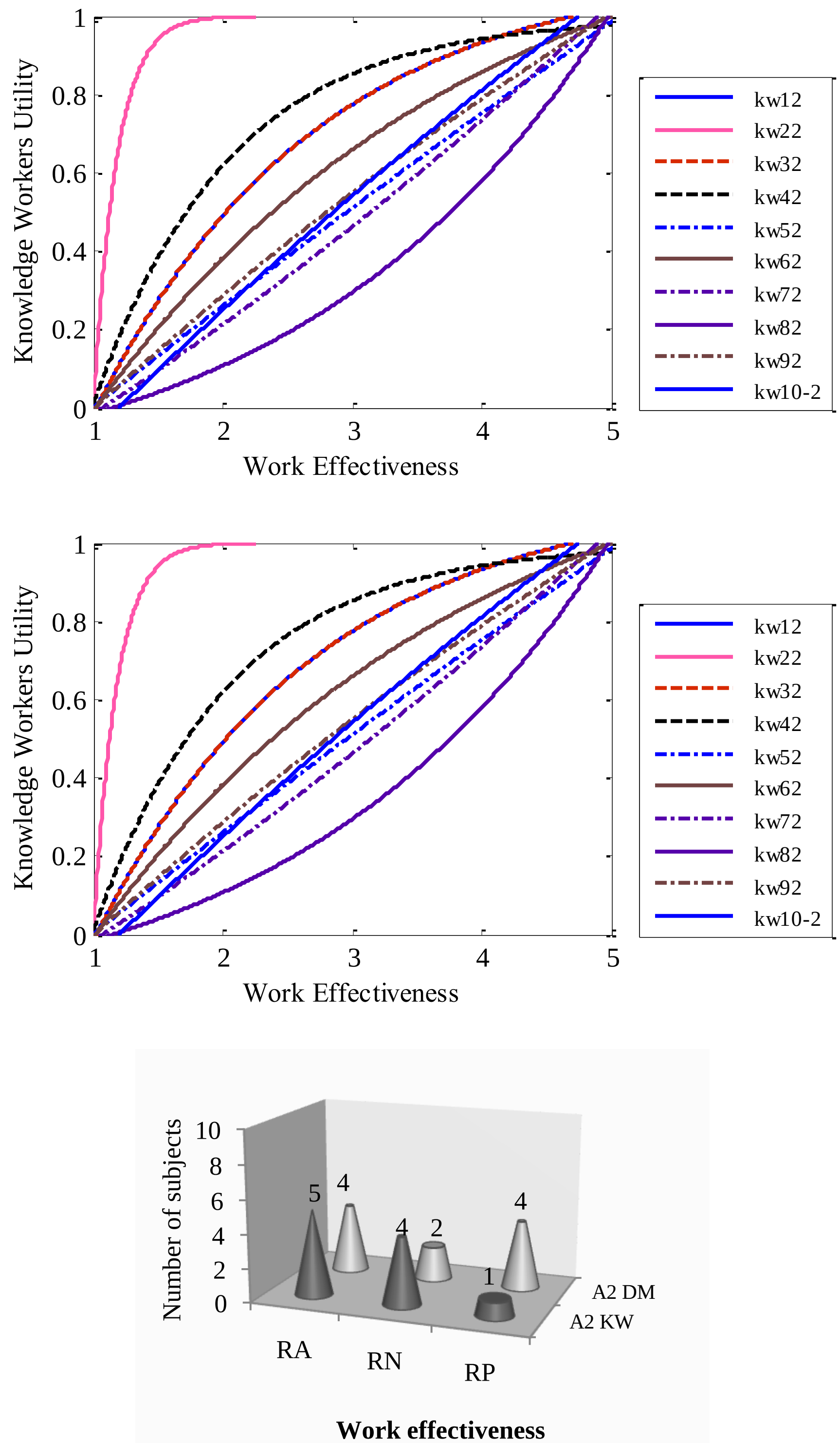
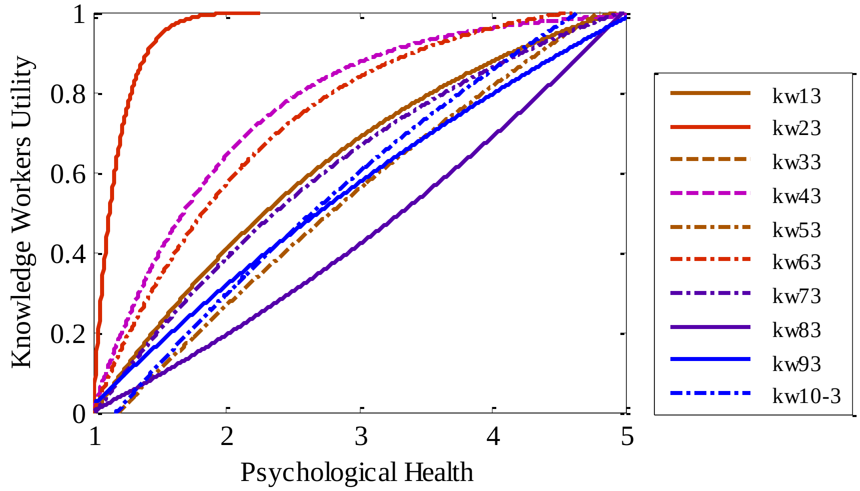
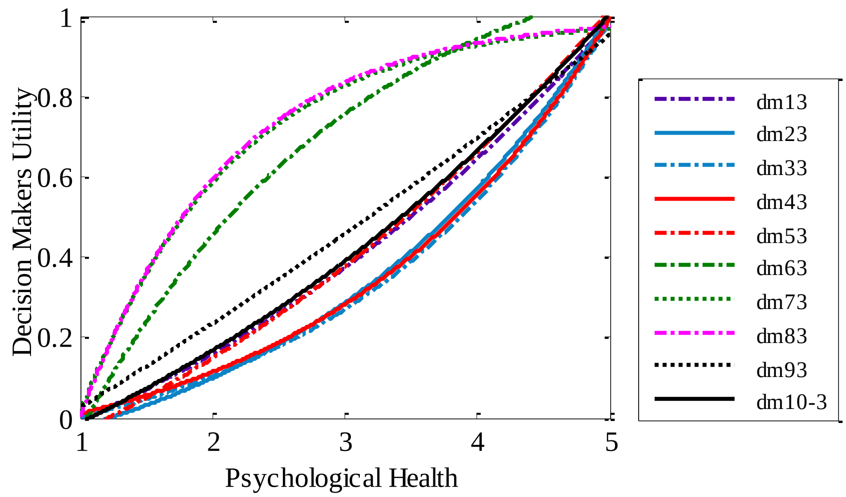


Figure 7.12 – SAUF for Attribute A2; top – knowledge workers, middle – decision makers, bottom – risk categorization summary





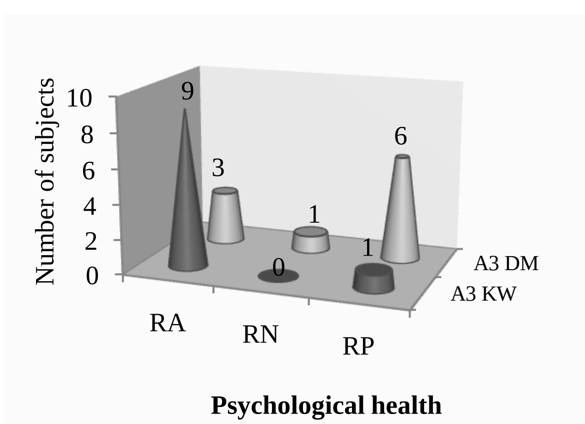


Figure 7.13 – SAUF for Attribute A3; top – knowledge workers, middle – decision makers, bottom – risk categorization summary

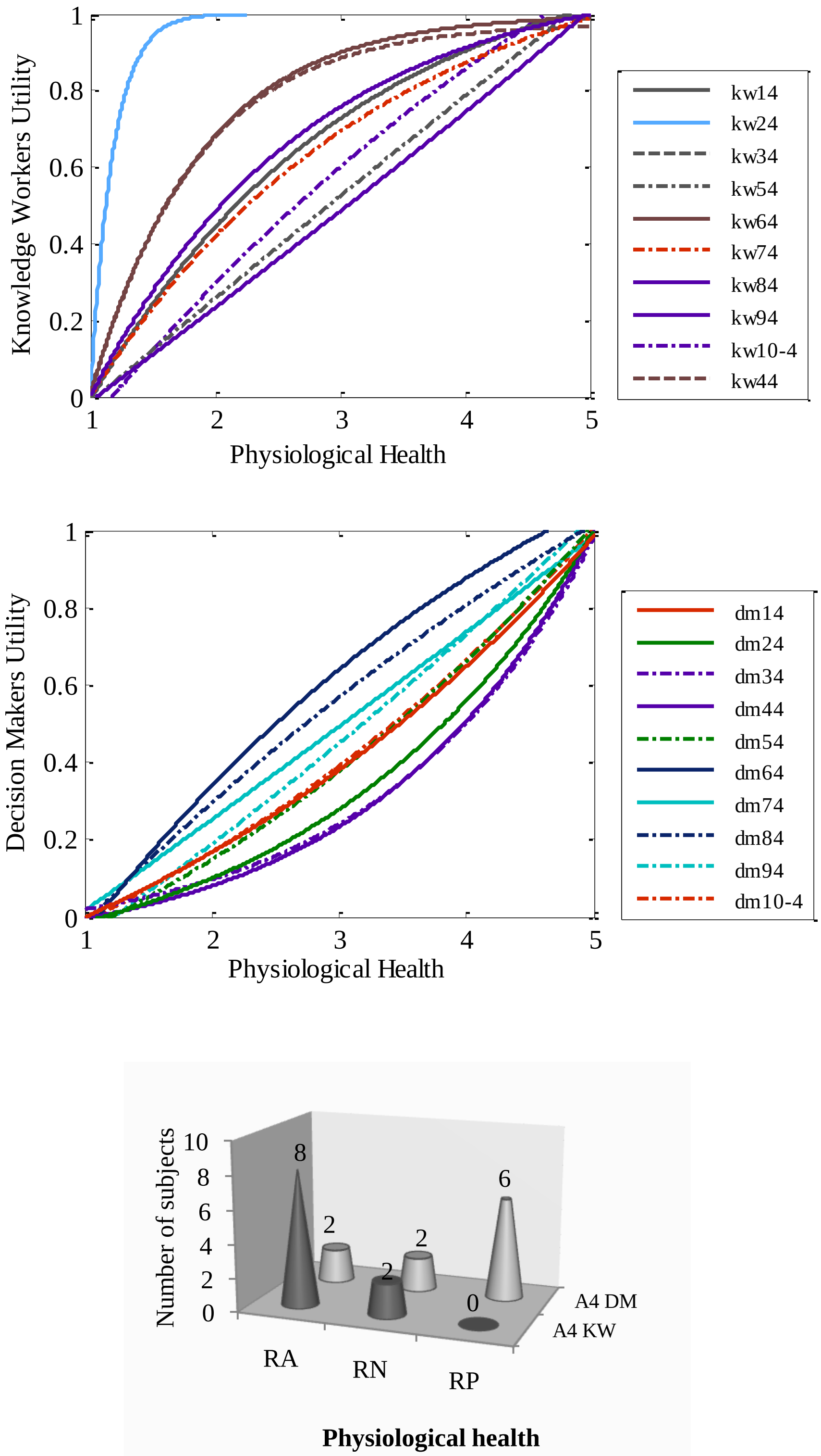
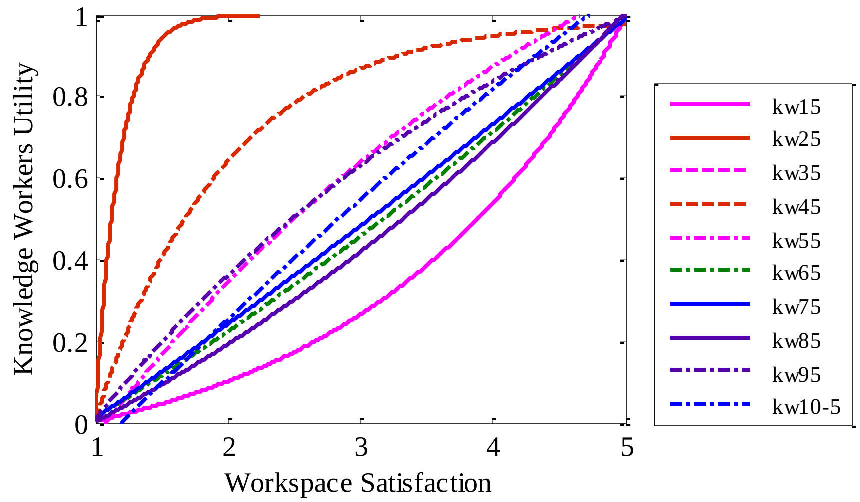
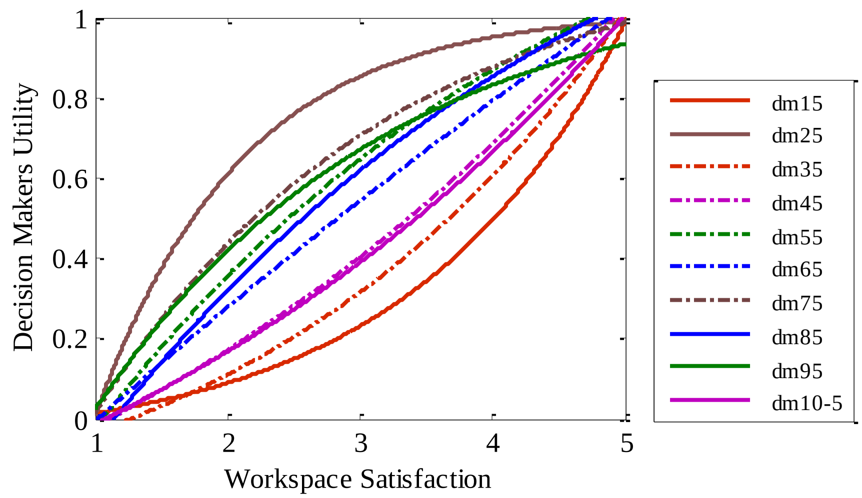


Figure 7.14 – SAUF for Attribute A4; top – knowledge workers, middle – decision makers, bottom – risk categorization summary





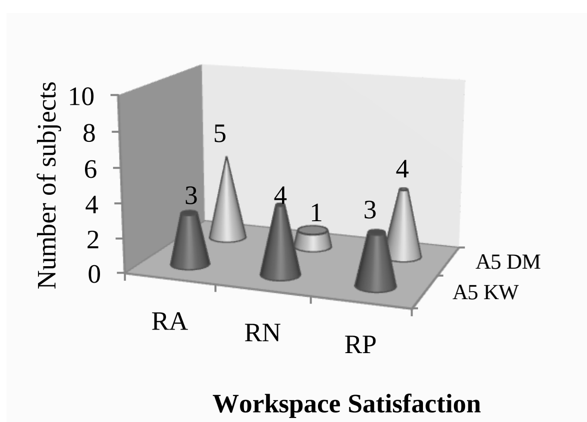
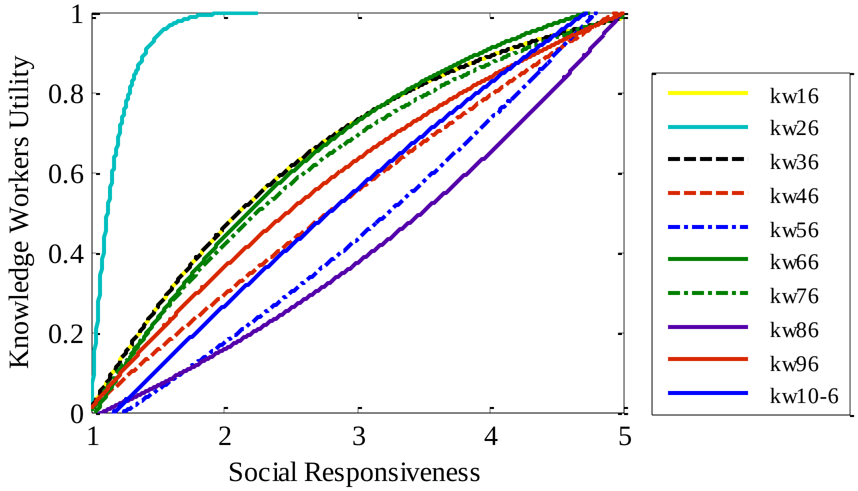
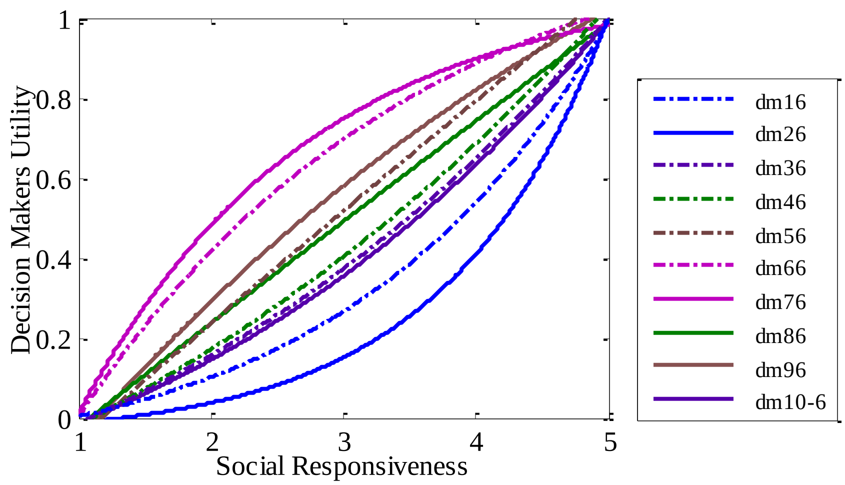


Figure 7.15 – SAUF for Attribute A5; top – knowledge workers, middle – decision makers, bottom – risk categorization summary





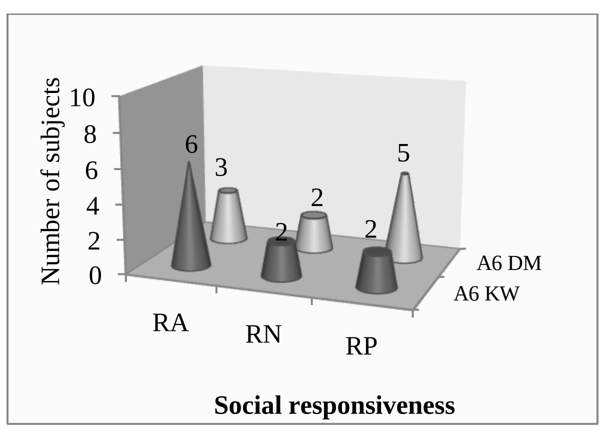


Figure 7.16 – SAUF for Attribute A6; top – knowledge workers, middle – decision makers, bottom – risk categorization summary

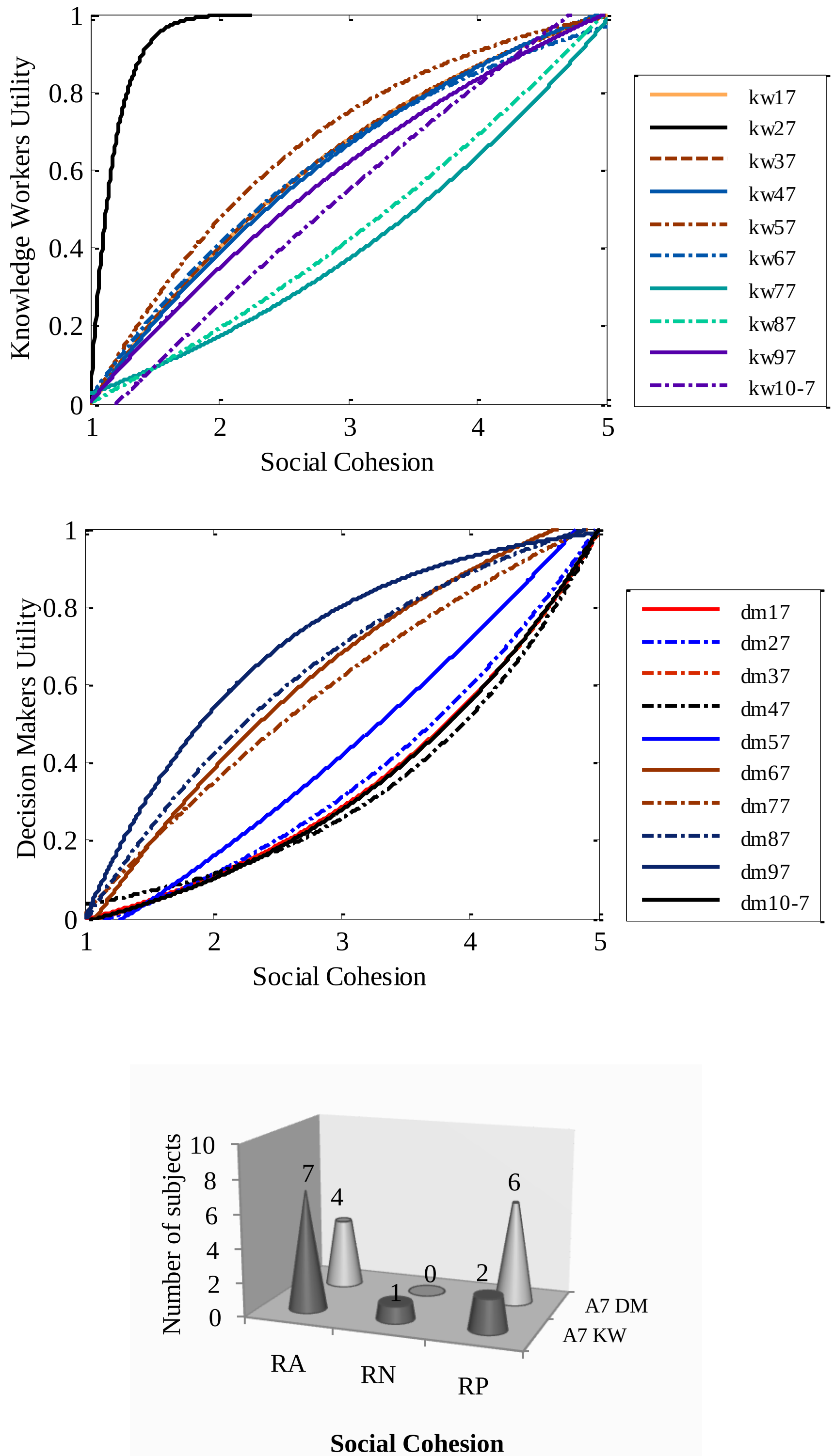


Figure 7.17 – SAUF for Attribute A7; top – knowledge workers, middle – decision makers, bottom – risk categorization summary

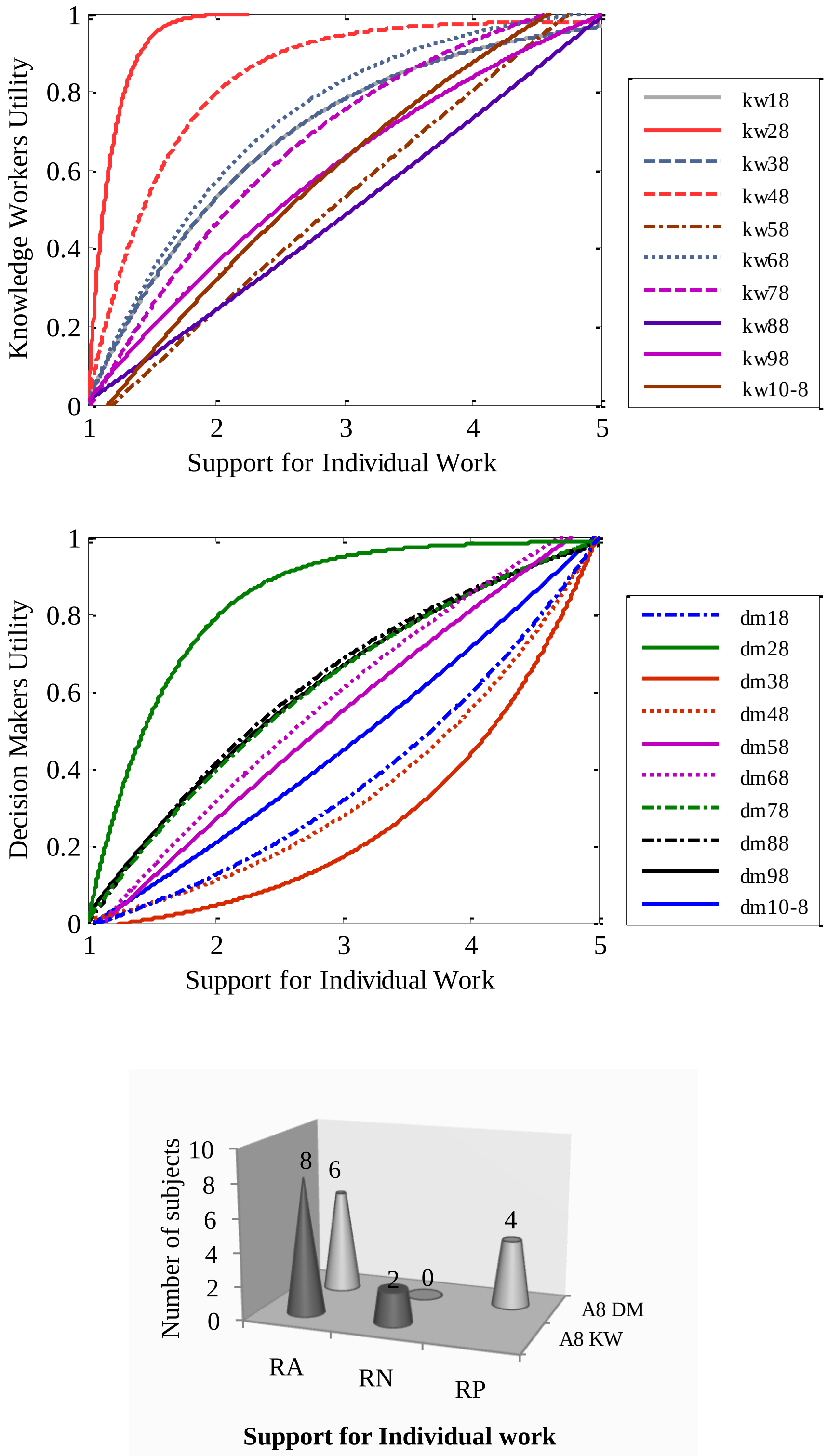


Figure 7.18 – SAUF for Attribute A8; top – knowledge workers, middle – decision makers, bottom – risk categorization summary

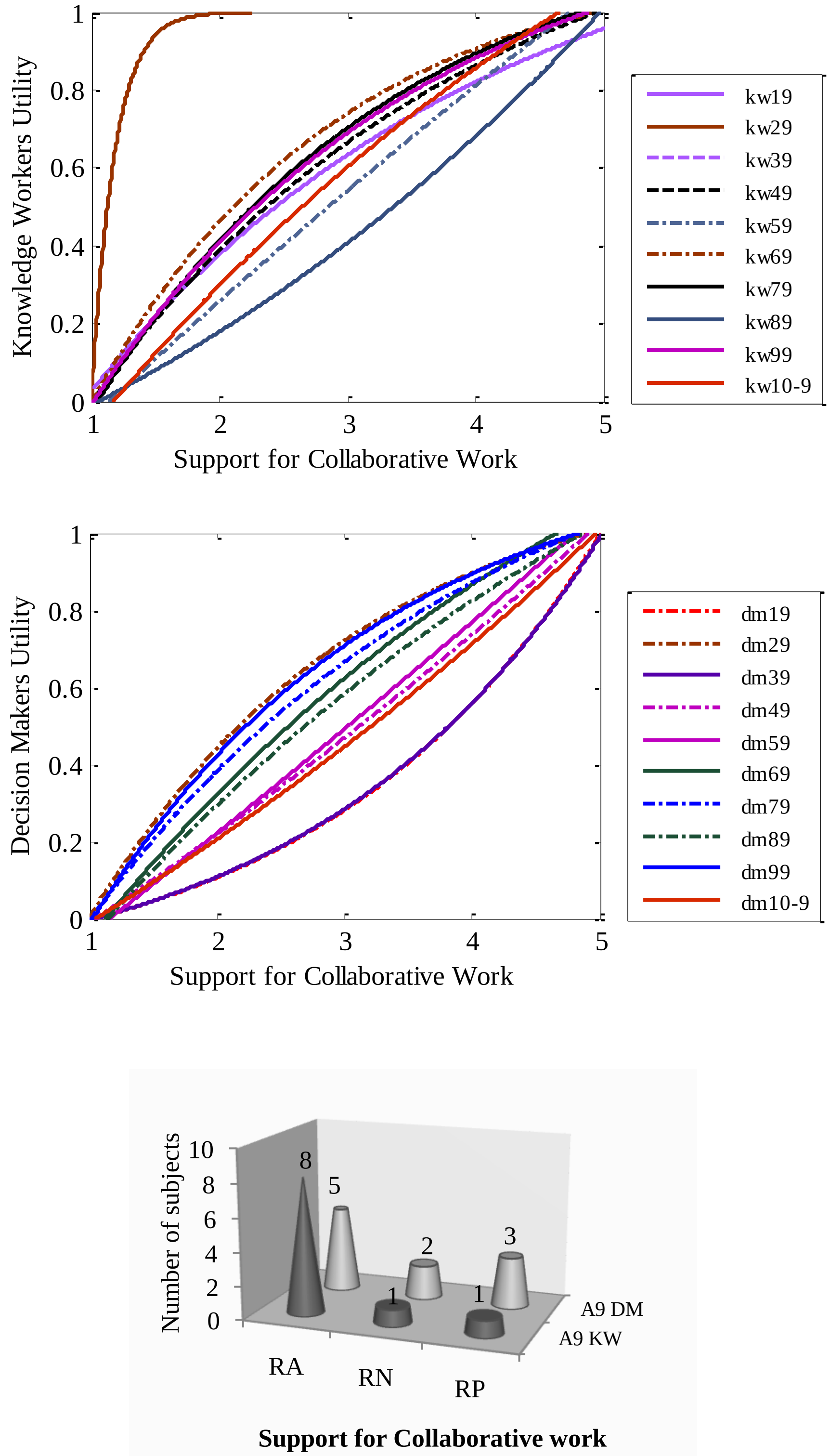
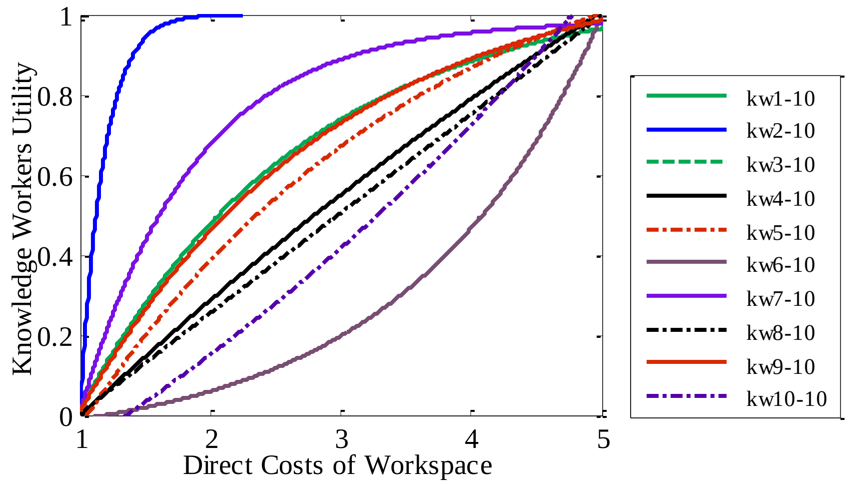
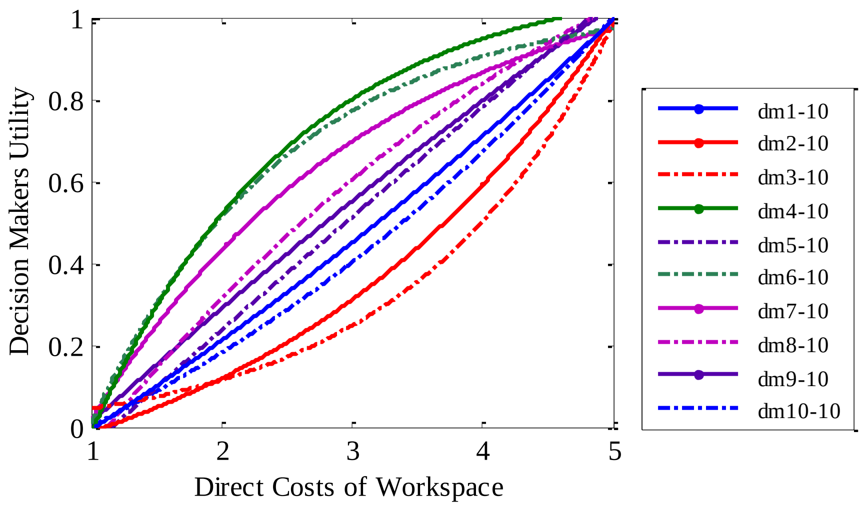


Figure 7.19 – SAUF for Attribute A9; top – knowledge workers, middle – decision makers, bottom – risk categorization summary





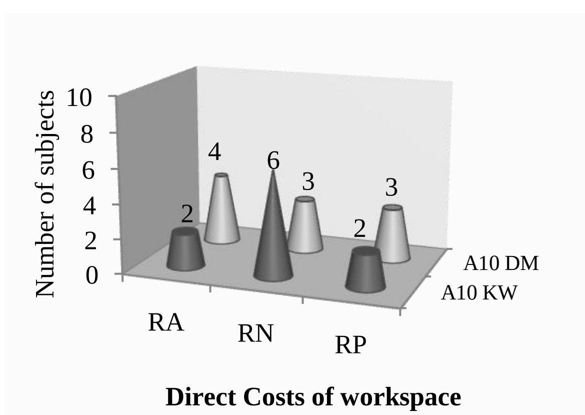


Figure 7.20 – SAUF for Attribute A10; top – knowledge workers, middle – decision makers, bottom – risk categorization summary

7.3.4.3.1. Discussion of Results for Risk Attitudes

Table 7.7 and Figures 7.11 – 7.20 presented the results of best-fit single attribute utility functions and summary of subjects in each risk category for all 10 attributes, as obtained for knowledge workers and decision-makers. The results suggest that knowledge workers mostly showed risk averseness towards the following attributes: work efficiency (70%); work effectiveness (50%); psychological health (90%); physiological health (80%); social responsiveness (60%); social cohesion (70%); support for individual work (80%); and support for collaborative work (80%). Results for workspace satisfaction fetched mixed attitudes with a fairly equal distribution in all three risk categories. For direct costs, most knowledge workers (60%) showed a risk neutral attitude. The results have significant implications for the problem of workspace decision-making. There is a high probability that if costs are kept constant, knowledge workers will prefer a workspace that provides sufficient control over distractions so that the impacts of distractions are moderate or lower; and the workspace provides moderate or better support for individual and collaborative work. The results align with the results of the research studies discussed in Chapter 3, in which researchers have explored the impacts of auditory distractions on knowledge workers, how ability to exercise control is helpful, and the key characteristics of workspaces for knowledge workers. The results seem to be in line with an expected response from knowledge workers; since knowledge workers are the users of the workspace, they seem to be more concerned about their requirements from their workspace rather than the costs of workspace. These deductions are verified later through the expected utilities calculated for each workspace option.

Decision-makers, on the other hand, did not exhibit any specific risk behavior. The attitudes are mostly fairly distributed among the three risk categories. For attributes psychological health, physiological health, and social cohesion, 60% showed risk proneness, implying that they may gamble a workspace that provides significant control over distractions but, is costly, to a workspace that is significantly economical but provides no control over distractions.

In order to find out if these differences in risk attitudes of two groups, i.e., knowledge workers and decision-makers, towards various attributes were significant to affect their workspace choice, an independent samples t-test was performed. The results of the t-test are discussed in the next section.

7.3.4.4. Analysis of Between Group Variations in Risk Behavior

An independent samples t-test was performed to learn if the two groups, knowledge workers and decision-makers, were similar in their risk attitudes towards various attributes. It is important to mention here that t-test is conducted on 16 subjects out of 20, as four subjects were randomly kept aside for validation of the results of risk behavior. Statistical package SPSS 17.0 was used to perform this test. T-test is considered to be a special case of one of the simplest analysis of variance (ANOVA) procedures. ANOVA was not performed because; ANOVA is not suitable if the number of groups is less than three. The results of the t-test are shown in Table 7.8 (a) and (b). T-test assumes that the variances of the dependent variable in the two populations are equal; therefore, SPSS automatically conducts Levene test for equal variance. As shown in Table 7.8 (b) the value of F for Levene test is not significant for all 10 attributes; therefore, the assumption of equal variance is not violated. Therefore, the statistics corresponding to equal variances assumed are used for analysis. Other assumptions of independent samples t-test, namely normality of the data in each population, though t-test is quite robust to this assumption and independence of the data from each population, were also satisfied; therefore, the results of t-test are considered to be valid.

Table 7.8 - T-test Results for Risk Coefficient Analysis; a) group statistics

Group Statistics											
Attributes	Group	N	Mean	Std. Deviation	Std. Error Mean	Attributes	Group	N	Mean	Std. Deviation	Std. Error Mean
A1	KW	8	0.947	1.926	0.681	A6	KW	8	0.891	1.951	0.690
	DM	8	-0.082	0.356	0.126		DM	8	-0.056	0.333	0.118
A2	KW	8	0.868	1.966	0.695	A7	KW	8	0.941	1.923	0.680
	DM	8	-0.124	0.392	0.138		DM	8	-0.095	0.490	0.173
A3	KW	8	0.934	1.931	0.683	A8	KW	8	1.046	1.893	0.669
	DM	8	0.006	0.561	0.198		DM	8	-0.066	0.440	0.156
A4	KW	8	1.059	1.898	0.671	A9	KW	8	0.904	1.936	0.684
	DM	8	-0.227	0.259	0.092		DM	8	-0.025	0.326	0.115
A5	KW	8	0.620	2.061	0.729	A10	KW	8	0.861	1.990	0.704
	DM	8	0.002	0.402	0.142		DM	8	0.057	0.398	0.141

Table 7.8 - T-test Results for Risk Coefficient Analysis; b) t-test statistics

Independent Samples Test										
Attributes		**Levene's Test for Equality of Variances**		**t-test for Equality of Means**						
									95% Conf. Int. of the Diff.	
		F	Sig.	t	df	Sig. 2-tailed	Mean Diff.	Std. Err.Dif	Lower	Upper
A1	Equal variances assumed	2.832	0.115	1.485	14.000	0.160	1.029	0.693	-0.457	2.514
	Equal variances not assumed			1.485	7.478	0.178	1.029	0.693	-0.588	2.645
A2	Equal variances assumed	2.631	0.127	1.400	14.000	0.183	0.992	0.709	-0.528	2.512
	Equal variances not assumed			1.400	7.554	0.201	0.992	0.709	-0.659	2.643

Table 7.8 – Continued

A3	Equal variances assumed	1.992	0.180	1.305	14.000	0.213	0.927	0.711	-0.597	2.452
	Equal variances not assumed			1.305	8.172	0.228	0.927	0.711	-0.706	2.561
A4	Equal variances assumed	3.773	0.072	1.899	14.000	0.078	1.286	0.677	-0.167	2.739
	Equal variances not assumed			1.899	7.262	0.098	1.286	0.677	-0.304	2.876
A5	Equal variances assumed	2.715	0.122	0.832	14.000	0.419	0.618	0.742	-0.974	2.210
	Equal variances not assumed			0.832	7.533	0.431	0.618	0.742	-1.113	2.349
A6	Equal variances assumed	3.193	0.096	1.353	14.000	0.198	0.947	0.700	-0.554	2.448
	Equal variances not assumed			1.353	7.407	0.216	0.947	0.700	-0.690	2.583
A7	Equal variances assumed	2.214	0.159	1.476	14.000	0.162	1.036	0.701	-0.469	2.540
	Equal variances not assumed			1.476	7.904	0.179	1.036	0.701	-0.585	2.657
A8	Equal variances assumed	2.371	0.146	1.617	14.000	0.128	1.112	0.687	-0.362	2.586
	Equal variances not assumed			1.617	7.755	0.146	1.112	0.687	-0.482	2.705
A9	Equal variances assumed	3.273	0.092	1.338	14.000	0.202	0.929	0.694	-0.560	2.417
	Equal variances not assumed			1.338	7.397	0.221	0.929	0.694	-0.695	2.552
A10	Equal variances assumed	2.823	0.115	1.119	14.000	0.282	0.803	0.718	-0.736	2.342
	Equal variances not assumed			1.119	7.559	0.297	0.803	0.718	-0.868	2.475

7.3.4.4.1. Discussion of t-test results

The group mean in Table 7.8 (a) suggests that knowledge workers are risk averse towards all 10 attributes, implying that they will prefer a workspace that provides control over distractions such that: impacts of distractions are never more than moderate; support for individual and collaborative work is moderate or better; and costs are also not significantly high. The group mean for decision-makers suggest that they are either risk neutral or risk prone, which implies either they are indifferent to workspace choice, or they may gamble a workspace with significant control over distractions to a workspace that may be economical. The question of importance is, if the two groups differ significantly in their risk attitudes towards all 10 attributes such that their behavior will significantly alter workspace evaluations. The results in Table 7.8 (b) provide evidence that the risk coefficients of the two groups for all 10 attributes are not significantly different, $p > 0.05$, implying that the two groups may behave alike, risk averse, when considering the choice of a workspace. The implication of this risk averseness for workspace decision-making is such that a decision-maker may always prefer a workspace with moderate or better control over distractions to playing a gamble. In summation, the analyses of single attribute utility functions provide the following insights:

- The two groups, both decision-makers and knowledge workers, showed monotonic behavior towards all the attributes, i.e., either more is good or more is bad.
- The two groups, both decision-makers and knowledge workers, showed similar risk attitudes towards all 10 attributes, with most of them being risk averse to various impacts of distractions on workspace users and functional requirements of workspace to support individual and collaborative work.

7.3.4.5. Validation of T-test Results for Risk Behavior

In the above section, the independent samples t-test showed similarity in risk behavior, mostly risk averseness, towards various attributes; this implies that both knowledge workers and decision-makers may behave alike (t-test results show risk averseness) when considering the choice of a workspace. Remember that the t-test was conducted on 16 subjects out of the sample of 20. The remaining four subjects were not involved in the statistical analysis as these were kept aside for validating the results of the t-test. To increase confidence in t-test results, a cross-validation was performed using the holdout methodology. Cross-validation measures the generalizability of the results of a statistical analysis to an independent population. For meaningful and un-biased results, cross-validation requires that the validation set and test-set belong to the same population. Therefore, it was appropriate to apply this methodology for confirming the results of t-test on risk behavior of subjects.

The holdout method is the most fundamental and straightforward procedure for seeking a more immediate estimate of replicability within the constraints of a single study. The technique simply requires random splitting of a given sample into two sets, called the training set and the testing set. Thompson (1994) suggests that the more the subsamples are disproportionate, the more is the confidence in the results. For instance, a subsample of 25% of cases that yields consistent results would suggest more confidence in the findings than a subsample consisting of 50% of the results. In this study, the ratio of 80:20 was employed. Of the 10 knowledge workers, two, kw4 and kw7, were randomly assigned to the testing set. Research randomizer was used to generate these random assignments. Similarly, of the 10 decision-makers, two, dm2 and dm6, were randomly assigned to the testing set. The assumption is that, if the single attribute utility functions of these four subjects will fall within the extremes of risk behavior, as shown in the risk model for attribute A1, Figure 7.21, then the t-test results are sample invariant as long as the sample is drawn from the same population. It is important to mention here that the results of holdout constitute an "estimate of replicability, and the external replication is preferred whenever possible" (Thompson, 1996).

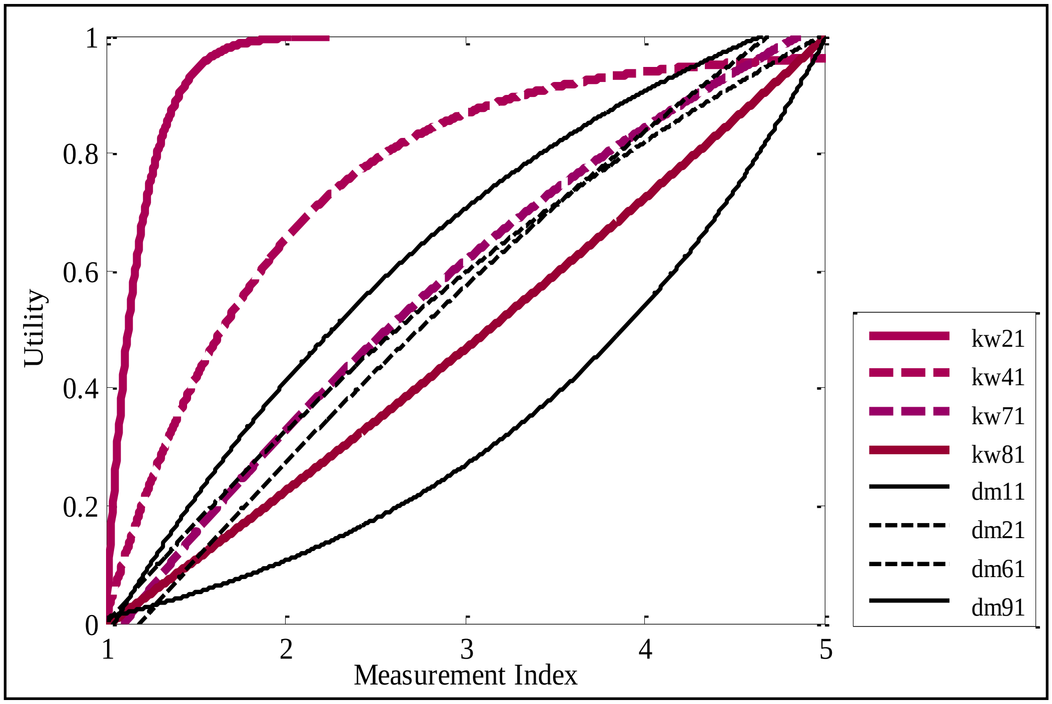


Figure 7.21 - Risk Model for Attribute Work Efficiency with Test Subjects

Figure 7.21 shows the risk model for attribute A1, work efficiency. Solid and dotted thick lines show the extremes of risk behavior of two randomly selected knowledge workers. Alike, solid and dotted thin lines show the extremes of risk behavior of two randomly selected decision-makers. Similar models for all the 10 attributes are presented in Appendix I (B). Eyeballing the graphs suggests that the risk attitude of all four randomly selected subjects falls well within the risk limits defined by the extremes for all 10 attributes. This validation increases the confidence that both knowledge workers and decision-makers may prefer the adaptable workspace the most and may suggest open workspace as the least preferred workspace. The expected utilities will further help with the verification of workspace preferences; however, the results for risk behavior could act as a quick and efficient guide to knowing subject's preferences and for making small variations in workspace alternatives.

7.3.5. Analysis of Attribute Weights and Results

Attributes weights show the relevance of an attribute for a subject. Variations in personal values and desires explain individual differences in attribute relevance. Weights determine the relative importance of each utility function in the final aggregation. When multiple decision-makers are cooperating as a team or as a coalition, the weight assessment process is very important in identifying possible lack of agreements, and in determining the degree to which lack of agreements have significant implications for the final decision.

The data for swing weights (discussed in Section 7.2.2.2.1) was normalized to obtain weights of attributes as assigned by knowledge workers and decision-makers. The normalized weights for both the groups are shown in the Table 7.9. The standard normalization equation is shown below (Equation 2):

$$w_i = \frac{r_i}{\sum r_i} \tag{2}$$

where, w_i is the weight of attribute i, $0 \leq w_i \leq 1$, r is the rating provided by the subject, and $\sum w_i = 1$.

Table 7.9 - Normalized Weights for Two Groups of Subjects

Knowledge workers	ATTRIBUTES									
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
kw1	0.153	0.144	0.034	0.169	0.119	0.110	0.102	0.085	0.068	0.017
kw2	0.110	0.092	0.183	0.165	0.147	0.037	0.073	0.128	0.055	0.009
kw3	0.127	0.109	0.182	0.055	0.036	0.164	0.145	0.091	0.073	0.018
kw4	0.112	0.140	0.126	0.133	0.098	0.056	0.070	0.105	0.084	0.077
kw5	0.115	0.107	0.131	0.164	0.123	0.057	0.082	0.098	0.090	0.033
kw6	0.128	0.120	0.150	0.143	0.083	0.075	0.090	0.135	0.060	0.015
kw7	0.118	0.143	0.160	0.168	0.050	0.101	0.084	0.134	0.034	0.008
kw8	0.182	0.164	0.109	0.127	0.145	0.091	0.036	0.073	0.055	0.018
kw9	0.136	0.109	0.095	0.129	0.068	0.102	0.088	0.116	0.075	0.082
kw10	0.128	0.120	0.150	0.143	0.083	0.075	0.090	0.135	0.060	0.015
Decision makers	**ATTRIBUTES**									
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
dm1	0.182	0.164	0.145	0.127	0.018	0.109	0.091	0.073	0.055	0.036
dm2	0.148	0.100	0.112	0.090	0.130	0.059	0.080	0.140	0.067	0.074
dm3	0.183	0.165	0.128	0.073	0.055	0.037	0.009	0.147	0.092	0.110
dm4	0.091	0.018	0.109	0.073	0.145	0.127	0.055	0.182	0.164	0.036
dm5	0.128	0.120	0.150	0.143	0.084	0.075	0.090	0.135	0.060	0.015
dm6	0.123	0.107	0.122	0.092	0.111	0.099	0.105	0.117	0.086	0.037
dm7	0.125	0.113	0.013	0.025	0.075	0.063	0.038	0.088	0.213	0.250
dm8	0.182	0.155	0.100	0.109	0.082	0.055	0.073	0.136	0.064	0.045
dm9	0.094	0.123	0.189	0.160	0.132	0.047	0.057	0.075	0.085	0.038
dm10	0.129	0.151	0.215	0.172	0.108	0.022	0.011	0.065	0.043	0.086

As mentioned above, the question was if the subjects differ significantly or are in agreement for their preferences for various attributes within the same group and between groups. To find answers, two types of statistical tests were used. One test was used where, agreement within a group was measured using James' (1984) inter-rater agreement index, r_{wg}. Inter-rater agreement index suggests the absolute consensus in scores furnished by multiple judges on a single target. A perfect agreement will result in $r_{wg} = 1$, and a perfect lack of agreement will lead r_{wg} to approach 0.0. Secondly, an independent samples t-test for two groups (decision-makers and knowledge workers) was performed to find out if the two groups were significantly different from each other in their preferences for various attributes. Gardiner and Edwards (1975) suggest that often the difference in preferences are smaller than anticipated; therefore, these tests will help verify the following hypotheses:

$H1_0$: Knowledge workers will have a strong agreement for attribute's relative importance for the decision problem, i.e., $r_{wg} >= 0.70$.

$H1_A$: Knowledge workers will differ in their relative importance of various attributes for the decision problem, i.e., $r_{wg}<0.7$.

$H2_0$: Decision-makers will have a strong agreement for attribute's relative importance for the decision problem, i.e., $r_{wg} >= 0.70$.

$H2_A$: Decision-makers will differ in their relative importance of various attributes for the decision problem, i.e., $r_{wg}<0.7$.

$H3_0$: Knowledge workers and decision-makers will show similarity in their relative importance of various attributes for the decision problem.

$H3_A$: Knowledge workers and decision-makers will differ significantly in their relative importance of various attributes for the decision problem.

In the next two sections, each of these tests is discussed in detail followed by a discussion of results.

7.3.5.1. Within-Group Analysis for Attribute Weights

The inter-rater agreement index, r_{wg}, is a measure of agreement when multiple raters evaluate a single target on a single dimension. The r_{wg} index is shown in Equation 5 (James, 1984).

$$r_{wg} = 1 - \frac{s_x^2}{\sigma_{EU}^2} \tag{5}$$

where, s_x^2 is the observed variance of a given item x, and σ_{EU}^2 is the variance that would be expected if all the judgments were exclusively due to random error measurement. To calculate the r_{wg} indices, an estimate of the expected variance when there is a total lack of agreement is needed. This estimation is based on a null distribution that represents a total lack of agreement. For discrete scales, a uniform distribution represents a best approach to indicate a total lack of agreement (James, 1984). However, for continuous scales, James (1984) suggest using multiple distributions to accommodate for various possible response biases, like central tendency (triangular distribution), leniency, and severity (skewed). Thus, three null distributions for a five-point scale were employed in this analysis: normal, heavy skewed, and triangular. Expected error variances for the three distributions for a five-point scale are: 1.04 for normal; 0.44 for heavy skew; and 1.32 for triangular (LeBreton and Senter, 2008). The inter-rater agreement indices are calculated using Equation 5 for all 10 attributes. These are shown in Table 7.10. A r_{wg} value of 0.7 to 1.0 was considered a strong to very strong agreement (LeBreton and Senter, 2008, James, 1984). 0.7 is the heuristics in psychological sciences (James, 1984).

As shown in Table 7.10, there is a very strong within group agreement, $r_{wg} > 0.9$, among knowledge workers for the relative relevance of each attribute towards the decision problem. Alike, decision-makers also show very strong within group agreement,

$r_{wg} > 0.9$. Consequently, the null hypothesis $H1_0$ and $H2_0$ were accepted, which stated that knowledge workers and decision-makers, will have a strong within-group agreement for attribute's relative importance for the decision problem, i.e., $r_{wg} >= 0.70$.

Table 7.10 - Inter-rater Agreement Index for Attribute Weights

Knowledge workers r_{wg}	**Attributes**									
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
Normal Distribution	0.999	0.999	0.998	0.998	0.998	0.998	0.999	0.999	0.999	0.999
Heavy skew distribution	0.998	0.998	0.995	0.997	0.996	0.997	0.998	0.998	0.994	0.998
Triangular distribution	0.999	0.999	0.998	0.999	0.998	0.999	0.999	0.999	0.999	0.999
Decision makers r_{wg}	**Attributes**									
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
Normal Distribution	0.998	0.998	0.997	0.998	0.998	0.998	0.998	0.998	0.997	0.995
Heavy skew distribution	0.997	0.995	0.993	0.995	0.996	0.997	0.997	0.996	0.993	0.989
Triangular distribution	0.999	0.998	0.997	0.998	0.998	0.999	0.999	0.998	0.997	0.996

7.3.5.2. Between Group Analysis for Attribute Weights

Gardiner and Edwards (1975) suggests that when multiple decision-makers from different groups enter into a coalition, comparison of attribute weights for the different groups help to clarify the extent and nature of lack of agreement. Therefore, an independent samples t-test was performed for two groups, knowledge workers and decision-makers. The results will show if the two groups were similar or significantly different from each other in their relative preferences for various attributes. The test will help validate the following hypothesis:

$H3_0$: Knowledge workers and decision-makers will show similarity in their relative importance of various attributes for the decision problem.

$H3_A$: Knowledge workers and decision-makers will differ significantly in their relative importance of various attributes for the decision problem.

7.3.5.2.1. Discussion of results for independent samples t-test

The results for independent samples t-test are shown in the Table 7.11 (a) and (b). The left columns in Table 7.11 (b) are the Levene test for the assumption that the variances of the two groups are equal. The values of F are not significant for attributes A1 through A8 and A10, which means that the assumption of equal variance is not violated. Therefore, the statistics corresponding to the row equal variances assumed are used for analysis. However, for attribute A9, support for collaborative work, the value of F is significant. This means that the assumption of equal variances is violated, resulting in the statistics corresponding to the row equal variances not assumed to be the correct statistics used for analysis. Other assumptions of t-test are normality of the data in each population and independence of the data from each population. Because the t-test is quite robust to violations of normality assumption, this was not tested with special consideration. Box plots were plotted to see if the data is approximately normal. The data of the two samples had no relationship with each other; therefore, the assumption of independence was not violated.

Table 7.11 - T-test Results for Attribute Weights; a) group statistics

Group Statistics											
Attributes	Group	N	Mean	Std. Deviation	Std. Error Mean	Attributes	Group	N	Mean	Std. Deviation	Std. Error Mean
A1	KW	10	0.131	0.022	0.007	A6	KW	10	0.087	0.036	0.011
	DM	10	0.139	0.035	0.011		DM	10	0.069	0.033	0.011
A2	KW	10	0.125	0.022	0.007	A7	KW	10	0.086	0.027	0.009
	DM	10	0.122	0.044	0.014		DM	10	0.061	0.033	0.011
A3	KW	10	0.132	0.045	0.014	A8	KW	10	0.110	0.023	0.007
	DM	10	0.128	0.054	0.017		DM	10	0.116	0.039	0.012
A4	KW	10	0.140	0.034	0.011	A9	KW	10	0.065	0.016	0.005
	DM	10	0.106	0.045	0.014		DM	10	0.093	0.054	0.017
A5	KW	10	0.095	0.038	0.012	A10	KW	10	0.029	0.027	0.009
	DM	10	0.094	0.039	0.012		DM	10	0.073	0.069	0.022

Table 7.11 - T-test Results for Attribute Weights; b) t-test statistics

Independent Samples Test										
Attributes		**Levene's Test for Equality of Variances**		**t-test for Equality of Means**						
									95% Conf. Int. of the Diff.	
		F	Sig.	t	df	Sig. 2-tailed	Mean Diff.	Std. Err.Dif	Lower	Upper
A1	Equal variances assumed	3.024	0.099	-0.587	18	0.564	-0.008	0.013	-0.035	0.020
	Equal variances not assumed			-0.587	15.30	0.566	-0.008	0.013	-0.035	0.020
A2	Equal variances assumed	1.327	0.264	0.207	18.00	0.839	0.003	0.015	-0.029	0.036
	Equal variances not assumed			0.207	13.34	0.839	0.003	0.015	-0.030	0.037
A3	Equal variances assumed	0.077	0.784	0.166	18.00	0.870	0.004	0.022	-0.043	0.051
	Equal variances not assumed			0.166	17.35	0.870	0.004	0.022	-0.043	0.051
A4	Equal variances assumed	1.413	0.250	1.860	18.00	0.079	0.033	0.018	-0.004	0.071

Table 7.11 – Continued

	Equal variances not assumed			1.860	16.74	0.081	0.033	0.018	-0.005	0.071
A5	Equal variances assumed	0.000	1.000	0.070	18.00	0.945	0.001	0.017	-0.035	0.037
	Equal variances not assumed			0.070	17.99	0.945	0.001	0.017	-0.035	0.037
A6	Equal variances assumed	0.001	0.979	1.132	18.00	0.272	0.018	0.015	-0.015	0.050
	Equal variances not assumed			1.132	17.90	0.272	0.018	0.015	-0.015	0.050
A7	Equal variances assumed	1.345	0.261	1.843	18.00	0.082	0.025	0.014	-0.004	0.054
	Equal variances not assumed			1.843	17.34	0.082	0.025	0.014	-0.004	0.054
A8	Equal variances assumed	3.791	0.067	-0.407	18.00	0.689	-0.006	0.014	-0.036	0.024
	Equal variances not assumed			-0.407	14.58	0.690	-0.006	0.014	-0.036	0.025
A9	Equal variances assumed	4.825	0.041	-1.546	18.00	0.139	-0.028	0.018	-0.065	0.010
	Equal variances not assumed			-1.546	10.62	0.151	-0.028	0.018	-0.067	0.012
A10	Equal variances assumed	2.371	0.141	-1.864	18.00	0.079	-0.044	0.023	-0.093	0.006
	Equal variances not assumed			-1.864	11.80	0.087	-0.044	0.023	-0.094	0.007

The statistics in Table 7.11 (b) suggests that the attribute weights for the two groups are not significantly different, $p > 0.05$, implying that both groups provide similar relevance to the 10 attributes. Therefore, hypothesis $H3_0$ is accepted. Furthermore, the group means statistics in Table 7.11 (a) shows that the attribute A10, direct costs of the workspace, has received the least mean weight in both groups, implying that both groups think that other attributes are more important than cost of the workspace. Attribute 'physiological costs' received the highest preference among knowledge workers and 'work efficiency' received the highest preference among decision-makers. This insight is very significant from the workspace decision-making perspective as mostly these decisions are cost-effectiveness driven, where there is no scope to incorporate the nine subjective attributes, A1 through A9. This validates the necessity to adopt a more robust decision-making approach as has been proposed and developed in this study.

7.3.5.3. Summary of Statistical Tests for Attribute Weights

Both the statistics, inter-rater agreement index, r_{wg}, and independent samples t-test, suggests that the subjects have a very strong ($r_{wg} > 0.9$) within-group concordance and show similarity, $p > 0.05$, in their relative importance of various attributes towards the decision problem. Based on these results, therefore, hypotheses $H1_0$, $H2_0$, and $H3_0$ have been accepted. These results have significant implications for workspace decision-making, as it suggests that both decision-makers and knowledge workers may end up with similar preferences for various workspace alternatives. This insight is validated later with the results of the expected utilities that are used to assign preference rankings to five workspace alternatives.

7.3.6. Multi-Attribute Utility Aggregation Models

Multi-attribute utility functions (MAUF), which are aggregations of various single attribute utility functions, are formed to represent decision problems with multiple objectives. The functional form of the aggregated model depends on the presence or absence of independence among the component attributes. Three forms of attribute independence affect the aggregation of component utility functions: preferential independence; utility independence; and additive independence. Preferential independence is achieved if the preference ranking of hypothetical alternatives for one attribute remains the same when the values of other attributes are changed. Utility independence is achieved when the subjects' preference ranking for alternative gambles on one attribute remains constant when the values of other attributes are altered. Additive independence is a special case of utility independence in which only the marginal probability distributions of alternatives affect preference orderings for the hypothetical lotteries.

Under the assumptions of preference independence and utility independence, the aggregated utility function may take either the additive form, Equation 6, or the multiplicative form, Equation 7 (Keeney and Raiffa, 1976):

$$u(x_1, x_2, x_3, \ldots\ldots x_n) = \sum_{i=1}^{n} k_i u_i(x_i) \tag{6}$$

where, x_1, x_2, $\ldots x_i \ldots, x_n$ are the n different attributes, $n \geq 2$, k are scaling constants, u(x) are single attribute utility functions, and $\sum k_i = 1$.

$$1 + ku(x_1, x_2, x_3, \ldots\ldots x_n) = \prod_{i=1}^{n} [kk_i u_i(x_i) + 1] \tag{7}$$

where, x_1, x_2, $\ldots x_i \ldots, x_n$ are the n different attributes, $n \geq 2$, k are scaling constants, u(x) are single attribute utility functions, and k is a non-zero solution to the Equation (8):

$$1 + k = \prod_{i=1}^{n} (1 + kk_i) \tag{8}$$

Additive models are the simplest form of multi-attribute utility models and compensatory in nature. The aggregation takes care that an increase in the utility of an attribute is compensated by a decrease in the utility of another attribute. As a result, these are applied mostly to decision problems in the field. Both the additive and multiplicative aggregation rule assumes utility independence. A brief illustration of utility independence is as follows:

The attribute X_1 is utility independent of other attributes (X_2, X_3,…………..X_n) if preferences among lotteries over X_1, specifying various amounts of X1 and the probabilities of receiving them do not depend on the levels where other attributes (X_2, X_3,…………..X_n) are fixed. Utility independence is a strong assumption, but is not easily satisfied. In this study, utility independence is tested for all 10 attributes by asking the following two questions for each gamble. One, do you think your indifference point in the gamble will change if all other nine attributes are fixed at their best level? Two, do you think your indifference point will change if all other nine attributes are fixed at their worst level? Extensive testing of utility independence was not enforced, as it can impose an "unwarranted complexity" (Ananda and Herath, 2005, p. 413). Also, it has been shown repeatedly that substantial amounts of deviation from utility independence will make little difference to the aggregate utility value, and even less to the rank ordering of alternative consequences (Edwards, 1977). A frequently satisfied condition that makes the assumption of utility assumption very unlikely to cause trouble is conditional monotonicity. The additive approximation will almost always work well if, for each attribute, either more is preferable to less or less is preferable to more throughout the range of attributes involved in the evaluation. Therefore, if the best-fit utility function for an attribute was monotone and 50% of the subjects replied 'No' to the questions aimed to verify utility independence, then the attribute was assumed to possess utility independence.

Appendix I (C) present the single attribute utility functions (SAUF) of all 20 subjects for various attributes. Visual inspection of these functions suggests monotonicity. Also, 70% (14 out of 20) of the subjects suggested that their preferences for lotteries will not change if the levels of the remaining attributes will be changed. As a result, additive modeling was deduced to be the appropriate modeling method for single attribute aggregation.

7.3.6.1. Uncertain Attributes

The nature of attributes for this decision problem is such that uncertainty is an integral part of the consequences for attributes A1 through A9. Therefore, the decision model was designed to provide expected utility of the alternatives where, according to the expected utility theory, the decision-maker seeks to choose the alternative with the highest expected utility.

According to Mongin (1997), "expected utility (EU) theory states that the decision-maker chooses between risky or uncertain prospects by comparing their expected utility values, i.e., the weighted sums obtained by adding the utility values of outcomes multiplied by their respective probabilities" (p. 342). Suppose L is a lottery yielding consequences x_1, x_2, x_3,--x_n with probabilities p_1, p_2, p_3,--p_n. Let $\bar{x}$ is the uncertain consequence of the lottery L, then the expected utility of this lottery is Equation 9 (Winterfedt and Edwards, 1986):

$$E[u(\bar{x})] = \sum_{i=1}^{n} p_i u(x_i) \tag{9}$$

The literature refers to the expected utility as subjective expected utility (SEU) also, where the term subjective suggests that probabilities can be based on subjective beliefs and utilities may reflect personal expereinces. In expected utility, probabilities measure uncertainties, and von Neumann-Morgenstern utilities are used to evaluate outcomes. Decisions are subsequently made according to expectations of utility.

7.3.6.2. Expected Utilities of Workspace Alternatives

Equation 9 was used to calculate the expected utilities of the following five workspace alternatives considered for evaluation in this study: W1, open workspace; W2, open workspace with noise cancellation headphones; W3, open workspace with personal sound masking system; W4, open workspace with flexible acoustic screens; and W5, adaptable workspace. A brief description of each type of workspace is provided in Chapter 6. During the one-to-one interview conducted for this stage of the study, two decision-makers, dm4 and dm5, and two knowledge workers, kw2 and kw5, did not feel comfortable in assigning probabilities to the hypothetical consequences discussed in Section 7.2.2.3. Therefore, expected utilities were calculated for total 16 subjects, of which eight were decision-makers and eight were knowledge workers. The results are presented in Table 7.12 and Figure 7.21. Table 7.13 presents an illustration of math behind the calculation of expected utilities for subject kw1.

Table 7.12 – Expected Utilities of Workspace Alternatives

Subject	Expected Utility					Subject	Expected Utility				
	W1	W2	W3	W4	W5		W1	W2	W3	W4	W5
kw1	0.448	0.576	0.631	0.681	0.762	dm1	0.543	0.482	0.338	0.283	0.306
kw3	0.278	0.716	0.715	0.865	0.954	dm2	0.282	0.307	0.392	0.617	0.622
kw4	0.456	0.490	0.576	0.787	0.862	dm3	0.147	0.232	0.320	0.380	0.793
kw6	0.334	0.583	0.865	0.890	0.985	dm6	0.219	0.658	0.656	0.780	0.760
kw7	0.516	0.588	0.616	0.876	0.904	dm7	0.770	0.804	0.810	0.729	0.730
kw8	0.413	0.424	0.422	0.553	0.513	dm8	0.448	0.576	0.631	0.681	0.762
kw9	0.617	0.638	0.689	0.734	0.826	dm9	0.509	0.658	0.582	0.581	0.689
kw10	0.094	0.129	0.659	0.974	0.980	dm10	0.334	0.356	0.510	0.511	0.570

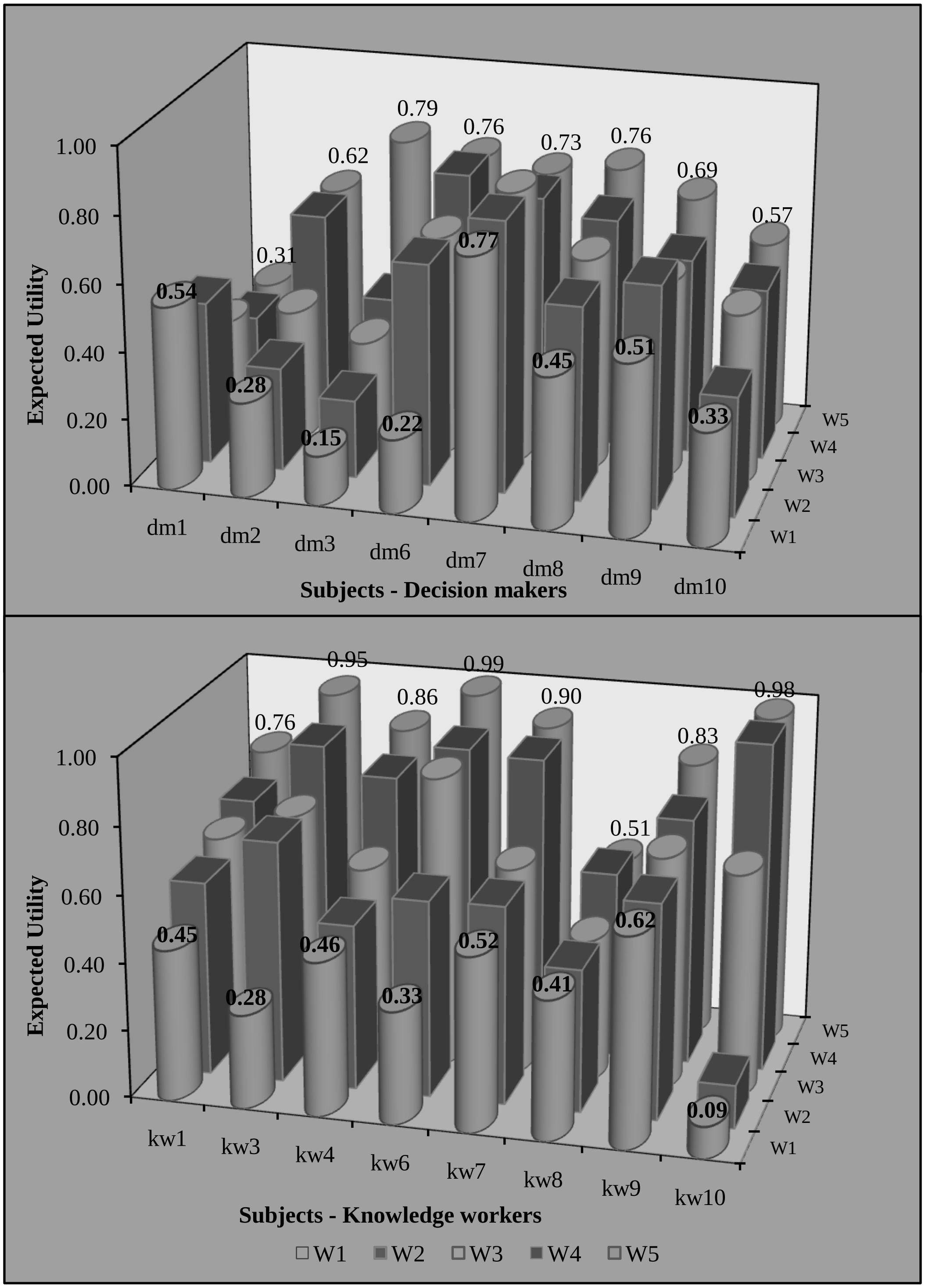


Figure 7.22 – Expected Utilities of Workspace Alternatives

Table 7.13 - Expected Utilities of Subject kw1

Attribute	Consequence	U (x)	W1		W2		W3		W4		W5	
			Pi (xi)	**EUi (xi)**	**Pi (xi)**	**EUi (xi)**	**Pi (xi)**	**EUi (xi)**	**Pi (xi)**	**EUi (xi)**	**Pi (xi)**	**EUi (xi)**
A1	Best	0.180	0.05	0.009	0.10	0.018	0.20	0.036	0.10	0.018	0.60	0.108
	Better	0.137	0.10	0.014	0.25	0.034	0.30	0.041	0.60	0.082	0.10	0.014
	Neutral	0.108	0.15	0.016	0.35	0.038	0.20	0.022	0.10	0.011	0.10	0.011
	Bad	0.049	0.35	0.017	0.25	0.012	0.20	0.010	0.10	0.005	0.10	0.005
	Worst	0.000	0.35	0.000	0.05	0.000	0.10	0.000	0.10	0.000	0.10	0.000
A2	Best	0.150	0.10	0.015	0.05	0.008	0.20	0.030	0.10	0.015	0.60	0.090
	Better	0.133	0.15	0.020	0.25	0.033	0.30	0.040	0.60	0.080	0.10	0.013
	Neutral	0.113	0.15	0.017	0.35	0.040	0.20	0.023	0.10	0.011	0.10	0.011
	Bad	0.039	0.20	0.008	0.25	0.010	0.20	0.008	0.10	0.004	0.10	0.004
	Worst	0.000	0.40	0.000	0.10	0.000	0.10	0.000	0.10	0.000	0.10	0.000
A3	Best	0.100	0.10	0.010	0.10	0.010	0.20	0.020	0.10	0.010	0.50	0.050
	Better	0.089	0.15	0.013	0.20	0.018	0.30	0.027	0.60	0.053	0.20	0.018
	Neutral	0.085	0.20	0.017	0.35	0.030	0.20	0.017	0.10	0.009	0.10	0.009
	Bad	0.060	0.35	0.021	0.20	0.012	0.20	0.012	0.10	0.006	0.10	0.006
	Worst	0.000	0.20	0.000	0.15	0.000	0.10	0.000	0.10	0.000	0.10	0.000
A4	Best	0.120	0.10	0.012	0.05	0.006	0.20	0.024	0.10	0.012	0.50	0.060
	Better	0.098	0.15	0.015	0.25	0.025	0.25	0.025	0.60	0.059	0.20	0.020
	Neutral	0.072	0.20	0.014	0.35	0.025	0.25	0.018	0.10	0.007	0.10	0.007
	Bad	0.029	0.35	0.010	0.25	0.007	0.20	0.006	0.10	0.003	0.10	0.003
	Worst	0.000	0.20	0.000	0.10	0.000	0.10	0.000	0.10	0.000	0.10	0.000
A5	Best	0.085	0.10	0.009	0.10	0.009	0.20	0.017	0.20	0.017	0.60	0.051
	Better	0.071	0.15	0.011	0.20	0.014	0.25	0.018	0.40	0.028	0.10	0.007
	Neutral	0.068	0.15	0.010	0.35	0.024	0.20	0.014	0.20	0.014	0.10	0.007
	Bad	0.010	0.20	0.002	0.20	0.002	0.20	0.002	0.10	0.001	0.10	0.001
	Worst	0.000	0.40	0.000	0.15	0.000	0.15	0.000	0.10	0.000	0.10	0.000
A6	Best	0.054	0.15	0.008	0.15	0.008	0.10	0.005	0.20	0.011	0.50	0.027
	Better	0.037	0.20	0.007	0.20	0.007	0.25	0.009	0.40	0.015	0.20	0.007
	Neutral	0.032	0.25	0.008	0.35	0.011	0.25	0.008	0.20	0.006	0.10	0.003
	Bad	0.008	0.20	0.002	0.20	0.002	0.25	0.002	0.10	0.001	0.10	0.001
	Worst	0.000	0.20	0.000	0.10	0.000	0.15	0.000	0.10	0.000	0.10	0.000
A7	Best	0.075	0.10	0.008	0.10	0.008	0.10	0.008	0.20	0.015	0.50	0.038
	Better	0.066	0.15	0.010	0.15	0.010	0.20	0.013	0.40	0.026	0.20	0.013
	Neutral	0.056	0.15	0.008	0.20	0.011	0.25	0.014	0.20	0.011	0.10	0.006
	Bad	0.028	0.20	0.006	0.35	0.010	0.25	0.007	0.10	0.003	0.10	0.003
	Worst	0.000	0.40	0.000	0.20	0.000	0.20	0.000	0.10	0.000	0.10	0.000
A8	Best	0.140	0.10	0.014	0.05	0.007	0.25	0.035	0.10	0.014	0.50	0.070
	Better	0.112	0.15	0.017	0.20	0.022	0.30	0.034	0.40	0.045	0.20	0.022
	Neutral	0.105	0.15	0.016	0.25	0.026	0.25	0.026	0.20	0.021	0.10	0.011
	Bad	0.053	0.20	0.011	0.30	0.016	0.10	0.005	0.20	0.011	0.20	0.011
	Worst	0.000	0.40	0.000	0.20	0.000	0.10	0.000	0.10	0.000	0.20	0.000
A9	Best	0.060	0.40	0.024	0.25	0.015	0.20	0.012	0.20	0.012	0.50	0.030
	Better	0.048	0.20	0.010	0.30	0.014	0.25	0.012	0.20	0.010	0.20	0.010
	Neutral	0.045	0.15	0.007	0.20	0.009	0.20	0.009	0.40	0.018	0.10	0.005
	Bad	0.007	0.15	0.001	0.15	0.001	0.20	0.001	0.10	0.001	0.10	0.001
	Worst	0.000	0.10	0.000	0.10	0.000	0.15	0.000	0.10	0.000	0.10	0.000
A10	Best	0.045	0.20	0.009	0.10	0.005	0.10	0.005	0.10	0.005	0.10	0.005
	Better	0.037	0.35	0.013	0.35	0.013	0.25	0.009	0.10	0.004	0.10	0.004
	Neutral	0.034	0.30	0.010	0.20	0.007	0.25	0.009	0.20	0.007	0.10	0.003
	Bad	0.007	0.20	0.001	0.20	0.001	0.20	0.001	0.40	0.003	0.10	0.001
	Worst	0.000	0.05	0.000	0.15	0.000	0.20	0.000	0.20	0.000	0.60	0.000
Expected Utility				**0.448**		**0.577**		**0.632**		**0.681**		**0.762**

The concern was if the two groups of subjects significantly differed in their expected utilities (preferences) for various workspace options. And, if they did differ, then was there any trend that bears importance for workspace decision-making. Therefore, an independent samples t-test for two samples was performed. The test results are shown in Table 7.14 (a) and (b). The test results will help verify the following hypothesis:

$H4_0$: The two groups provide similar expected utilities to five workspace alternatives, i.e., the job role doesn't affect a subject's relative satisfaction with a workspace.

$H4_A$: The two groups significantly differ on the expected utilities of five workspace alternatives, i.e., the job role affects a subject's relative satisfaction with a workspace.

7.3.6.3. Between-Group Analysis of Expected Utilities

A t-test for two independent samples, knowledge workers and decision-makers, was performed on the expected utility values to test if knowledge workers and decision-makers were similar or differed significantly in their satisfaction with the five workspace alternatives. The results of the t-test are shown in the Table 7.14 (a) and (b). The left columns in Table 7.14 (b) are the Levene test for the assumption that the variances of the two groups are equal. Because the values of F are not significant for the workspaces W1, W2, W3, and W4, the assumption of equal variance was not violated. Thus, the statistics corresponding to equal variances assumed were used for analysis. For workspace W5, the value of F in Levene's test is significant, which implies violation of the assumption of equal variance. Therefore, the statistics corresponding to equal variances not assumed were used for analysis.

Table 7.14 - T-test Results for Expected Utilities; a) group statistics

Group Statistics					
Workspace	**Group**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
W1	KW	8	0.395	0.162	0.057
	DM	8	0.407	0.202	0.072
W2	KW	8	0.519	0.181	0.064
	DM	8	0.509	0.199	0.070
W3	KW	8	0.649	0.128	0.045
	DM	8	0.530	0.172	0.061
W4	KW	8	0.795	0.136	0.048
	DM	8	0.570	0.172	0.061
W5	KW	8	0.848	0.157	0.056
	DM	8	0.654	0.160	0.056

Table 7.14 - T-test Results for Expected Utilities; b) t-test statistics

Independent Samples Test								
Workspace Alternatives		**Levene's Test for Equality of Variances**		**t-test for Equality of Means**				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.
W1	Equal variances assumed	.608	.448	-.125	14	.902	-.012	.092
	Equal variances not assumed			-.125	13.37	.902	-.012	.092
W2	Equal variances assumed	.459	.509	.101	14	.921	.010	.095
	Equal variances not assumed			.101	13.88	.921	.010	.095
W3	Equal variances assumed	1.524	.237	1.568	14	.139	.119	.076
	Equal variances not assumed			1.568	12.90	.141	.119	.076
W4	Equal variances assumed	.401	.537	2.902	14	.012	.225	.077
	Equal variances not assumed			2.902	13.32	.012	.225	.077
W5	Equal variances assumed	.011	.918	2.442	14	.028	.194	.079
	Equal variances not assumed			2.442	13.98	.028	.194	.079

7.3.6.3.1. Discussion of results for independent samples t-test

Statistics in Table 7.14 (b) suggests that knowledge workers were significantly different from decision-makers on expected utilities (satisfaction) for workspaces W4 ($p = 0.012$) and W5 ($p = 0.028$). Inspection of the group statistics in Table 7.14 (a) indicates that the expected utilities of knowledge workers for workspaces W4 and W5 were significantly higher than the expected utilities of the decision-makers. This may be because W4 and W5 are the workspaces that are assumed to provide significant and very significant control over distractions, which implies a little or none impacts of distractions on individuals. In addition, W4 and W5 were assumed to provide significant and very significant support for individual work and collaborative work; therefore, they garnered more individual satisfaction to the end users of such workspaces. Decision-makers' expected utilities (satisfaction) for workspace W4 and W5 were lower may be because of much higher costs of W4 and W5; however, it is still higher than their utilities of W3, W2, and W1. The results led to mixed conclusions regarding the hypothesis validation, where $H4_0$ was accepted for workspaces W1, W2, and W3, but rejected in favor of $H4_A$ for workspace W4 and W5.

In summation, the two groups, knowledge workers and decision-makers, differed in their expected utilities for workspace alternatives W4 and W5; the group statistics showing mean satisfaction level of knowledge workers significantly higher with these workspaces than that of the decision-makers. However, the two groups showed similar levels of satisfaction with workspaces W1, W2, and W3. The results have significant implications for workspace decision making as these suggest that the users of workspace, knowledge workers, feel strongly about the workspace that provide significant or better control over distractions and that supports their needs of concentration and collaboration significantly. Therefore, it is urgent and timely to consider a different more robust approach to workspace selection. This study has shown that decision-based approach is a valid as well as more-appropriate method.

7.3.7. Workspace Ranking

In the previous section, it was shown that workspace W5 received the highest expected utility, followed by W4, W3, W2, and W1 arranged in the decreasing order of utility values. Though utility functions are cardinal, the magnitude of the difference of expected utilities of alternatives under consideration is meaningless because this difference can be expanded or reduced by conducting a positive linear transformation (Levy, 2006). Therefore, further statistical tests for difference in magnitudes of expected utilities were not performed. Nonetheless, for investment decisions such as this one, ranking of the alternatives is what matters the most.

Consequently, expected utility values were used to rank the five workspace alternatives in the order of preference. Higher expected utilities yield higher ranking. Following ranks were assigned: 1 = most preferred workspace; 2 = significantly preferred workspace; 3 = moderately preferred workspace; 4 = preferred workspace; and 5 = least preferred workspace. The two groups resulted in eight sets of rankings for each group; these are shown in Table 7.15 and Figure 7.22. The question was if the two groups had agreement for the ranks of workspace alternatives. Therefore, two types of statistical tests were performed: one involved the individuals from the same group to test for concordance within each group. James' (1984) inter-rater agreement index (r_{wg}) and Kendall's coefficient of agreement, W, for rankings among raters were calculated to test for within group agreement. Kendall's coefficient of concordance (W) determines the magnitude of agreement among several judges (eight) evaluating a given set of objects (five in this study).

Next, to test between-group concordance, Schucany and Frawley's (1973) W was calculated. This test is considered as the most appropriate test to find between-group concordance. Details of these tests are presented in the next three sections.

Table 7.15 - Workspace Ranks for Two Groups

Subject	Workspace Ranks					Subject	Workspace Ranks				
	W1	W2	W3	W4	W5		W1	W2	W3	W4	W5
kw1	5	4	3	2	1	dm1	1	2	3	5	4
kw3	5	4	3	2	1	dm2	5	4	3	2	1
kw4	5	4	3	2	1	dm3	5	4	3	2	1
kw6	5	4	3	2	1	dm6	5	3	4	1	2
kw7	5	4	3	2	1	dm7	3	2	1	5	4
kw8	5	3	4	1	2	dm8	5	4	3	2	1
kw9	5	4	3	2	1	dm9	5	2	3	4	1
kw10	5	4	3	2	1	dm10	5	4	3	2	1

The test results and overall workspace rankings will help validate the following null and alternative hypotheses:

$H5_0$: Knowledge workers will have a strong to very strong agreement for the ranking of the five workspace alternatives; i.e., within group concordance coefficient for workspace rankings will be ≥ 0.7.

$H5_A$: Knowledge workers will have moderate to weak agreement about the ranking of the five workspace alternatives; i.e., within group concordance coefficient will be < 0.7.

$H6_0$: Decision-makers will have a strong to very strong agreement for the ranking of the five workspace alternatives; i.e., within group concordance coefficient for workspace rankings will be ≥ 0.7.

$H6_A$: Decision-makers will have moderate or worst agreement about the ranking of the five workspace alternatives; i.e., within group concordance coefficient will be < 0.7.

H_0: For knowledge-based organizations, adaptable workspace is valuable over rather cost-effective open plan workspace.

Visual analysis of Figure 7.23 (top) shows that most knowledge workers (seven out of eight) synonymously rank workspace option W5, adaptable workspace, as the most preferred workspace, except for kw8 who ranked workspace W5 significantly preferred rather than the most preferred workspace. Also, workspace W1, open workspace, received the least preferred rank by all 8 knowledge workers. On the other hand, Figure 2.23 (bottom) shows high variance in workspace ranking as obtained from decision-makers. This implies a strong agreement among knowledge workers for workspace rankings and may be a weak agreement among decision-makers. Consequently, appropriate statistical tests were performed for scientific evaluation of this visual analysis. Test details and results are discussed in next three sections.

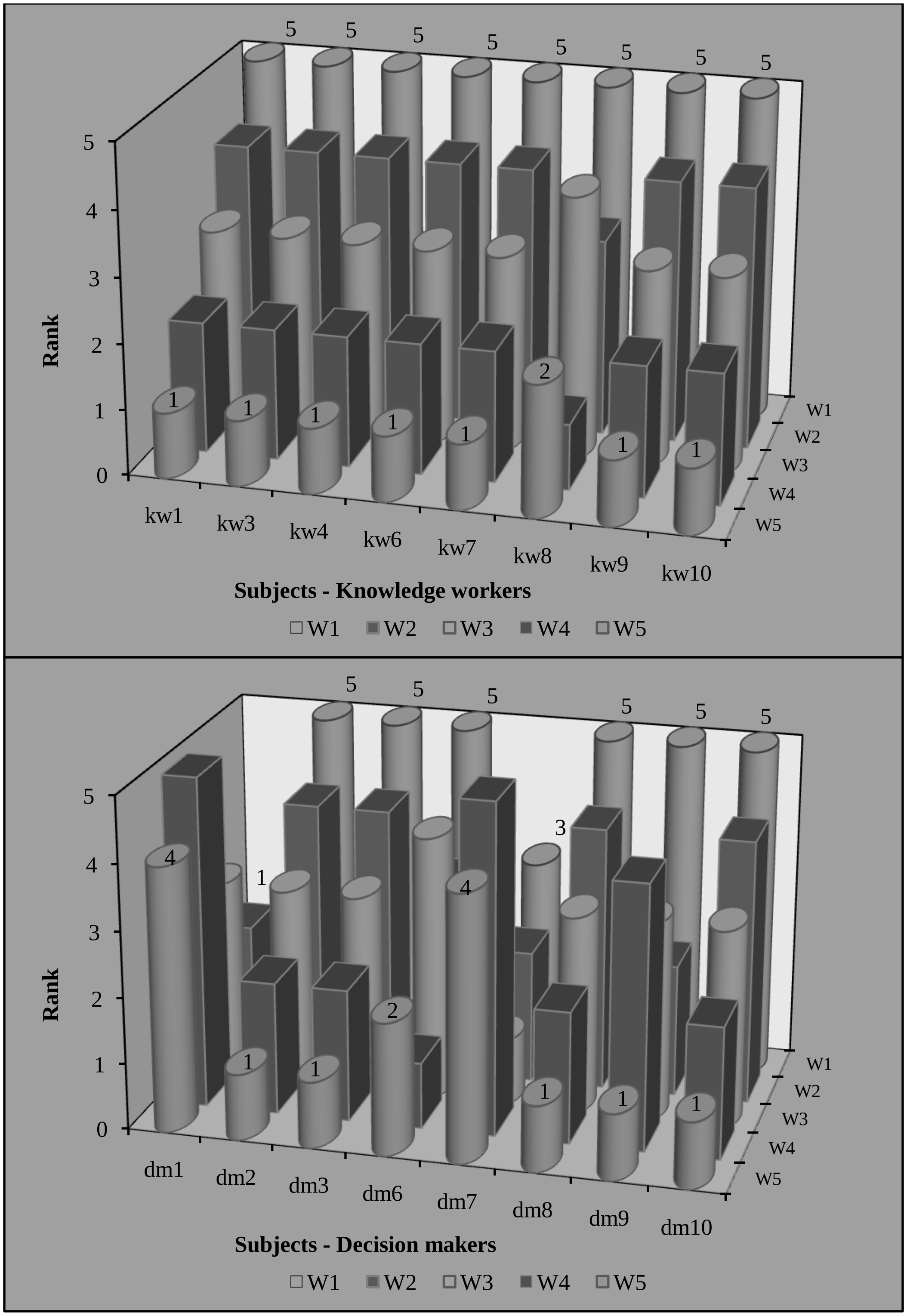


Figure 7.23 – Workspace Ranks for Two Groups

7.3.7.1. Within-Group Concordance Analysis for Workspace Ranks

Inter-rater agreement index, r_{wg}, is a measure of agreement when multiple raters evaluate a single target on a single dimension. Equation 5 was used to evaluate the value of r_{wg} for five workspace alternatives. Estimation of r_{wg} is based on a null distribution that represents a total lack of agreement. James (1984) suggests that for discrete scales, a uniform distribution represents a best approach to indicate a total lack of agreement. Therefore, the corresponding expected error variance of 2.0 for a uniform distribution over 5-point scale was used in this evaluation. The statistics for r_{wg} for the two groups are shown in Table 7.16 (a) and (b).

Kendall's W, which is a measure of coefficient of agreement among raters, was calculated for each group of subjects. The range of possible values within which Kendall's coefficient of concordance may fall is $0 \leq W \leq 1$. When there is complete agreement among m sets of ranks, $m \geq 3$, W is equal to 1. On the other hand, when there is no pattern of agreement among m sets of ranks, W is equal to zero. The value of W cannot be a negative number, since when there are more than two sets of ranks it is not possible to have a complete lack of agreement among all the sets. The test results for the two groups are shown in Table 7.17 (a) and (b). Discussion of results for two statistics is provided in the next section. The two statistics will help verify the hypotheses: $H5_0$ vs. $H5_{A;}$ and $H6_0$ vs. $H6_{A;}$ as stated above in Section 7.3.5.

7.3.7.1.1. Discussion of results for knowledge workers

Statistics in Table 7.16 (a) suggests that knowledge workers show a very strong agreement, $r_{wg} > 0.9$, for ranking of all five workspace options. Alike, results in Table 7.17 (a) shows that Kendall's W for group of knowledge workers is 0.956, which is close to 1. Both the statistics in conjunction provide evidence that knowledge workers depicted a very strong within group concordance about the ranks of five workspaces. Consequently, the hypothesis $H5_0$ was accepted, which stated that knowledge workers will have a strong to very strong agreement for the ranking of the five workspace alternatives; i.e., within group agreement index will be ≥ 0.7.

Table 7.16 – Inter-rater Agreement Index for Workspace Ranks; a) knowledge Workers

Group	Inter-rater Agreement Index				
	W1	W2	W3	W4	W5
KW	1.00	0.94	0.94	0.94	0.94

Table 7.17 – Kendall's W for Workspace Ranks; a) knowledge workers

Workspace Alternative	Test Statistics		
	Mean Rank	Asymp. Sig.	Kendall's W
W1	5.00	0.000	0.956
W2	3.88		
W3	3.13		
W4	1.88		
W5	1.13		

7.3.7.1.2. Discussion of results for decision-makers

Table 7.16 (b) shows that decision-makers had a perfect lack of agreement on rankings for workspaces W1 and W4; and agreement for ranking of W5 is very weak. W2 and W3 fetched moderate agreement for their ranking in the group of eight decision-makers. Alike, Kendall's W for decision-makers is 0.266, which is close to zero, implying poor agreement among the eight members of the group for workspace ranking. The critical value for Kendall's W at m=8 and n = 5 at .05 significance level is 0.287.

Since 0.266 is less than 0.287, the hypothesis $H6_0$ is rejected in favor of alternative hypothesis $H6_A$, which states that decision-makers will have moderate or worst agreement about the ranking of the five workspace alternatives.

Table 7.16 – Inter-rate Agreement Index for Workspace Ranks; b) decision-makers

Group	Inter-rater Agreement Index				
	W1	W2	W3	W4	W5
DM	0.00	0.51	0.65	0.00	0.08

Table 7.17 – Kendall's W for Workspace Ranks; b) decision-makers

Workspace Alternative	Decision makers		
	Mean Rank	Asymp. Sig.	Kendall's W
W1	4.25	0.075	0.266
W2	3.13		
W3	2.88		
W4	2.75		
W5	2.00		

7.3.7.2. Between-Group Concordance for Workspace ranks

In the above sections, it was shown that knowledge workers strongly recommended the following ranks for the five workspace alternatives: workspace W5 was ranked the most preferred, followed by workspace W4 that was ranked significantly preferred; W3 fetched moderate preference; W2 being preferred, W1 was suggested as the least preferred. Decision-makers shared the similar ranking sequence as can be seen in Table 7.17 (b) under mean rank; however, the agreement for rankings among the eight members of the group was moderate to weak. Although decision-makers showed weak consensus among themselves, the next important question was if the two groups were in agreement with each other for this ranking sequence such that decision about workspace choice is facilitated. Generally, the highest ranked alternative is considered the best choice and the lowest ranked alternative the worst choice.

The most appropriate statistics for testing between-group concordance is Schucany and Frawley's (1973) W. W is the standardized version of L* that estimates concordance between groups based on the null hypothesis of no concordance. W relates well to the usual interval [-1, 1] of correlation measure where: W = 0 indicates no concordance between groups; and W = 1 implies complete agreement between groups, and -1 indicates completely opposite ordering between two groups. A value of 0.7 or more is considered a strong agreement. The equations of L^* and W are Equation 10 and 11 (Schucany and Frawley, 1973):

$$L^* = [L - E(L)] / \sqrt{Var(L)} \tag{10}$$

where

$$E(L) = m_1 m_2 k(k+1)^2 / 4$$

$$Var(L) = m_1 m_2 (k-1) k^2 (k+1)^2 / 144 \quad \text{, and}$$

$$L = \sum_{i=1 \ldots k} S_i T_i$$

S_i = sums of ranks in columns for group 1, where columns represent objects and rows represent judges.

T_i = sums of ranks in columns for group 2, where columns represent objects and rows represent judges.

m_1 = number of judges in group 1.

m_2 = number of judges in group 2.

k = number of objects to be ranked.

$$W = [L - E(L)] / [\max(L) - E(L)] \in [1, -1] \tag{11}$$

where

$\min(L) = m_1 m_2 k(k+1)(k+2)/6$, and

$\max(L) = m_1 m_2 k(k+1)(2k+1)/6$

Substituting $m_1 = 8$, $m_2 = 8$, and k = 5 in Equation 11, the value of *W*, two group concordance, was found to be 0.89, which implies a strong agreement between the two groups for ranking of the five alternatives.

7.3.7.3. Summary of Results for Workspace Ranks

In summation, both the groups provided similar ranking to the five workspace alternatives; knowledge workers showed very strong agreement while decision-makers agreed weakly. Statistics for two group concordance showed that when the rankings provided by the two groups are analyzed together for agreement, they share an acceptable level of concordance, W= 0.89. Consequently, the five workspaces are ranked as shown in Table 7.18.

Table 7.18 – Overall Workspace Ranking Using Workspace Choice Decision Model

Workspace	Description	Rank	Category
W1	Open workspace	5	Least Preferred
W2	Open workspace with noise cancellation headphones	4	Preferred
W3	Open workspace with personal sound masking system	3	Moderately preferred
W4	Open workspace with flexible acoustic screens	2	Significantly preferred
W5	Adaptable workspace	1	Most preferred

With these results for workspace rankings, the hypothesis H_0 is accepted, which stated that for knowledge-based organizations, adaptable workspace is valuable over rather cost-effective open plan workspace. It is important to remember that this finding os valid within the assumptions and limitations stated in Sections 7.3.1 and 7.3.2.

7.3.7.4. Graphical Presentation of Summary of Results for Workspace Ranks

Crothers (1981) argue that for displaying results of experiments, graphical displays are superior to tabular presentations as they are much easier for most people to understand. Therefore, radar graph are also plotted for the workspace rankings as shown in Figure 7.24.

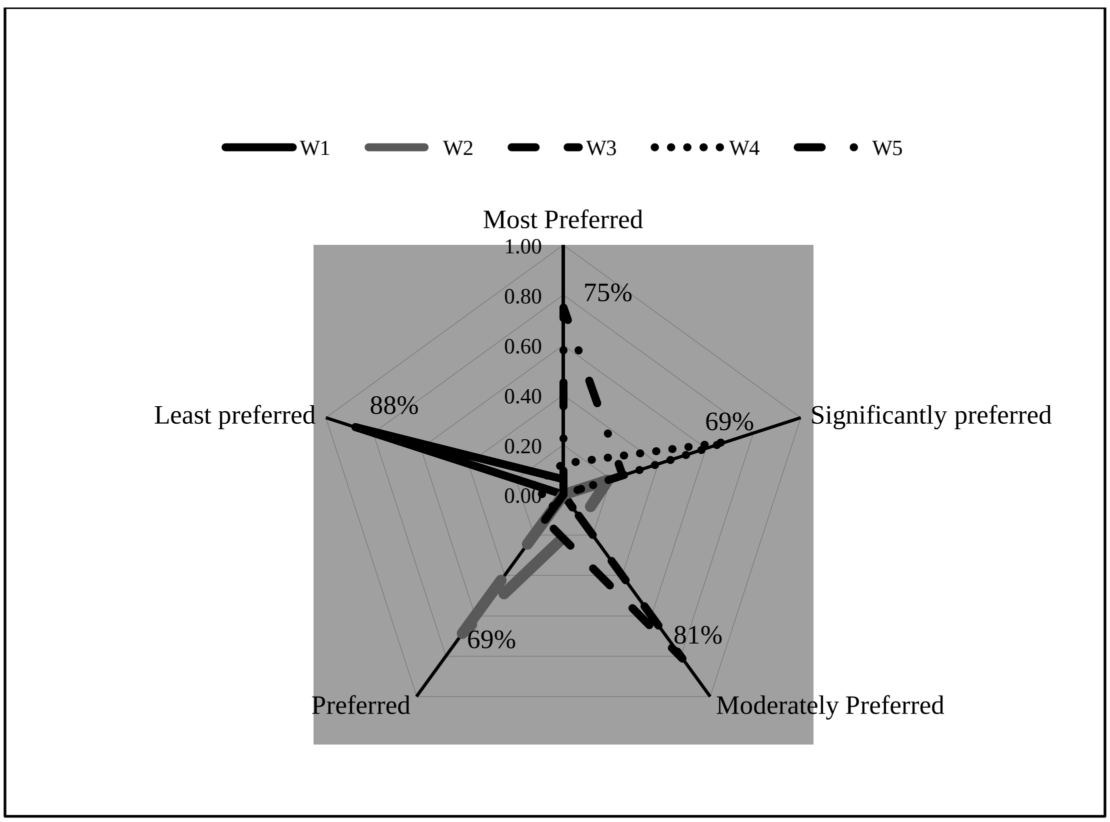


Figure 7.24 – Radar Graph for Overall Workspace Ranking

The figure clearly shows the following results:

- 75% of the subjects rank workspace W5, adaptable workspace, as the most preferred workspace.
- 69% subjects rank workspace W4, open workspace with flexible acoustics screens, significantly preferred.
- 81% subjects rank workspace W3, open workspace with personal sound masking system, as moderately preferred.
- 69% subjects rank workspace W2, open workspace with noise cancellation headphones, preferred.
- Workspace W1, open workspace, is ranked as the least preferred by 88% of the subjects.

7.4. Research Conclusion

The multi-attribute workspace choice utility model developed in Section 7.2 and its reliable and consistent application to evaluation of five workspace alternatives performed in Section 7.3 showed that a structured decision-based procedure for workspace selection could be developed. Therefore, the overall hypothesis, Hm_0, of this research study is accepted. The findings of the application of this model to workspace selection provide evidence that the decision-based procedure offsets the inconsistencies and limitations of the cost-benefit approach for workspace selection.

7.5. Summary

This chapter presented the data collection, data analysis, and results for a multi-attribute utility analysis approach to workspace selection. The multi-attribute workspace choice utility decision model was applied to a complex and realistic problem of workspace selection. The workspace decision model resulted in the following ranks for the five workspace alternatives: W5 received the most preferred status; W4 was suggested as significantly preferred; W3 was ranked moderately preferred; W2 was preferred; W1 was suggested as the least preferred workspace. Consequently, the hypothesis H_0 made in favor of adaptable workspace was accepted. The multi-attribute approach and the workspace choice utility decision model provided insightful findings that cannot be matched by any of the currently available techniques; however, the assumptions and limitations of these findings are stated in Sections 7.3.1 and 7.3.2.

The results of various analyses performed during the process show that the attribute preferences, risk behavior, and workspace preferences are in synchronization, which is a very important aspect of model reliability. For instance, imagine a scenario, where t-test results for risk behavior would have shown that the two groups significantly differ in their risk behavior for 10 attributes. Similarly, the t-test for attributes weights would have shown that the two groups significantly differ in their preferences for attributes importance towards the decision problem. But, the t-test for workspace selection would have shown that the two groups show similar preferences for workspace alternatives. In such a case, the results of the workspace choice decision model would have come under scrutiny for inconsistent results. However, current results corroborate model's reliability.

A number of appropriate statistics were used that provided the following results: the null hypotheses $H1_0$ and $H2_0$ were accepted, according to which the two groups, knowledge workers and decision-makers, will have a strong agreement for attribute's relative importance for the decision problem, i.e., r_{wg} >= 0.70. The two groups showed similar preferences for the relative importance of various attributes towards the decision problem; therefore, $H3_0$ was accepted. $H4_0$ was accepted for workspaces W1, W2, and W3, but rejected in favor of $H4_A$ for workspace W4 and W5. The reason was that knowledge workers were more satisfied with workspace W4 and W5 than decision-makers; however, both the groups were similarly satisfied with W1, W2, and W3. The findings suggest that the users of workspace, knowledge workers, feel strongly about the workspace that provide significant or better control over distractions and that supports individual and collaborative work environment. Therefore, it is urgent and timely to consider a different and more robust approach to workspace selection; this study has shown that decision-based approach is one such technique. Consequently, the overall hypothesis, Hm_0, of this research study was accepted, which stated that a structured decision-based procedure for workspace selection could be developed.

The workspace decision model is a novel approach to workspace selection where relative performance attributes are applied in the decision-making process. Compared to traditional cost-benefit methods of workspace selection, in which factors with attached dollar value can be considered, this approach allows simultaneous processing of subjective (dollar value cannot be attached) and objective performance attributes with rationality and consistency. Therefore, it can serve as an important tool for organizational effectiveness.

The next step entails validation of the workspace rankings. This is the focus of Chapter 8.

CHAPTER 8

STAGE V - VALIDATION OF THE MAU WORKSPACE CHOICE DECISION MODEL

8.1. Introduction

In an empirical context, validity is described as a statistical correlation between the results of an experiment conducted by the investigator and other independently observed events (Anastasi, 1982, Nunnally, 1978). External validity and internal validity both should be of concern to a researcher. External validity suggests generalizability, whereas internal validity checks for the rigor of the study and consideration of alternative explanations for any causal relationship that is explored or established through the study (Huitt, 1998). For instance, many studies have shown that noise negatively affects performance; however, this relationship will pass the test of internal validity if there are no other mediators affecting the relationship. Three basic internal validity types are: criterion validity; construct validity; and content validity.

Construct validity checks how well a device or an instrument measures the concept for which the instrument is designed. For instance, imagine a researcher attempting to measure creativity. In such a case, construct validity will require the researcher to define creativity very clearly such that an acceptable level of construct validity can be reached.

Content validity refers to a test's capability to represent all the contents of a particular concept (Carmines and Zeller, 1979). For instance, imagine a researcher attempting to develop a test of creativity. Content validity will require that not only creativity shall be measured for abstract visualizations, but also for performance in problem-solving, decision-making, analytical reasoning and any other aspect of the concept termed creativity. Heffner (2004) suggests that “there is no easy way to determine content validity aside from expert opinion” (Chapter 7).

Criterion related validity is also referred to as instrumental validity or predictive validity. It shows the accuracy of an instrument or a device by comparing it with another measure or a procedure that has been shown to be valid (Heffner, 2004), or another measurement obtained from the same target population (Carmines and Zeller, 1979). Nunnnally (1978) notes that criterion-related validity, “is at issue when the purpose is to use an instrument to estimate some important form of behavior that is external to the measuring instrument itself, the latter being referred to as the criterion” (p. 87). For instance, in order to test the predictive validity of a new intelligence test, the scores from the new test should be compared with scores from other valid measures of cognitive aptitudes, like General IQ test, Reynolds intellectual screening test, etc. A high positive correlation coefficient will suggest predictive validity.

The above definitions suggest that that the multi-attribute workspace choice utility decision model should be tested for its criterion validity. Therefore, the subjects of this stage of the study were requested to rank the five workspace alternatives from most preferred (1) to least preferred (5). First, they were introduced with each workspace. It was told that the key characteristic of these workspaces is that a workspace that provides a particular (very significant/significant/moderate/a little/none) control over distractions is the one that contributes in the respective way (very significant/significant/moderate/a little/none) towards all 10 attributes, A1 through A10. The following question was asked: Please rank the workspace alternatives in Table 8.1 from 1 through 5: where 1 = most preferred workspace; 2 = significantly preferred workspace; 3 = moderately preferred workspace; 4 = preferred workspace; and 5 = least preferred workspace.

Table 8.1 - Workspace Alternatives

Workspace	Description	Rank
W1	Workspace that provides no control over distractions; e.g. open workspace.	
W2	Workspace that provides a little control over distractions; e.g. you are provided with noise cancellation headphones.	
W3	Workspace that provides moderate control over distractions; e.g. personal sound masking for individual workspaces.	
W4	Workspace that provides a significant control over distractions, e.g. you work in an environment where you can operate personal acoustical shadow technology.	
W5	Workspace that provides very significant or complete control over distractions, e.g. Queen's attentive office cubicle, IBM's BlueSpace.	

8.2. Data Analysis, Results, and Discussion

Criterion validity is the degree to which the measurement correlates with an external known criterion or another measurement obtained from the same target population. A correlation coefficient of zero implies there is no relationship between the measured or predicted values and the direct measurement. As the strength of the relationship between the measured or predicted values and direct measurement increases, so does the correlation coefficient. A correlation coefficient of 1 implies that there is a perfect correlation between the measured value and a known value.

The statistics for finding correlation coefficients are: Pearson correlation in parametrics; and Kendall rank correlation and Spearman correlation in nonparametrics.

Because the sample size for this study was small and the data was ordinal, nonparametric statistics was used in this analysis. Spearman's rho (Spearman rank correlation coefficient), which is analogous to Pearson’s product-moment correlation coefficient in parametrics, was calculated for each subject to find out the correlation between the directly assigned ranks and the ranks derived by using the multi-attribute workspace choice decision model. This Spearman rho was to be compared with the critical value from the published tables. Criterion validity was expected to have been achieved if 70% (11 subjects), a heuristics from psychological sciences, of the rho values were equal to or greater than the critical value. Heuristics of 0.7 from psychological sciences was appropriate for this study as most of the theoretical background for this study comes from the field of psychological sciences.

At a 0.05 significance level and for a sample size of 16 subjects, the critical value of Spearman rank correlation coefficient came out to be 0.506. The results of Spearman rank correlation between the derived scores and direct measurement as calculated for knowledge workers and decision-makers are presented in the Table 8.2. The results show that 12 subjects have Spearman correlation coefficient, ρ, greater than the critical value of 0.506. Therefore, the workspace choice decision model designed through this study qualifies the criterion validity test, which stated that: criterion validity was expected to have been achieved if 70% (11 subjects), a heuristics from psychological sciences, of the rho values were equal to or greater than the critical value. Consequently, the model is shown to deliver valid results within the context of the study assumptions and limitations, stated in Section 7.3.1 and 7.3.2.

Table 8.2 - Spearman ρ for Derived and Direct Workspace Ranks

Subject	Rank Variable	Workspace Alternatives					Spearman ρ, critical ρ = .506
		W1	W2	W3	W4	W5	
Kw1	Actual Rank	5	4	3	2	1	1.000
	Rank derived from EUs	5	4	3	2	1	
kw3	Actual Rank	5	4	3	2	1	1.000
	Rank derived from EUs	5	4	3	2	1	
kw4	Actual Rank	5	4	3	2	1	1.000
	Rank derived from EUs	5	4	3	2	1	
kw6	Actual Rank	5	4	3	2	1	1.000
	Rank derived from EUs	5	4	3	2	1	
kw7	Actual Rank	5	2	1	3	4	0.873
	Rank derived from EUs	5	4	3	2	1	
kw8	Actual Rank	5	3	4	2	1	0.900
	Rank derived from EUs	5	3	4	1	2	
kw9	Actual Rank	5	3	1	2	4	0.300
	Rank derived from EUs	5	4	3	2	1	
kw10	Actual Rank	5	2	1	3	4	0.873
	Rank derived from EUs	5	4	3	2	1	
dm1	Actual Rank	5	4	3	2	1	-0.900
	Rank derived from EUs	1	2	3	5	4	
dm2	Actual Rank	5	3	1	2	4	0.300
	Rank derived from EUs	5	4	3	2	1	
dm3	Actual Rank	5	4	3	2	1	1.000
	Rank derived from EUs	5	4	3	2	1	
dm6	Actual Rank	5	4	3	1	2	0.900
	Rank derived from EUs	5	3	4	1	2	
dm7	Actual Rank	5	4	3	2	1	-0.500
	Rank derived from EUs	3	2	1	5	4	
dm8	Actual Rank	5	4	3	2	1	1.000
	Rank derived from EUs	5	4	3	2	1	
dm9	Actual Rank	5	4	3	2	1	0.600
	Rank derived from EUs	5	2	3	4	1	
dm10	Actual Rank	5	4	3	2	1	1.000
	Rank derived from EUs	5	4	3	2	1	

8.3. Summary

This chapter presented the validation process that was established to verify the accuracy of the multi-attribute workspace choice utility decision model. The results presented in this chapter provide an excellent basis for future studies. One important extension of these results is its implementation into a Web-based decision support system. In the next chapter, a summary of the key findings of this study, contributions to the theory and practice, and a discussion about the limitations of the study and a decision-based approach to workspace selection are provided.

CHAPTER 9

FINDINGS, CONCLUSIONS, CONTRIBUTIONS, AND FUTURE RESEARCH

9.1. Summary

In today's knowledge-based economy, knowledge workers are the key to sustainability and development of organizations (Davenport and Prusak, 1998, Toffler, 1980). Research has consistently shown that workspace and its environment plays a key role in accomplishing this goal. With improved understanding of the non-auditory effects of auditory distractions on office workers, particularly knowledge workers, combined with innovations in workspace technology, organizations can significantly improve and transform their effectiveness. However, the decision to adopt and implement emerging workspace technologies is often a difficult one; this is often due to lack of understanding of the potential value, integration with existing built environment, organizational values, cost justifications, and alignment with overall business strategies. It is further complicated by the uncertainty and risks associated with such decisions. The objective of this study was to develop a robust methodology to aid decision-makers in selecting the most-appropriate type of workspace for their organization in view of the costs resulting from externally generated involuntary auditory distractions. The hypothesis was that to contain the costs of auditory distractions and costs of workspaces' must-have requirements, a structured decision-based procedure for workspace selection can be developed. Decision theory was applied to the problem because it deals with the problem of inconsistencies, irrationality, and sub-optimality that occurs in the case of unaided human decision making. Thurston (2001) argues that in decision theory these issues are remedied because decision theory is built on a set of axioms of rational behavior. The mathematical models explicitly capture decision-makers' preferences and risk behaviors to suggest the most preferred option through some expected utility (satisfaction) in case the decision-maker was consistent, rational and unbiased.

This dissertation was a step towards first building a comprehensive theoretical framework to explicitly lay down the connections in the theory that existed in different academic domains but did not explicitly connect in any one domain or study. The task led to identification of a number of factors that should affect decisions about workspaces in knowledge organizations within the scope of the decision context. Multi-Attribute Utility Theory was then applied to build the multi-attribute workspace choice utility decision model. The decision model was used to evaluate five workspace options and the results were validated to test the reliability of the model. The study revealed mixed findings for the hypotheses. A summary of the findings, hypotheses, and implications for workspace decision making are discussed in the next section.

9.2. Research Findings

Appropriate statistical tests conducted throughout the study provided the following insights. It is important to note that these findings are guided by the assumptions and limitations stated in Sections 7.3.1 and 7.3.2.

- The two groups, both knowledge workers and decision-makers, showed similar risk attitudes towards all 10 attributes of the decision model, with most of them being risk averse to various impacts of distractions on workspace users and the functional requirements of the workspace to support individual and collaborative work. The results imply that, despite the job role, the two groups may behave alike when considering the choice of a workspace.

- Knowledge workers and decision-makers both showed strong to very strong within group agreement (r_{wg} >= 0.8) for the relative importance of each attribute towards the decision problem. Consequently, the null hypotheses $H1_0$ and $H2_0$ were accepted, which stated that knowledge workers and decision-makers will have a strong within-group agreement for attribute's relative importance for the decision problem, i.e., r_{wg} >= 0.70.
- The two groups, knowledge workers and decision-makers, in accordance provided similar relevance to various attributes of the workspace decision problem. Consequently, hypothesis $H3_0$ was accepted, which stated that the two groups will show similar preferences for relative importance of various attributes towards the decision problem. Furthermore, the group mean statistics shows that the attribute, direct costs of the workspace, has received the least mean weight in both groups, implying that both groups think that other attributes are more important than cost of workspace. This insight is very significant from the workspace decision-making perspective as mostly these decisions are cost-effectiveness driven, and where there is no scope to incorporate the subjective attributes. This validates the necessity to adopt a more robust decision-making approach as has been proposed, developed, and validated in this study.
- The two groups, knowledge workers and decision-makers, differed significantly in their expected utilities for workspace alternatives W4 and W5; the descriptive statistics showed the mean expected utilities of knowledge workers significantly higher than that of the decision makers. However, the two groups did not differ on their expected utilities for W1, W2, and W3. The results imply that knowledge

workers will be more satisfied when they get a workspace with significant or better control over distractions; and that significantly supports the key functional requirements of collaboration and concentration. The results are in agreement with the literature reviewed in Chapter 3, especially the studies by (Olson, 2002, Chou et al., 2001, Heerwagen et al., 2004, Davies, 2005). Therefore, it is urgent and timely to consider a different more robust approach to workspace selection rather than continuing with old cost-benefit analysis. This study has shown that decision-based approach is a valid as well as more-appropriate method.

- Analysis of within-group rankings of workspace alternatives showed that knowledge workers had a high degree of agreement for workspace rankings, $r_{wg} > 0.9$ and Kendall'W 0.956. Consequently, $H5_0$ was accepted which concerned knowledge workers within-group agreement for workspace rankings. Decision-makers, on the other hand, had a perfect lack of agreement on rankings for workspaces W1 and W4; a very weak agreement for the ranks of W5. W2 and W3 fetched moderate agreement. Consequently, hypothesis $H6_0$ was rejected in favor of $H6_A$, which stated that decision-makers will have moderate to weak agreement about the ranking of the five workspace alternatives.
- The between-group analysis of workspace rankings, suggested a strong agreement (W=0.89) for workspace rankings. In all, 75% of the subjects ranked W5 the most preferred workspace. 69% suggested W4 as significantly preferred; 81% ranked W3 moderately preferred; W2 was ranked preferred by 69% of the subjects. Workspace W1 was suggested as the least preferred by 88% subjects. Consequently, the

hypothesis H_0 was accepted, which stated that for knowledge-based organizations, adaptable workspace is valuable over rather cost-effective open plan workspace.

9.3. Research Conclusions and Contributions

This study is a valuable and useful resource for both researchers and practitioners concerned with selecting the most-appropriate emerging workspace technologies. Decision-makers are facing this problem on a daily basis and the most adopted strategy is to employ the traditional cost-benefit methodology. The study contributes to theory and practice in many ways by establishing recommendations and propositions that are in synchronization with the transforming nature of work, workers, and work environments in this age of enterprise transformation (Rouse, 2005). Table 9.1 presents a summary of these contributions, which are briefly discussed.

Table 9.1 – Summary of Contributions to Theory and Practice

Contribution Type	**Contribution**	
Theory	1	Synthesis of literature on non-auditory effects of office noise, open plan office settings, and enquiry of workplace design and environmental variables.
	2	Indirect costs of auditory distractions and workspace design were highlighted for their significance for workspace decision-making.
	3	Development of a workspace choice decision model.
	4	Multi-criteria decision-based approach to workspace selection.
Practical	1	Framework for facility decision-makers to perform systematic and controlled analysis of their concern for workspace decision making.
	2	Real life application of workspace choice decision model.

The theoretical contributions of this study are manifold. First, this dissertation provides a comprehensive synthesis of literature on the effects of auditory distractions, speech and sound, on task performance, especially complex task performance; non-auditory effects of open plan office noise are highlighted and significance is established for their importance as workspace decision variable. Workplace design and environment features that are perceived as the most critical by office workers, especially knowledge workers, are noted. The literature comes from a number of domains and currently does not connect in the existing knowledge base. The original multi-disciplinary theoretical knowledge-base generated through this effort resulted in a refereed publication (Roper and Juneja, 2008). It provides a holistic and systematic understanding of why auditory distractions are a source of significant concern for office workers, in general, and knowledge workers, in particular. It also highlights the fundamental issue with open plan office settings: the sustainability of two extremely contrasting requirements, concentration and collaboration, in the same workspace and work environment at a given time. Therefore, the paper challenges the cost-effectiveness of open plan workplaces when evaluated for its contribution to organizational effectiveness.

The literature revealed that workspace decision-making is a multi criteria process associated with a great deal of inconsistency and uncertainty. Guided by the literature on decision theory, the goal was to build a multi-attribute utility decision model for workspace choice. This dissertation reports the first application of the multi-criteria decision making method, MAUT, to workspace selection when auditory distractions coming from surrounding work environment is shown to be the concern of significant importance. The structure of the fundamental objective hierarchy for workspace choice that forms a basis for multi-attribute workspace utility decision model is validated through an expert-based Delphi questionnaire. The multi-attribute workspace choice utility decision model is then validated for its application to workspace choice through two groups of subjects from the AEC industry, knowledge workers and decision-makers. The successful application of the model to evaluation of five workspace alternatives verified the overall hypothesis, Hm_0, of this research study, which stated that a structured decision-based procedure for workspace selection can be developed. Further validation of the model with knowledge-based organizations in different industries will increase the power and enhance the generalizability of the model.

This dissertation also has significant practical implications. Using the results obtained from the empirical study, the workspace decision model was applied to the ranking of five workspace choices. The results showed that the two extremes of workspace preferences, i.e., the best and the worst, were adaptable workspace and open workspace. Within the context of assumptions and limitations stated in Sections 7.3.1 and 7.3.2, these results verified the hypothesis H_0 of the study, which stated that: for knowledge-based organizations, adaptable workspace is valuable over rather cost-effective open plan workspace. Furthermore, the results of the workspace choice decision model were tested for their criterion validity to enhance the prediction power of the decision model. 12 subjects had Spearman correlation coefficient, ρ, greater than the critical value of 0.506. Therefore, the workspace decision model designed through this study is considered valid within the context of the study assumptions and limitations (7.3.1 and 7.3.2).

This decision-making tool is intended to help facility decision-makers in two ways: First, because of the structured nature of the approach, it will allow systematic and controlled analysis of their concerns; and, second, it will provide a quantitative value to their evaluation of both subjective and objective criteria. The tool is a very appropriate device for corporate facility decision-makers or facility management personal to establish a strategic link between the workspace and the business bottom line.

Furthermore, it is important to mention that the literature review conducted in this study showed that the field of Facility Management is far behind other domains for its contribution to the respective domain of study (see Figure 3.4). Although a few studies have been published in the refereed journals in the past few years (Olson, 2002, Roper and Juneja, 2008), the field is still far from a comprehensive knowledge-base to account for its definition as IFMA puts it: “Facility Management is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology” (IFMA). This study thus provides a significant contribution to the body of knowledge in the area of Facility Management.

9.4. Limitations of the Study and Future Research

Like all research, this dissertation could be improved and extended. One drawback of a multi-disciplinary study is the possibility of leaving out certain models, theories, and approaches from certain domains. The goal of this dissertation was not to develop an integrative one-for-all workspace choice decision theory, but draw from the aforementioned fields and provide a complimentary view on costs of workspace for office workers, especially knowledge workers, and thus knowledge-based organizations, in the presence of auditory distractions in the surroundings. One extension of these results is the implementation of workspace choice utility decision model into a Web-based decision support system.

Decision-making for workplaces' indoor environment is indeed a complex problem involving multiple conflicting objectives and uncertain consequences. Therefore, unless the problem is structured using tools and models of decision analysis, it poses an extremely cumbersome task of human decision-making where a decision-maker can easily ignore a number of important criteria because of human cognitive limitations. In this dissertation, the focus of efforts was on one environmental element, auditory distractions, speech and sound. However, to provide a complete understanding of the costs of workspace for office workers, particularly knowledge workers, and thus knowledge-based organizations, other indoor environmental factors, such as temperature, air quality, and lighting, among many others, must also be integrated into a workspace choice decision model. Consequently, another potential future research could be comprehensive exploration of the significance of various indoor environment variables for organizational effectiveness. How these can be modeled into a decision support system that allows rational analysis of alternative indoor environments while implicitly including the risks and uncertainty associated with such decisions? The long-term research goal could be to develop a theoretical and practical basis for determining how to identify the most-appropriate workplace environment to achieve more competitive and effective organization.

Furthermore, the participants of the Delphi study were researchers and academicians interested in the field of study. It will be a great opportunity to include other stakeholders, like corporate facility decision-makers and CEOs, in the Delphi to obtain multi-level and multi-industry view of the decision problem.

The advantages of utility analysis approach do come at a price. There are several potential difficulties with the utility assessment procedure, including level of effort required, biases and inconsistencies. Some researchers argue that the level of effort and length of time required to properly determining a utility function is too great. Since not all the subjects of Phase III of the study were familiar with decision-making theory and procedures, some subjects stated that the lottery questions were non-intuitive and difficult to understand. They reported difficulty in visualizing the hypothetical consequences. A potential research opportunity is to test the decision model with corporate executives who are involved in the process of decision-making on a daily basis. This will not only generate ideas for further improvement, but will also increase the power of the workspace choice decision model. However, it is important to remember that the technique is costly, in terms of time required from decision-makers and the time for which they are expected to concentrate on difficult questions.

Another important aspect of administration of utility analysis questionnaire is that it requires an interviewer to be sensitive to the interviewees' reactions to questions and allow the interviewer to re-question to control for biases and consistency. This is a real skill which must be developed before the results of an interview can be reliably employed. Much of this can be alleviated, however, through the use of intelligent computer programs for assessing utilities and performing the analysis.

Lastly, this study has shown the significance of using a decision-based approach to workspace selection. The methodology simplified the problem by providing it a structure that is easily comprehensible, and allows simultaneous processing of both, qualitative and quantitative conflicting objectives, through a single decision-making model. It was made clear that in the absence of such an approach, the potential to ignore a number of important criteria because of human cognitive limitations is very high. Therefore, extension of decision-based approach to exploration of other critical areas of facility related decisions would be a valuable effort.

APPENDIX A

INVITATION EMAIL

Dear Subject,

I am a Ph.D. candidate in the College of Architecture at Georgia Institute of Technology, researching “decisions about workspace type and impacts of auditory distractions in knowledge–based organizations”.
We (my advisors and I) extend this invitation your way because you are an expert in the field of study. Your book titled “------------” and many related publications offers confidence that your participation is precious to successful completion and will add significant value to the results of the study. I need your help in validating my research. I promise that you will find the study very interesting, indulging, satisfying, and valuable.

Summary of research

Auditory distractions are shown to have significant negative bearings on knowledge workers, thereby affecting the overall productivity of an organization, since knowledge workers are the key costs and revenue generators in knowledge-based organizations. Rationally, these negative impacts shall form a basis for decision making when choosing a workspace type (static vs. adaptable) for knowledge workers. However, organizational decisions are generally guided by cost-benefit analysis in which the subject impacts are not explicitly included because these cannot be converted into precise dollar figures. Therefore, a multi-attribute utility model of workspace decision making is proposed that will allow investigation of subjective factors for their utility for a particular organization and then a cost-utility tradeoff can be performed to choose the best appropriate workspace.

The study is divided into three phases.

Phase I is the expert based Delphi questionnaire wherein the initial fundamental objective hierarchy developed on the basis of comprehensive literature analysis will be validated. The phase includes 8-15 experts. This phase is generally conducted via face-to-face interviews that typically take somewhere between 1 – 2 hrs. We decided to run this phase as an online survey questionnaire because that will give the participant the flexibility to respond at ones’ convenient time and location and it provides us the feasibility to contact out of state and international experts.

Phase II is the second round of expert based Delphi questionnaire wherein consensus for fundamental objective hierarchy will be sought. This is also anticipated as an online questionnaire.

Phase III is the preference elicitation questionnaire wherein utility functions and weights for various agreed on attributes will be elicited and probabilities for various consequences will be sought.

The study is expected to produce the following knowledge and deliverables:

1. The objective hierarchy for choice of workspace type for knowledge workers.
2. The risk profiles of various stakeholders for choice of workspace type for knowledge workers.
3. Decision model that will facilitate corporate facility decision makers in selecting the best workspace alternative (static open or adaptable) for their organization in accordance with the organization's work, policies, financial bottom-line and business mission.

Your participation is very valuable for this study and your assent to participate is beyond thankfulness. Please allow me to request you to kindly accept this invitation. If you have any questions, please contact me at pjuneja@ti.gatech.edu or my faculty advisors at kathy.roper@coa.gatech.edu and bill.rouse@ti.gatech.edu.

Parminder Juneja
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College of Architecture & Tennenbaum Institute (www.ti.gatech.edu)
Georgia Institute of Technology

Kathy O. Roper
Associate Professor
College of Architecture & Tennenbaum Institute (www.ti.gatech.edu)
Georgia Institute of Technology

William Bill Rouse
Executive Director of Tennenbaum Institute (www.ti.gatech.edu)
Professor, School of Industrial and Systems Engineering
Georgia Institute of Technology

APPENDIX B

CONSENT FORM

Georgia Institute of Technology
Tennenbaum Institute and College of Architecture
Kathy O. Roper (Principal investigator) and Parminder Juneja (Co-investigator)
Atlanta, GA 30332

1. Introduction

You are being asked to participate in a research study conducted by Parminder Juneja and Kathy O. Roper, from Tennenbaum Institute at the Georgia Institute of Technology (Georgia Tech). The results are sought to be used in the PhD dissertation only. You were selected as a possible participant because of your expertise in the field of organizational strategy decisions and workplace environment and behavior. Please read the information below, and ask questions about anything you do not understand, before deciding whether or not to participate.

2. Participation and Withdrawal

Your participation in this study is completely voluntary and you are free to choose whether to be in it or not. If you choose to be in this study, you may subsequently withdraw from it at any time without penalty or consequences of any kind. The investigator may withdraw you from this research if circumstances arise which warrant doing so, but such an event is unlikely.

3. Purpose and Benefits

The purpose of this study is to gather information on subjective costs of auditory distractions in knowledge based organizations and seek out their relevance to the decision making strategy for choice of workspace type. We expect to use this data to better understand and model these subjective costs as value objectives in a multi-attribute decision model for choice of workspace type. The decision model allows explicit inclusion of subjective costs/impacts, which in other case are generally intuitively known but go ignored in cost-benefit analysis. The model is expected to facilitate decision makers in choosing the best workspace in accordance with their organizational goals. The data will be formatted to make it easily recognizable and understandable. It will be presented in the PhD dissertation and also be made available to the participants.

4. Procedures

After gaining your assent to participate, you will be sent a survey invitation through Survey Gizmo (web-based survey tool) that will contain the link to the survey. You can start the survey anytime at your convenience within the allocated period of time. You are allowed to save the survey and reinitiate later from the point of exit at your convenience.

The structure of the study is as follow:

The study is divided into three phases, where: Phase I is the expert based Delphi questionnaire that includes 8-15 experts in the field of the study. The key goal of this phase is "validation of the fundamental objective hierarchy" that has been developed on the basis of comprehensive literature analysis. This phase is of critical importance as it prepares the foundations for the whole study and the decision model. Because of the nature of the key goal, this phase is lengthy as each objective is described clearly followed by questions for the respective objective. Therefore, we anticipate that this phase may take somewhere between 1-2 hours.

Phase II is the second round of the expert based Delphi questionnaire and the goal is to reach consensus on the objectives in the objective hierarchy. Depending on the results from phase I, this phase may take somewhere between 20 minutes to 1 hour.

Phase III is the preference elicitation questionnaire wherein utility functions and weights for various attributes (attributes are measurement indices for lowest level objectives) that were confirmed in the phase II will be elicited and probabilities for various consequences will be sought. Phase III will include about 20-30 subjects depending on the availability of the subjects.

At the beginning of each phase, you will be asked about some demographics information that will include mostly professional information like questions about highest degree, experience in the current field, experience in the previous field etc. You will be allowed to skip this page if you have already filled in the demographics information in the previous phase.

5. Potential Risks/Discomforts

None are known or expected.

6. Compensation to you

There is no monetary compensation; however the results of the study and the proposed decision model will be made available to the subjects.

7. Confidentiality

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. When the study has been completed, all such identifying information will be destroyed, and none of your responses will be in any way traceable back to you.

You should be aware, however, that the study is not being run from a "secure" https server of the kind typically used to handle credit card transactions, so there is a small possibility that responses could be viewed by unauthorized third parties (e.g., computer hackers).

To make sure that this research is being carried out in the proper way, the Georgia Institute of Technology IRB may review study records. The Office of Human Research Protections may also look at study records.

8. Costs to You

There are no monetary costs involved, except the time that you will spend on filling out the questionnaire, which is the only but the most important requirement to make this study a success.

9. Questions About the Study

If you have any questions or concerns about the about the research, please feel free to contact:

Parminder K Juneja (Co-Investigator)
Tennenbaum Institute
760 Spring St NW, Atlanta, GA 30332
404-385-3367; pjuneja@ti.gatech.edu

Professor Kathy O. Roper (Principal Investigator)
Building Construction Department, College of Architecture and
Tennenbaum Institute
280 Ferst Dr. NW, Atlanta, GA 30332
404-385-4139; Kathy.roper@coa.gatech.edu

10. Subject Rights

You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you feel you have been treated unfairly, or you have questions regarding your rights as a research subject, you may contact compliance officer Ms. Melanie Clark at melanie.clark@gtrc.gatech.edu or (404) 894-6942. The office is located 505 Tenth Street, NW, Atlanta, Georgia 30318.

You may start the survey now. Completion of the survey implies that you have read (or have had read to you) the information contained in this consent form and would like to be a volunteer in this research study. Thank you very much for your participation.

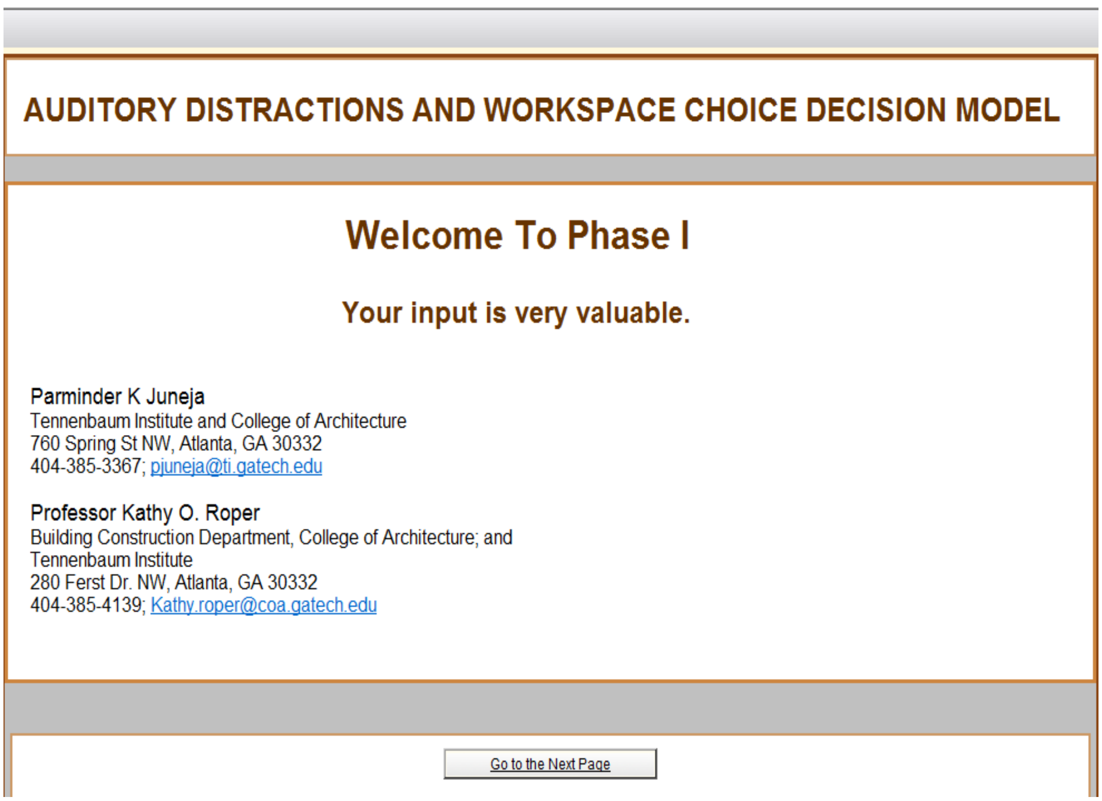
Parminder K Juneja (Co-Investigator)

Professor Kathy O. Roper (Principal Investigator)

APPENDIX C

WEB BASED DELPHI STUDY – PHASE I

The research instrument for Phase I of the Delphi study was a Web-based questionnaire that was designed and developed using online survey software SurveyGizmo. This Appendix presents the snapshots of the instrument.



AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

RESEARCH CONSENT

Georgia Institute of Technology
Tennenbaum Institute and College of Architecture
Kathy O. Roper (Principal investigator) and Parminder Juneja (Co-investigator)
Atlanta, GA 30332

1. Introduction

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3. Purpose and Benefits

The purpose of this study is to gather information on subjective costs of auditory distractions in knowledge based organizations and seek out their relevance to the decision making strategy for choice of workspace type. We expect to use this data to better understand and model these subjective costs as value objectives in a multi-attribute decision model for choice of workspace type. The decision model allows explicit inclusion of subjective costs/impacts, which in other case are generally intuitively known but go ignored in cost-benefit analysis. The model is expected to facilitate decision makers in choosing the best workspace in accordance with their organizational goals. The data will be formatted to make it easily recognizable and understandable. It will be presented in the PhD dissertation and also be made available to the participants.

4. Procedures

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The structure of the study is as follow:
The study is divided into three phases, where: Phase I is the expert based Delphi questionnaire that includes 8-15 experts in the field of the study. The key goal of this phase is "validation of the fundamental objective hierarchy" that has been developed on the basis of comprehensive literature analysis. This phase is of critical importance as it prepares the foundations for the whole study and the decision model. Because of the nature of the key goal, this phase is lengthy as each objective is described clearly followed by questions for the respective objective. Therefore, we anticipate that this phase may take somewhere between 1-2 hours.

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Phase III is the preference elicitation questionnaire wherein utility functions and weights for various attributes (attributes are measurement indices for lowest level objectives) that were confirmed in the phase II will be elicited and probabilities for various consequences will be sought. Phase III will include about 20-30 subjects depending on the availability of the subjects.

At the beginning of each phase, you will be asked about some demographics information that will include mostly professional information like questions about highest degree, experience in the current field, experience in the previous field etc. You will be allowed to skip this page if you have already filled in the demographics information in the previous phase.

5. Potential Risks/Discomforts

None are known or expected.

6. Compensation to you

There is no monetary compensation, however the results of the study and the proposed decision model will be made available to the subjects.

7. Confidentiality

depending on the availability of the subjects.

At the beginning of each phase, you will be asked about some demographics information that will include mostly professional information like questions about highest degree, experience in the current field, experience in the previous field etc. You will be allowed to skip this page if you have already filled in the demographics information in the previous phase.

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You may start the survey now. Completion of the survey implies that you have read (or have had read to you) the information contained in this consent form and would like to be a volunteer in this research study. Thank you very much for your participation.

Parminder K Juneja (Co-Investigator)

Professor Kathy O. Roper (Principal Investigator)

Go to the Previous page | Go to the Next Page

AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

DEMOGRAPHICS INFORMATION

Please fill in the following information. Many Thanks.

Please do not worry about saving the information. Your responses will be automatically saved once you click the "**Go to the Next Page**" button at the bottom of the page.

	Your Information
Last Name	
First Name	
Title (Dr./ Professor/ Ms. / Mrs. / Mr.)	
Highest Degree Earned	
Email	
Total Professional Experience (in years)	
Research Interest	
Total Research Experience (in years)	
Area of Expertise	
Job Title	
Job Responsibility	
Job Organization	
Industry	
Location (City, State, Country)	

Go to the Previous page Go to the Next Page

Adaptable Workspace

An adaptable workspace is a workspace that allows (and/or assists) the user to exercise control over distractions coming from one's surrounding work environment. It supports the conflicting requirements of collaboration and concentration by allowing the environment to adapt to functional needs of the user or by allowing the user to adjust the micro-environment to suit to ones various needs such as functional, psychological, physiological, etc. The prototypes are: "Attentive Office Cubicle" from Human Media Lab at Queen University; and "BlueSpace" from IBM and Steelcase.
To gain information about these prototypes, you are requested to visit the following URLs (Please open the below URL's in a new window.)

1. Attentive Office Cubicle: This is a video from Queen University's Human media lab.

   www.hml.queensu.ca/files/videos/Mamuji_Vertegaal_Dickie_Sohn_Danninger_2004.mp4

2. BlueSpace: Each URL below is dedicated to explaining how a BlueSpace provides concentration, collaboration and personalization.

   www.research.ibm.com/bluespace/concen.html
   www.research.ibm.com/bluespace/collab.html
   www.research.ibm.com/bluespace/person.html

Decision Context

Please read carefully the decision context stated below. The decision context is specified by the decision activity under consideration, which in this study is, "the choice of workspace type for knowledge workers in knowledge-based organizations". It also identifies the boundaries for the activity under consideration.

Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results:

1. Knowledge workers are the key assets of knowledge-based organizations in terms of costs (salaries +benefits) to the organization and the revenue (productivity) they generate for their organization.

2. Auditory distractions coming from surrounding work environment incur huge intangible costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics:
   Originator - workspace environment;
   Occurrence - random;
   Discrete, i.e. these have a start time and an end time;
   Knowledge worker's control - none;
   Impact - detrimental and involuntary, since it cannot be controlled by the worker.

3. Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.

Note: Please click on the following link to open it in a new window, "Decision Context". Save the document on your system for future reference to decision context description.

Structure of the Objective Hierarchy

This is to explain how the objectives in an objective hierarchy are structured. You may skip reading this note if you are equipped with the knowledge for structuring objectives in an objective hierarchy.

Both top-down and bottom-up approaches are applied. The child objective (or sub-objective) of an objective in the hierrchy is developed by answering the following question for its parent objective: what do i mean by the objective at the parent level? For instance, the child objective(s) for the parent objective "Minimize potential intangible (subjective/indirect) costs of workspace for knowledge based organizations" was (ere) obtained by asking the following question about the parent objective: "What do i mean by stating that I want to minimize potential intangible (subjective/indirect) costs of workspace for knowledge-based organizations?" From the interdisciplinary and international literature analysis, I learnt that externally generated auditory distractions is one workspace aspect that is shown to have many negative impacts on knowledge workers. This implies that these distractions possesses the potential to incur huge intangible/indirect costs for knowledge-based organizations in terms of lost/reduced productivity. Because, negative impacts of distractions are many such as, cognitive, emotional, health, etc, these are grouped into five main categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under physiological impacts whereas mental well-being impacts like negative emotions, annoyance, are grouped under psychological impacts. This is why the parent objective "Minimize potential intangible (subjective/indirect) costs of workspace for knowledge based organizations" is further sub-divided into five sub-objectives. This implies, the meaning and scope of "Minimize potential intangible (subjective/indirect) costs of workspace for knowledge based organizations" is bounded by its five sub-objectives.

The parent objective in the hierarchy is cross-verified by asking the following question about the child objective: "Why is the child objective important?" If the child is helping to achieve the parent objective, the relationship is rationalized. For instance, for the objective "minimize potential performance costs of distractions" the objective was translated into a broader objective by asking the following question: "Why is it important that the potential performance costs of distractions for knowledge workers be minimized?" A potential performance cost indicates a cost to the organization. If the performance cost is increased due to distractions this implies high product (knowledge–based product in this study) cost and less revenue if the net price is kept the same.
Furthermore, literature suggests that these performance costs are both direct and indirect and reducing both will help minimize costs to the respective organization. Because we have limited the decision model to computing the value of indirect components only (and then comparing the objective costs with the subjective utility), therefore it is rational to assume that if the potential performance costs are minimized, then the potential indirect costs will be minimized. Therefore, the child is important to achieve the parent objective and should be included in the objective hierarchy.

Note: Please click on the following link to open it in a new window "Method to structure objective hierrachy". Save the document on your system for future reference to method description.

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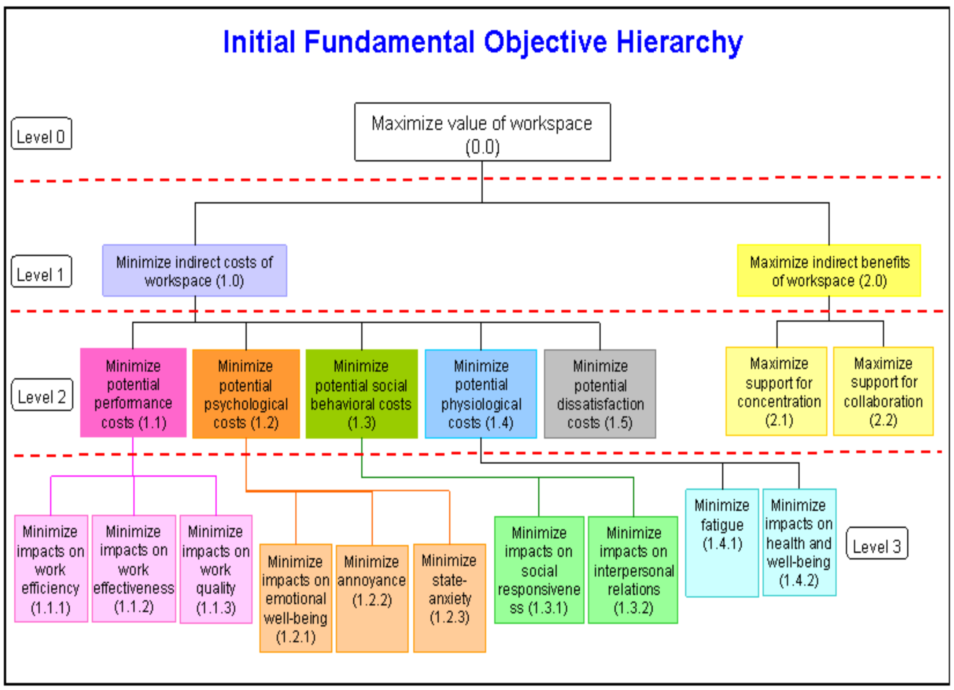
AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Page 2 - VALIDATION OF LEVELS 0 AND 1 OF THE OBJECTIVE HIERARCHY

*This is to remind you that once you start working on this page, to be able to save your data you will be required to finish this page and click the "***Go to the Next Page***" button at the bottom of the page. So, please consider the length of the page and the time available to finish the page. To close the questionnaire so as to get back to the same later, just close the page. Click on the survey link in your email, to get back to the questionnaire at any time. All questions are required (*).*

Validation Procedure for Objective Hierarchy and Attributes

The initial objective hierarchy shown in the figure below is prepared on the basis of comprehensive literature analysis. The objectives are selected because it is deduced that these are the important criterions to be considered when choosing a workspace for knowledge workers. In the following sections, a description is presented for each objective, the parent and child (i.e. objective and sub-objective) relationship in the hierarchy is established, and explanation is given for the relationship. The goal is to seek your expert opinion about the validity of the following: the objectives for this decision problem; the parent-child relationship; and the significance of each child for their parent. In addition, you are requested to provide your input and reasoning in case you would like to modify objective(s) or their description or their title. The process will help verify and validate the structure of the objective hierarchy. The description for attributes (measurement scale) is also provided (lowest level objectives are measured in terms of attributes). The goal is to validate the attributes for their respective objectives. Please follow the steps I through III, to complete this phase of the study.



Step I – Validation Of Level 0

Objective 0.0: Maximize the value of workspace.

Choosing a workspace type (static open vs. adaptable) is an investment decision for an organization. In accordance with investment decision theory, maximizing the value of this investment would be the key objective of decision makers. Therefore, the top-level objective of this decision problem is: "Maximize the value of workspace".

Step I – Validation Of Level 0

Objective 0.0: Maximize the value of workspace.

Choosing a workspace type (static open vs. adaptable) is an investment decision for an organization. In accordance with investment decision theory, maximizing the value of this investment would be the key objective of decision makers. Therefore, the top-level objective of this decision problem is: "Maximize the value of workspace".

Please answer the following questions for objective 0.0.

1.
Do you agree that the objective "maximize the value of workspace" is an appropriate top-level objective for this decision problem?
*

Agree Disagree Not sure

Step II – Validation of Level 1

Description for Level 1

Studies show that in knowledge-based organizations, workspace incurs huge subjective (indirect/intangible) costs because of its negative bearings on knowledge workers in terms of negative impacts on mood, psychology, health, mental health etc. These negative impacts are subjective in nature and cannot be converted into precise dollar figures but are shown to be the cause of huge productivity losses in the long run, thereby compromising the value of workspace investment for the respective organization. A strategically chosen workspace that aligns workspace with the needs of knowledge work and knowledge workers is argued to reduce these subjective costs and increase benefits. Consequently, the value of a workspace is actually a function of the following four components: direct costs of workspace, direct benefits of workspace, indirect costs of workspace, and indirect benefits of workspace. The direct components are not included in the objective hierarchy because inclusion of monetary components along with the non-monetary components is shown to increase the tendency to under assess the importance of non-financial consequences. However, budget can always be used as a constraint by a decision maker who possesses the flexibility to make a comparison between cost and utility, i.e. how much it is worth to increase the utility of subjective factors by a point. Therefore, the parent objective at level 0 ("maximize value of workspace") is proposed to have two children, 1.0 and 2.0, as listed below:

1.0 Minimize potential indirect costs of workspace,
2.0 Maximize potential indirect benefits of workspace.

These sub-objectives are discussed below.

Description and Questions for Objectives at Level 1

Objective 1.0: Minimize potential indirect costs of workspace.

EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur indirect (intangible/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997), which implies reduced net revenue for the organization.

Because, negative impacts of EGIAD are many such as, cognitive, emotional, health, etc, these are grouped into five key categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under the broader concept, physiological impacts whereas, mental well-being impacts like negative emotions, annoyance etc., are grouped under the broader concept, psychological impacts. Therefore, this parent objective is proposed to have five children, 1.1 through 1.5, as listed below.

1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

However, before we go further down the hierarchy, please answer the following questions regarding objective 1.0.

2.
In the stated decision context (if you didn't save the decision context on your system, please save it now. The decision context can be accessed through this link:

2.
In the stated decision context (if you didn't save the decision context on your system, please save it now. The decision context can be accessed through this link: Decision Context), **do you agree that minimizing potential indirect costs of workspace is a valid sub-objective of the objective "maximize the value of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not sure

3.
Do you agree that minimizing indirect costs of workspace is important to maximize the value of workspace for knowledge-based organization?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not sure

4.
Do you agree that minimizing potential indirect costs of workspace should be included in the objective hierarchy?
(Note: If you didn't save the important definitions on your system please save it now. The definitions for objective and objective hierarchy can be accessed through this link: Important Definitions.)
*

Agree Disagree Not sure

Objective 2.0: Maximize potential indirect benefits of workspace.

Two important input components of knowledge-based work are: individual work and group work. In terms of importance of one component over the other for their contribution to the output (knowledge worker's productivity), both the components have been shown to carry equal importance. Therefore, in knowledge-based organizations both the components of knowledge work should be equally supported by a workspace. A number of field studies provide evidence for this argument, where knowledge workers establish the support for concentration and collaboration from their workspace as the topmost functional requirement (Olson 2005, Heerwagen et. al 2004, Paul et al 2001). Consequently, this objective is proposed to have two sub-objectives, 2.1 and 2.2, as listed below:

2.1 Maximize workspace's support for individual concentrated work, and
2.2 Maximize workspace's support for collaborative group work.

However, before we go further down the hierarchy, please answer the following questions regarding objective 2.0.

5.
In the stated decision context (decision context - always open the link in a new window), **do you agree that maximizing potential indirect benefits of workspace is a valid sub-objective of the objective "maximize the value of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not sure

6.

Do you agree that maximizing potential indirect benefits of workspace is important to maximize the value of workspace for knowledge-based organization?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

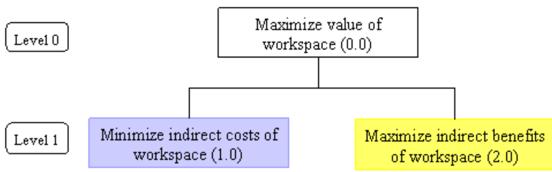
Agree Disagree Not sure

7.
In the stated decision context (decision context - always open the link in a new window), do you agree that maximizing indirect benefits of workspace should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not sure

Completeness and Redundancy checks for Partial OH at Level 1

The partial objective hierarchy (OH) at level 1 is shown below.



Note: For reference, the description for objectives 1.0 and 2.0 are copied below. If you remember these from above, you may skip reading the same.

Objective 1.0: Minimize potential indirect costs of workspace.
EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur indirect (intangible/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997), which implies reduced net revenue for the organization.
Because, negative impacts of EGIAD are many such as, cognitive, emotional, health, etc, these are grouped into five categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under the broader concept, physiological impacts whereas, mental well-being impacts like negative emotions, annoyance etc., are grouped under the broader concept, psychological impacts. Therefore, this parent objective is proposed to have five children, 1.1 through 1.5, as listed below.
1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Maximize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

Objective 2.0: Maximize potential indirect benefits of workspace.
Two important input components of knowledge-based work are: individual work and group work. In terms of importance of one component over the other for their contribution to the output (knowledge worker's productivity), both the components have been shown to carry equal importance. Therefore, in knowledge-based organizations both the components of knowledge work should be equally supported by a workspace. A number of field studies provide evidence for this argument, where knowledge workers establish the support for concentration and collaboration from their workspace as the topmost functional requirement (Olson 2005, Heerwagen et. al 2004, Paul et al 2001). Consequently, this objective is proposed to have two sub-objectives 2.1 and 2.2 as listed below.
2.1 Maximize workspace's support for individual concentrated work,
2.2 Maximize workspace's support for collaborative group work.

Please answer the following questions regarding this partial OH.

8.
Do you agree that the two sub-objectives 1.0 and 2.0 are sufficient to cover all the significant aspects of objective 0.0?
*

Agree Disagree Not sure

9.
According to the descriptions for sub-objectives 1.0 and 2.0, do you agree that the two sub-objectives are mutually exclusive? (Note: i.e., a particular value item can either be an indirect cost or a benefit but not both.)
*

Agree Disagree Not sure

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41%

AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

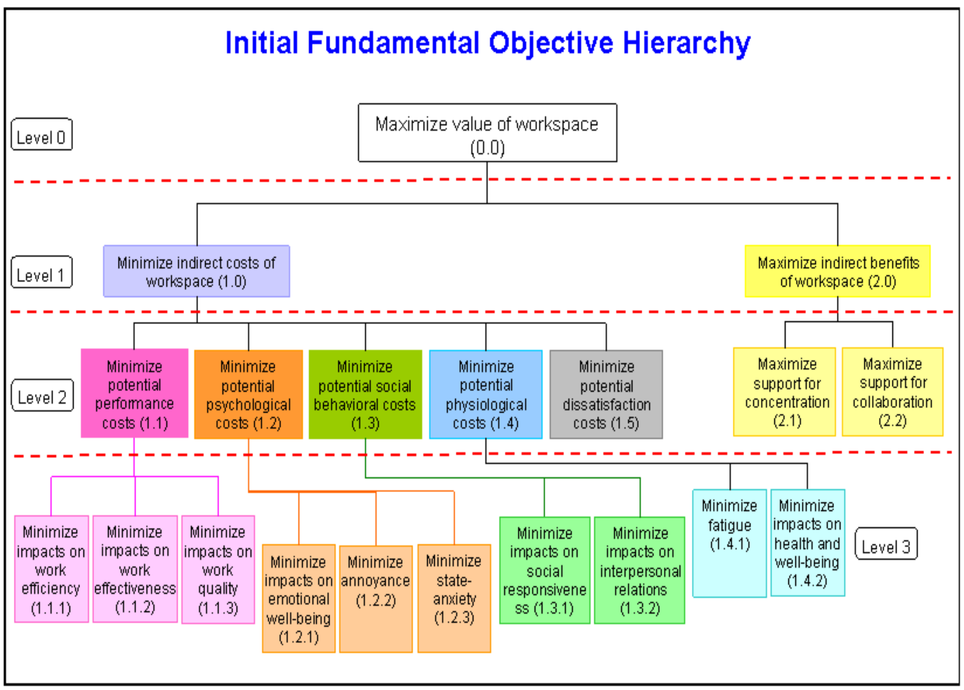
Page 3 - VALIDATION OF LEVELS 2 AND 3 OF THE OBJECTIVE HIERARCHY

*This is to remind you that once you start this page, to be able to save your data you will be required to finish this page and click the "**Go to the Next Page**" button at the bottom of the page. So, please consider the length of the page and the time available to finish the page. To close the questionnaire so as to get back to the same later, just close the page. Click on the survey link in your email, to get back to the questionnaire at any time. All questions are required (*).*

Step III – Validation of Levels 2 and 3

The descriptions and questions on pages 3 through 9 are dedicated to objectives at levels 2 and 3 of the objective hierarchy (OH). Because of increase in number of twigs at levels 2 and 3, each page from page 3 to 9, is designed to capture the data for one objective at level 2 and its further sub-divisions. The lowest level objectives are established using the following criterion: the objective is measurable; in accordance with the literature the lowest level objectives are sufficient to capture the important aspects of its parent objective within the scope of the decision context; and further splitting may complicate the model without imparting any benefit in the evaluation of alternatives. Attributes (evaluation measures / performance metrics) are described for all lowest level objectives followed by the questions to validate the attribute.

Note: The objective hierarchy is copied below for reference.



Descriptions and Questions for Objective 1.1 and further down the hierarchy

Note: Description of objective 1.0 at level 1 is copied below for reference.

Level 1, Objective 1.0: Minimize indirect costs of workspace.
EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur huge intangible (indirect/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997).

Descriptions and Questions for Objective 1.1 and further down the hierarchy

Note: Description of objective 1.0 at level 1 is copied below for reference.

Level 1, Objective 1.0: Minimize indirect costs of workspace.

EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur huge intangible (indirect/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997).

Because, negative impacts of EGIAD are many such as, cognitive, emotional, health, etc, these are grouped into five categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under the broader concept, physiological impacts whereas mental well-being impacts like negative emotions, annoyance, are grouped under the broader concept, psychological impacts. Therefore, this parent objective is proposed to have five children 1.1 through 1.5 as listed below.

1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

Level 2, Objective 1.1: Minimize potential performance costs of distractions (EGIAD).

In the literature, performance of knowledge workers is generally measured through work efficiency (speed to work), work quality (errors), and work effectiveness (newness or novelty). Research shows that EGIAD negatively impacts all the three components of knowledge worker's performance, where worker's performance in knowledge-based organizations is shown to have significant positive correlation with organizational productivity. Therefore, it is assumed that if the possible impacts of EGIAD on work efficiency, work quality, and work effectiveness are minimized, then the potential performance costs of distractions (EGIAD) can be minimized. To this end, this parent objective is proposed to have three children, 1.1.1 through 1.1.3, as listed below.

1.1.1 Minimize possible negative impacts of EGIAD on work efficiency of knowledge workers when concentrating,
1.1.2 Minimize possible negative impacts of EGIAD on work effectiveness of knowledge workers, and
1.1.3 Minimize possible negative impacts of EGIAD on work quality of knowledge workers.

However, before we go further down the hierarchy, please answer the following questions regarding objective 1.1.

10.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing potential performance costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

11.
Do you agree that minimizing potential performance costs resulting from EGIAD is important to minimize the potential indirect costs of workspace for knowledge-based organizations?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

12.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing potential performance costs resulting from EGIAD should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Level 3, Objective 1.1.1: Minimize possible negative impacts of EGIAD on work efficiency of knowledge workers when concentrating.

Work efficiency in this study implies speed to completion of a task or time taken to finish the task. When knowledge workers are concentrating on work, EGIAD

Level 3, Objective 1.1.1: Minimize possible negative impacts of EGIAD on work efficiency of knowledge workers when concentrating.

Work efficiency in this study implies speed to completion of a task or time taken to finish the task. When knowledge workers are concentrating on work, EGIAD results in unintended time loss, which is equal to the time for which the distraction lasted plus the time for reaching the same state of concentration as before getting distracted (Spira and Feintuch, 2005; Solingen et al., 1998). Once distracted, a person can take up to fifteen minutes of ramp-up time to reach the same state of concentration (attention and involvement) as before (Demarco and Lister, 1993, 1999). This is an intangible cost on knowledge workers' performance that accrues over time to cause huge performance losses, thereby increasing knowledge workers' performance costs as the time taken to finish the task at hand is probably increased. Also, many times to avoid such unnecessary and unintended impacts on work efficiency workers tend to find alternate ways of working, like working early mornings or late evenings, working in conference rooms, working from home etc., which is further shown to impact negatively work efficiency because of plausible lack of connectedness between alternative modes of working, like notes left on the previous location of work, time spent in finding a vacant conference room, etc.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.1.1.

13.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing potential negative impacts of EGIAD on work efficiency of knowledge workers is a valid sub-objective of the objective "minimize potential performance costs of distractions (EGIAD)"?
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

14.
Do you agree that minimizing potential negative impacts of EGIAD on work efficiency of knowledge workers when they are concentrating is important to minimize the potential performance costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

15.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on work efficiency of knowledge workers should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not sure

Attribute for Objective 1.1.1

Objective 1.1.1 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) to measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowledge workers (or users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of the impacts of distractions (externally generated auditory distractions) on their work efficiency when trying to concentrate. 1 = "not at all or very little" is the best level of the attribute, and 5 = "extremely significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize negative impacts of distractions on work efficiency	Participant's perception about strength of impacts of distractions on work	1	Not at all	I feel distractions have no impact on work efficiency.
		2	A little	I feel distractions have a little impact on work efficiency.
		3	Moderate	I feel distractions have a moderate impact on work efficiency.

significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Minimize negative impacts of distractions on work efficiency	Participant's perception about strength of impacts of distractions on work efficiency	1	Not at all	I feel distractions have no impact on work efficiency.
		2	A little	I feel distractions have a little impact on work efficiency.
		3	Moderate	I feel distractions have a moderate impact on work efficiency.
		4	Significant	I feel distractions have a significant impact on work efficiency.
		5	Very significant	I feel distractions have a very significant impact on work efficiency.

Please answer the following questions regarding the attribute for objective 1.1.1.

16.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree   Disagree   Not sure

17.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree   Disagree   Not sure

18.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree   Disagree   Not sure

19.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree   Disagree   Not sure

Level 3, Objective 1.1.2: Minimize possible negative impacts of EGIAD on work effectiveness (i.e. newness) of knowledge workers.

EGIAD (distractions) is a naturally occurring and a continuous phenomenon in office environments, especially in open plan offices. Theories of overload describe these "distractions as demands that exceed a person's capacity. Overload occurs when information comes faster than it can be assimilated and dealt with". These extra demand on cognitive abilities due to EGIAD causes cognitive fatigue, which reduces knowledge worker's subsequent readiness to perform (an aftereffect of being exposed to EGIAD). The attention narrows down and works on easily available routine cues rather than exploring in detail complex alternative ways to finish the task. This phenomenon is called cognitive economy. Glass and Singer (1972) showed the occurrence of cognitive economy phenomenon through a series of

Level 3, Objective 1.1.2: Minimize possible negative impacts of EGIAD on work effectiveness (i.e. newness) of knowledge workers.

EGIAD (distractions) is a naturally occurring and a continuous phenomenon in office environments, especially in open plan offices. Theories of overload describe these "distractions as demands that exceed a person's capacity. Overload occurs when information comes faster than it can be assimilated and dealt with". These extra demand on cognitive abilities due to EGIAD causes cognitive fatigue, which reduces knowledge worker's subsequent readiness to perform (an aftereffect of being exposed to EGIAD). The attention narrows down and works on easily available routine cues rather than exploring in detail complex alternative ways to finish the task. This phenomenon is called cognitive economy. Glass and Singer (1972) showed the occurrence of cognitive economy phenomenon through a series of experiments where they used task persistence as an aftereffect measurement index. Individuals exposed to uncontrollable distractions showed diminishing inclination to solve challenging puzzles. This is an intangible negative impact on knowledge worker's effectiveness to perform whereby, the most valuable characteristic of knowledge work, i.e. newness, is compromised.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.1.2.

20.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing potential negative impacts of EGIAD on work effectiveness of knowledge workers is a valid sub-objective of the objective "minimize potential performance costs of distractions (EGIAD)"?
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not sure

21.
Do you agree that minimizing potential negative impacts of EGIAD on work effectiveness of knowledge workers is important to minimize the potential performance costs of distractions ?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not sure

22.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on work effectiveness of knowledge workers should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not sure

Attribute for Objective 1.1.2

Objective 1.1.2 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowlec workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of the impacts of distractions (externa generated auditory distractions) on their work effectiveness. 1 = "not at all or very little" is the best level of the attribute, and 5 = "extremely significant" is the wo level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on work effectiveness of knowledge	Measure the perceived impact of EGIAD on work effectiveness of knowledge workers.	1	Not at all or very little	EGIAD is perceived to cause no or very little impact on work effectiveness (newness, creativity), which is ignorable in reference to negative impact on overall productivity.
		2	A little	Cognitive overloading (mental fatigue) resulting from EGIAD is negligible because mostly it helps in refreshing and gaining information. Therefore, EGIAD is perceived to cause little impact on work effectiveness but it is considered ignorable in reference to negative impact on overall productivity.

Attribute for Objective 1.1.2

Objective 1.1.2 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowled workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of the impacts of distractions (externa generated auditory distractions) on their work effectiveness. 1 = "not at all or very little" is the best level of the attribute, and 5 = "extremely significant" is the wo level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on work effectiveness of knowledge workers.	Measure the perceived impact of EGIAD on work effectiveness of knowledge workers.	1	Not at all or very little	EGIAD is perceived to cause no or very little impact on work effectiveness (newness, creativity), which is ignorable in reference to negative impact on overall productivity.
		2	A little	Cognitive overloading (mental fatigue) resulting from EGIAD is negligible because mostly it helps in refreshing and gaining information. Therefore, EGIAD is perceived to cause little impact on work effectiveness but it is considered ignorable in reference to negative impact on overall productivity.
		3	Moderate	Cognitive Overloading (mental fatigue) resulting from EGIAD is considerable to cause moderate impact on work effectiveness (newness, creativity). This cannot be ignored in reference to negative impact on overall productivity.
		4	Significant	Cognitive Overloading (mental fatigue) resulting from EGIAD is considerable to cause significant impact on work effectiveness (newness, creativity). This cannot be ignored in reference to negative impact on overall productivity.
		5	Extremely significant	Cognitive Overloading (mental fatigue resulting from EGIAD is considerable to cause extremely significant impact on work effectiveness (newness, creativity). This cannot be ignored in reference to negative impact on overall productivity.

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23.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree Disagree Not sure

24.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not sure

25.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not sure

26.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent the significant categories of measurement of the objective?
*

Agree Disagree Not sure

Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent the significant categories of measurement of the objective?
*

Agree Disagree Not sure

Level 3, Child Objective 1.1.3: Minimize possible negative impacts of EGIAD on work quality (i.e. errors) of knowledge workers.

According to various quality assurance models like, Capability Maturity Model, number of errors is one of the many quality measures for knowledge work. As the number of errors increases, the quality of work deteriorates, the rework increases, and thus the cost of production increases. Depending on the criticalness of the work either the quality plummets sharply or marginalizes proportionately. Research shows that when knowledge workers are concentrating on work, diversion of focus resulting from EGIAD increases the potential for errors, thereby decreasing the quality of the work and increasing overall costs.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.1.3.

27.
In the stated decision context (decision context - always open the link in a new window)**, do you agree that minimizing potential negative impacts of EGIAD on work quality of knowledge workers is a valid sub-objective of the objective "minimize potential performance costs of distractions (EGIAD)"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not sure

28.
Do you agree that minimizing potential negative impacts of EGIAD on work quality of knowledge workers is important to minimize the potential performance costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not sure

29.
In the stated decision context (decision context - always open the link in a new window)**, do you agree that minimizing possible negative impacts of EGIAD on work quality of knowledge workers should be included in the objective hierarchy?**
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not sure

Attribute for Objective 1.1.3

Objective 1.1.3 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a meausrement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowlec workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of impacts of EGIAD on their work quality = "not at all or very little" is the best level of the attribute and 5 = "extremely significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Minimize possible negative impacts of EGIAD on	Measure the perceived impact of EGIAD on work quality	1	Not at all or very little	EGIAD is perceived to have no or very little impact on work quality, which is ignorable in reference to negative impact on overall productivity.
		2	A little	Diversion of focus resulting from EGIAD is perceived to have a little impact on work

Attribute for Objective 1.1.3

Objective 1.1.3 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a meausrement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowlec workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of impacts of EGIAD on their work quality = "not at all or very little" is the best level of the attribute and 5 = "extremely significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on work quality of knowledge workers.	Measure the perceived impact of EGIAD on work quality of knowledge workers.	1	Not at all or very little	EGIAD is perceived to have no or very little impact on work quality, which is ignorable in reference to negative impact on overall productivity.
		2	A little	Diversion of focus resulting from EGIAD is perceived to have a little impact on work quality, which is ignorable in reference to negative impact on overall productivity
		3	Moderate	Diversion of focus resulting from EGIAD is perceived to have a moderate impact on work quality, which cannot be ignored in reference to negative impact on overall productivity.
		4	Significant	Diversion of focus resulting from EGIAD is perceived to have a significant impact on work quality, which cannot be ignored in reference to negative impact on overall productivity.
		5	Extremely significant	Diversion of focus resulting from EGIAD is perceived to have an extremely significant impact on work quality, which cannot be ignored in reference to negative impact on overall productivity.

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30.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree Disagree Not sure

31.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not sure

32.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not sure

33.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree Disagree Not sure

Completeness and Redundancy checks for Partial OH at Level 3

The partial objective hierarchy at level 3 for "potential performance costs" is shown below.

Level 2

Minimize potential performance costs (1.1)

Level 3

Minimize impacts on work efficiency (1.1.1)

Minimize impacts on work effectiveness (1.1.2)

Minimize impacts on work quality (1.1.3)

Note: For reference, the descriptions for objectives 1.1.1, 1.1.2, and 1.1.3 are copied below. If you remember these from above, you may skip reading the same.

Objective 1.1.1: Minimize possible negative impacts of EGIAD on work efficiency of knowledge workers when concentrating.
Work efficiency in this study implies speed to completion of a task or time taken to finish the task. When knowledge workers are concentrating on work, EGIAD results in unintended time loss, which is equal to the time for which the distraction lasted plus the time for reaching the same state of concentration as before getting distracted (Spira and Feintuch, 2005; Solingen et al., 1998). Once distracted, a person can take up to fifteen minutes of ramp-up time to reach the same state of concentration (attention and involvement) as before (Demarco and Lister, 1993, 1999). This is an intangible cost on knowledge workers' performance that accrues over time to cause huge performance losses, thereby increasing knowledge workers' performance costs as the time taken to finish the task at hand is probably increased. Also, many times to avoid such unnecessary and unintended impacts on work efficiency workers tend to find alternate ways of working, like working early mornings or late evenings, working in conference rooms, working from home etc., which is further shown to impact negatively work efficiency because of plausible lack of connectedness between alternative modes of working, like notes left on the previous location of work, time spent in finding a vacant conference room, etc.

Objective 1.1.2: Minimize possible negative impacts of EGIAD on work effectiveness (i.e. newness) of knowledge workers.
EGIAD (distractions) is a naturally occurring and a continuous phenomenon in office environments, especially in open plan offices. Theories of overload describe these distractions as demands that exceed a person's capacity. Overload occurs when information comes faster than it can be assimilated and dealt with. These extra demand on cognitive abilities due to EGIAD causes cognitive fatigue, which reduces knowledge worker's subsequent readiness to perform (an aftereffect of being exposed to EGIAD). The attention narrows down and works on easily available routine cues rather than exploring in detail complex alternative ways to finish the task. This phenomenon is called cognitive economy. Glass and Singer (1972) showed the occurrence of cognitive economy phenomenon through a series of experiments where they used task persistence as an aftereffect measurement index. Individuals exposed to uncontrollable distractions showed diminishing inclination to solve the challenging puzzles. This is an intangible negative impact on knowledge worker's effectiveness to perform whereby, the most valuable characteristic of knowledge work, i.e. newness, is compromised.

Objective 1.1.3: Minimize possible negative impacts of EGIAD on work quality (i.e. errors) of knowledge workers.
According to various quality assurance models like, Capability Maturity Model, number of errors is one of the many quality measures for knowledge work. As the number of errors increases, the quality of work deteriorates, the rework increases, and thus the cost of production increases. Depending on the criticalness of the work either the quality plummets sharply or marginalizes proportionately. Research shows that when knowledge workers are concentrating on work, diversion of focus resulting from EGIAD increases the potential for errors, thereby decreasing the quality of the work and increasing overall costs.

Please answer the following questions regarding this partial objective hierarchy.

34.
Do you agree that the three sub-objectives 1.1.1 through 1.1.3 are sufficient to cover all the significant aspects of objective 1.1?
*

Agree Disagree Not sure

35.
According to the descriptions for sub-objectives 1.1.1, 1.1.2 and 1.1.3 (decsriptions are copied above for reference), do you agree that the three sub-objectives are mutually exclusive?
(Note: a particular performance cost like increase in time to complete a job because the person was distracted thrice, can be assigned to exactly one of the three sub-objectives, which in this case will be objective 1.1.1)
*

Agree Disagree Not sure

Go to the Previous page | Go to the Next Page

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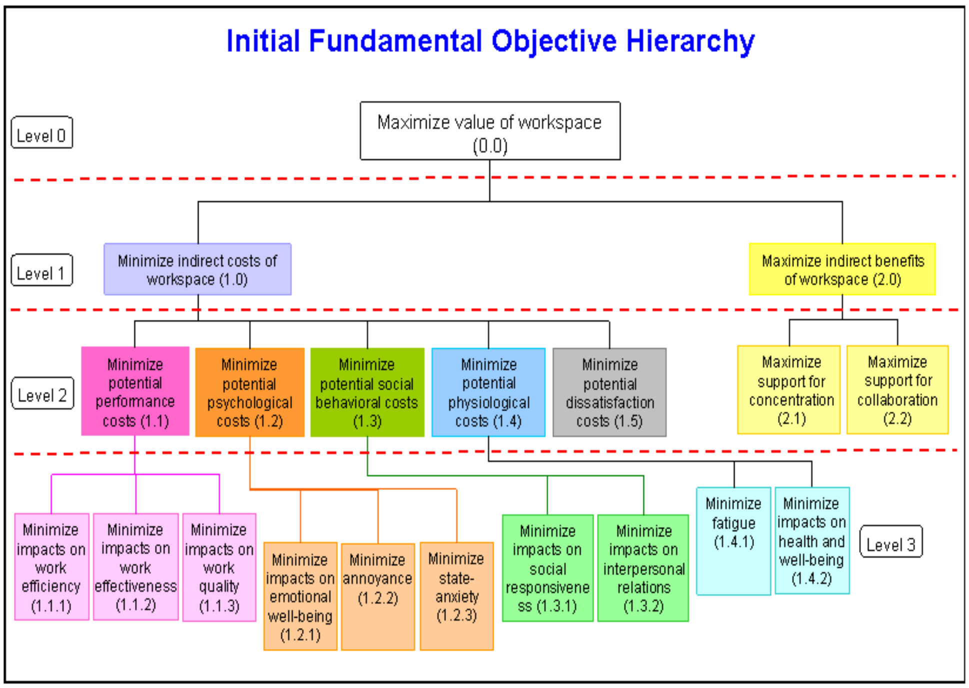
AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Page 4 - VALIDATION OF LEVELS 2 AND 3 OF THE OBJECTIVE HIERARCHY Continued

*This is to remind you that once you start this page, to be able to save your data you will be required to finish this page and click the "**Go to the Next Page**" button at the bottom of the page. So, please consider the length of the page and the time available to finish the page. To close the questionnaire so as to get back to the same later, just close the page. Click on the survey link in your email, to get back to the questionnaire at any time. All questions are required (*).*

Step III – Validation of Levels 2 and 3 Continued

Note: The objective hierarchy is copied below for reference.



Descriptions and Questions for Objective 1.2 and further down the hierarchy

Note: Description of objective 1.0 at level 1 is copied below for reference.

Level 1, Objective 1.0: Minimize indirect costs of workspace

EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur huge intangible (indirect/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997).

Because, negative impacts of EGIAD are many such as, cognitive, emotional, health, etc, these are grouped into five categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under the broader concept, physiological impacts whereas mental well-being impacts like negative emotions, annoyance, are grouped under the broader concept, psychological impacts. Therefore, this parent objective has five children 1.1 through 1.5 as listed below.

1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and

1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

Level 2, Objective 1.2: Minimize potential psychological well-being costs of distractions (EGIAD).

In medical care literature, "psychological well-being pertains to positive and negative affective states such as feeling enthusiastic, cheerful, interested, happy, anxious, depressed, or blue etc". These states are considered good indicators of mental health at a particular moment or as a whole. Research on non-auditory impacts (other than hearing loss) of noise identifies EGIAD as potential stimuli for reducing psychological well-being of knowledge workers. These impacts are indirect like, reduced task motivation, reduced aspiration etc., and subjective in nature and depend very much on the subject's sensitivity on the whole or on a particular day. Nevertheless, the shown outcomes are the same: reduced or lost productivity because of increased absenteeism; increased attrition; or reduced aspiration etc. Generally, subjects have expressed these costs through negative emotional states (alike medical care literature), increased annoyance, and increased anxiety. Therefore, it is assumed that if the possible impacts of distractions on emotional state, annoyance, and anxiety are minimized, then the potential psychological well-being costs of distractions for knowledge workers can be minimized. Therefore, this parent objective is proposed to have three children, 1.2.1 through 1.2.3, as listed below.

1.2.1 Minimize possible negative impacts of EGIAD on emotional well-being of knowledge workers,
1.2.2 Minimize possible annoyance resulting from EGIAD, and
1.2.3 Minimize possible state-anxiety resulting from EGIAD.

However, before we go further down the hierarchy, please answer the following questions regarding objective 1.2.

36.
In the stated decision context (decision context - **always open the link in a new window**)**, do you agree that minimizing potential psychological costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

37.
Do you agree that minimizing potential psychological costs resulting from EGIAD is important to minimize the potential indirect costs of workspace?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

38.
In the stated decision context (decision context - **always open the link in a new window**)**, do you agree that minimizing potential psychological costs resulting from EGIAD should be included in the objective hierarchy?**
(Important Definitions - **always open the link in a new window**)
*

Agree Disagree Not Sure

Level 3, Objective 1.2.1: Minimize possible negative impacts of EGIAD on emotional well-being (feeling) of knowledge workers.

Emotional feeling (or well-being) is a subjective phenomenon that consists of positive and negative components. The positive component generally includes concepts such as excitement, enthusiasm, motivation, aspiration, activation, pleasant mood etc. and the negative component generally includes concepts such as frustration, anger, irritation, disgust, fearfulness, unpleasant mood, and depression etc. Research shows that lack of control over distractions coming from surrounding work environment (EGIAD) shifts the emotional level of individuals towards the negative side, in some cases causing extreme distress depending on the sensitivity of an individual towards the surrounding noise, thereby accruing psychological well-being costs for knowledge workers. Glass and Singer (1972) showed that office noise is significantly associated with psychological well-being of office workers. It changes the mood of an individual, reduces tolerance for frustration, changes the perception of competence (Jones, 1984), influences the amount of effort needed to be put into the task (Cohen 1969, Miller 1974, Schulz and Schonpflug, 1982) etc. These demoralized perceptions and negative emotions cannot be seen and measured directly, however they bear huge costs for overall well-being of an individual and thus for their organizations.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.2.1.

39.

In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing potential negative impacts of EGIAD on emotional well-being of knowledge workers is a valid sub-objective of the objective "minimize potential psychological costs of distractions (EGIAD)"?**

(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)

*

Agree Disagree Not Sure

40.

Do you agree that minimizing potential negative impacts of EGIAD on emotional well-being of knowledge workers is important to minimize the potential psychological costs of distractions?

(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)

*

Agree Disagree Not Sure

41.

In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing possible negative impacts of EGIAD on emotional well-being of knowledge workers should be included in the objective hierarchy?**

(Important Definitions - always open the link in a new window)

*

Agree Disagree Not Sure

Objective 1.2.1 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. The PANAS Scale (Watson, Clark Tellegen, 1988) is employed to measure the emotional well-being of knowledge workers. The PANAS (Positive and Negative Affect Schedule) consists of positive affects and 10 negative affects. According to the scale, knowledge workers (i.e. users of workspace) will be asked to rate items (shown in table 1) on a point Likert scale (from 1 to 5) based on the strength of their emotion. 1 = "not at all or very little" is the best level of the attribute and 5 = "extremely significant" the worst level of the attribute. Item responses will be averaged for a mean score to obtain the perception of emotional well-being.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on emotional well-being of knowledge workers.	Measure the perceived impact of EGIAD on emotional well-being of knowledge workers.	1	Not at all or very little	EGIAD is perceived to have no or very little impact on emotional well-being of knowledge workers, which is ignorable in reference to negative impact on overall productivity.
		2	A little	EGIAD is perceived to have a little impact on emotional well-being of knowledge workers, which is ignorable in reference to negative impact on overall productivity.
		3	Moderate	EGIAD is perceived to shift the emotional feelings towards negative side, thereby impacting the emotional well-being moderately. This cannot be ignored in reference to negative impact on overall productivity.
		4	Significant	EGIAD is perceived to shift the emotional feelings towards negative side quite a bit, thereby impacting the emotional well-being significantly. This cannot be ignored in reference to negative impact on overall productivity.
		5	Extremely significant	EGIAD is perceived to shift the emotional feelings towards negative side quite a lot, thereby impacting the emotional well-being extremely significantly. This cannot be ignored in reference to negative impact on overall productivity.

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42. **Do you agree that the attribute is measuring the objective?**
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.) *

Agree Disagree Not Sure

43.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

44.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

45.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Level 3, Objective 1.2.2. Minimize annoyance resulting from EGAID.

"Noise annoyance is defined as an evaluative response towards the sound and its source, including both emotional ('nuisance', 'unpleasantness'), and cognitive ('disturbance', 'interference') aspects" (Zimmer et al, 2008). It is generally expressed or reported by subjects as a feeling of displeasure, irritation, adversiveness, being bothered, being disturbed, or being troubled. Noise annoyance is also a transient phenomenon, as the same sound possesses the potential to cause annoyance at one time and no effect at another time. Many stimuli that an individual is at first neutral to, or even finds pleasant, can turn into annoyances with repeated continued exposure. For instance, Zimmer et al (2008) showed that subjects performing the memory task judged a speech sample "slightly" annoying at the outset, however they judged the same speech to be "very" annoying while in the middle of the task. After the task completion, the annoyance rating again dropped to the intermediate level. Annoyance can escalate to extreme levels especially when the perceived cause of noise is another person and the issue goes unresolved.
Research shows that office noise (speech and non-speech) is among the most prevalent annoyance sources in workplace settings in the U.S. (Becker, 1981, Sundstrom 1986, Harris, 1978). Furthermore, noise is perceived as more annoying when performing complex cognitive tasks (which is one of the key characteristics of knowledge-based work), because it tends to interfere with the on-going activity. (Kjellberg and Ladstrom, 1994, Moran and Loeb, 1977). The long terms impacts include reduced feeling of overall well-being.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.2.2.

46.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing annoyance resulting from EGIAD is a valid sub-objective of the objective "minimize potential psychological costs of distractions (EGIAD)"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

47.
Do you agree that minimizing annoyance resulting from EGIAD is important to minimize the potential psychological costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

48.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing annoyance resulting from EGIAD should be included in the objective hierarchy?

(Important Definitions - always open the link in a new window)

*

Agree Disagree Not Sure

Attribute for Objective 1.2.2

Objective 1.2.2 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. The scale is adapted from the ear study by (van Dijk et al. 1987, Zimmer et al. 2008). According to the scale, knowledge workers (i.e. users of workspace) will be asked to respond on a 5-po Likert scale (from 1 to 5) about their perception of noise as "annoyance" or "psychologically disturbing" or "unpleasant". 1 = "not at all or very little" is the best le of the attribute, and 5 = "extremely significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize annoyance resulting from EGIAD.	Measure the strength of perception of EGIAD as annoyance or psychologically disturbing or being unpleasant.	1	Not at all or very little	EGIAD is perceived to cause no or very little annoyance, which is ignorable in reference to negative impact on overall productivity.
		2	A little	EGIAD is perceived to cause a little annoyance, which is ignorable in reference to negative impact on overall productivity because it is described as refreshing and informative.
		3	Moderate	Annoyance resulting from is moderate, which cannot be ignored in reference to negative impact on overall productivity.
		4	Significant	Annoyance resulting from is significant, which cannot be ignored in reference to negative impact on overall productivity.
		5	Extremely significant	Annoyance resulting from is extremely significant, which cannot be ignored in reference to negative impact on overall productivity.

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49. **Do you agree that the attribute is measuring the objective?**
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.) *

Agree Disagree Not Sure

50.
Do you agree with the response format for various levels, 1 through 5, of the attribute?

*

Agree Disagree Not Sure

51.
Do you agree with the description for various levels, 1 through 5, of the attribute?

*

Agree Disagree Not Sure

52.

52.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent the significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Level 3, Objective 1.2.3. Minimize possible negative impacts of EGIAD on state-anxiety of knowledge workers.

State-anxiety reflects a "transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity" (Charles D. Spielberger, Richard L. Gorusch, and Robert E. Lushene). State-anxiety may fluctuate over time and can vary in intensity depending on the amount of psychological stress, the character of cognitive demands, and relaxation training. Spielberger (1970) states that "state-anxiety, like kinetic energy, refers to an empirical process or reaction taking place at a particular moment in time and at a given level of intensity. Anxiety and noise studies consistently conclude that relatively low levels of environmental noise, like noise in open plan office, significantly affect the levels of induced anxiety, which accrues considerable risk in terms of increased stress and reduced psychological well-being of individuals (Edsell, 1976, Standing and Stage, 1980).

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.2.3.

53.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on state-anxiety of knowledge workers is a valid sub-objective of the objective "minimize potential psychological costs of distractions (EGIAD)"?
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

54.
Do you agree that minimizing possible negative impacts of EGIAD on state-anxiety of knowledge workers is important to minimize the potential psychological costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

55.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on state-anxiety of knowledge workers should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 1.2.3

Objective 1.2.3 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. The scale is adapted from the "State-T Anxiety inventory (STAI)". According to the scale, knowledge workers (i.e. users of workspace) will be asked to rate items (shown in table 2) on a 5-point Lik scale (from 1 to 5) about their perception of increase in anxiety due to EGIAD. 1 = "not at all or very little" is the best level of the attribute, and 5 = "extrem significant" is the worst level of the attribute. Item responses will be averaged for a mean score to obtain the perception of state-anxiety.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible	Measure the perceived	1	Not at all or very little	EGIAD is perceived to have no or very little impact on state-anxiety of knowledge workers, which is ignorable in reference to negative impact on overall productivity

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on state-anxiety of knowledge workers.	Measure the perceived impact of EGIAD on state-anxiety of knowledge workers.	1	Not at all or very little	EGIAD is perceived to have no or very little impact on state-anxiety of knowledge workers, which is ignorable in reference to negative impact on overall productivity.
		2	A little	EGIAD is perceived to have a little impact on state-anxiety of knowledge workers, which is ignorable in reference to negative impact on overall productivity.
		3	Moderate	EGIAD is perceived to have moderate impact on state-anxiety of knowledge workers. This cannot be ignored in reference to negative impact on overall productivity.
		4	Significant	EGIAD is perceived to have significant impact on state-anxiety of knowledge workers. This cannot be ignored in reference to negative impact on overall productivity.
		5	Extremely significant	EGIAD is perceived to have extremely significant impact on state-anxiety of knowledge workers. This cannot be ignored in reference to negative impact on overall productivity.

56.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree Disagree Not Sure

57.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

58.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

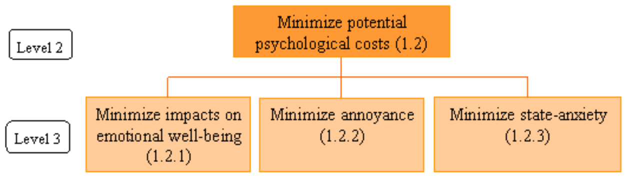
Agree Disagree Not Sure

59.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent the significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Completeness and Redundancy checks for Partial OH at Level 3

The partial objective hierarchy at level 3 for "potential psychological costs" is shown below.



Note: For reference, the descriptions for objectives 1.2.1, 1.2.2, and 1.2.3 are copied below. If you remember these from above, you may skip reading the same.

Objective 1.2.1: Minimize possible negative impacts of EGIAD on emotional well-being of knowledge workers.
Emotional feeling (or well-being) is a subjective phenomenon that consists of positive and negative components. The positive component generally includes concepts such as excitement, enthusiasm, motivation, aspiration, activation, pleasant mood etc. and the negative component generally includes concepts such as frustration, anger, irritation, disgust, fearfulness, unpleasant mood, and depression etc. Research shows that lack of control over distractions coming from surrounding work environment (EGIAD) shifts the emotional level of individuals towards the negative side, in some cases causing extreme distress depending on the sensitivity of an individual towards the surrounding noise, thereby accruing psychological well-being costs for knowledge workers. Glass and Singer (1972) showed that office noise is significantly associated with psychological well-being of office workers. It changes the mood of an individual, reduces tolerance for frustration, changes the perception of competence (Jones, 1984), influences the amount of effort needed to be put into the task (Cohen 1969, Miller 1974, Schulz and Schonpflug, 1982) etc. These demoralized perceptions and negative emotions cannot be seen and measured directly, however they bear huge costs for overall well-being of an individual and thus for their organizations.

Objective 1.2.2: Minimize annoyance resulting from EGIAD.
"Noise annoyance is defined as an evaluative response towards the sound and its source, including both emotional ('nuisance', 'unpleasantness'), and cognitive ('disturbance', 'interference') aspects" (Zimmer et al, 2008). It is generally expressed or reported by subjects as a feeling of displeasure, irritation, adversiveness, being bothered, being disturbed, or being troubled. Noise annoyance is also a transient phenomenon, as the same sound possesses the potential to cause annoyance at one time and no effect at another time. Many stimuli that an individual is at first neutral to, or even finds pleasant, can turn into annoyances with repeated continued exposure. For instance, Zimmer et al (2008) showed that subjects performing the memory task judged a speech sample "slightly" annoying at the outset, however they judged the same speech to be "very" annoying while in the middle of the task. After the task completion, the annoyance rating again dropped to the intermediate level. Annoyance can escalate to extreme levels especially when the perceived cause of noise is another person and the issue goes unresolved.
Research shows that office noise (speech and non-speech) is among the most prevalent annoyance sources in workplace settings in the U.S. (Becker, 1981, Sundstrom 1986, Harris, 1978). Furthermore, noise is perceived as more annoying when performing complex cognitive tasks (which is one of the key characteristics of knowledge-based work), because it tends to interfere with the on-going activity. (Kjellberg and Ladstrom, 1994, (Moran and Loeb, 1977). The long terms impacts include reduced feeling of overall well-being.

Objective 1.2.3: Minimize possible negative impacts of EGIAD on state-anxiety of knowledge workers.
State anxiety reflects a "transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity" (Charles D. Spielberger, Richard L. Gorusch, and Robert E. Lushene). State anxiety may fluctuate over time and can vary in intensity depending on the amount of psychological stress, the character of cognitive demands, and relaxation training. Spielberger (1970) states that "state anxiety, like kinetic energy, refers to an empirical process or reaction taking place at a particular moment in time and at a given level of intensity. Anxiety/noise studies consistently conclude that relatively low levels of environmental noise, like noise in open plan office, significantly affect the levels of induced anxiety, which accrues considerable risk in terms of increased stress and reduced psychological well-being of individuals (Edsell, 1976, Standing and Stage, 1980).

Please answer the following questions regarding this partial objective hierarchy.

60.
Do you agree that the three sub-objectives, 1.2.1 through 1.2.3, are sufficient to cover all the significant aspects of objective 1.2?
*

Agree Disagree Not Sure

61.
According to the descriptions for sub-objectives 1.2.1, 1.2.2 and 1.2.3 (decsriptions are copied above for reference)**, do you agree that the three sub-objectives are mutually exclusive?**
(Note: i.e. a particular psychological cost like feeling low because of lack of control over people talking in neighboring workspaces, can be assigned to exactly one of the three sub-objectives, which in this case will be objective 1.2.1)
*

Agree Disagree Not Sure

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AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Page 5 - VALIDATION OF LEVELS 2 AND 3 OF THE OBJECTIVE HIERARCHY Continued

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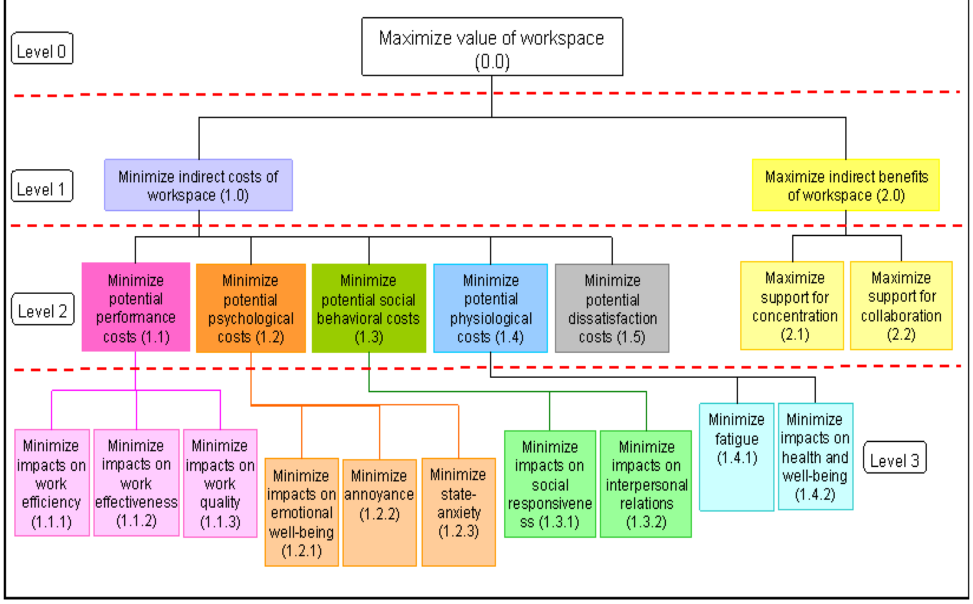
Step III – Validation of Levels 2 and 3 Continued

Note: The objective hierarchy is copied below for reference.

Initial Fundamental Objective Hierarchy



Descriptions and Questions for Objective 1.3 and further down the hierarchy

Note: Description of objective 1.0 at level 1 is copied below for reference.

Level 1, Objective 1.0: Minimize indirect costs of workspace.
EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur huge intangible (indirect/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997).

Because, negative impacts of EGIAD are many such as, cognitive, emotional, health, etc, these are grouped into five categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under the broader concept, physiological impacts whereas mental well-being impacts like negative emotions, annoyance, are grouped under the broader concept, psychological impacts. Therefore, this parent objective has five children 1.1 through 1.5 as listed below.
1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and

:/Attribute%20Social%20responsiveness.gif...

1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

Level 2, Objective 1.3: Minimize potential social behavioral costs of distractions (EGIAD)..

Social behavior is "a behavior directed towards, or taking place between, members of the same species". Research in psychology and social sciences show that EGIAD negatively affects the social behavior of individuals, more specifically the individuals who are easily irritated by distractions. The negative bearings are mostly expressed as change in helping attitude towards fellow workers and building of hostility or bitterness among fellow workers. These negative impacts possess the potential to misalign human behavior and key requirements of successful knowledge work, i.e. collaboration and communication. Therefore, it is assumed that if the possible negative impacts of distractions on helping attitude, also called social responsiveness in many studies, and interpersonal relations are minimized, then the potential social behavioral costs of distractions for knowledge workers can be minimized. To this end, this parent objective is proposed to have two children, 1.3.1 and 1.3.2, as listed below.

1.3.1 Minimize possible negative impacts of EGIAD on social responsiveness of knowledge workers, and
1.3.2 Minimize possible negative impacts of EGIAD on interpersonal relations of knowledge workers.

However, before we go further down the hierarchy, please answer the following questions regarding objective 1.3.

62.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing potential social behavioral costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

- Agree
- Disagree
- Not Sure

63.
Do you agree that minimizing potential social behavioral costs resulting from EGIAD is important to minimize the potential indirect costs of workspace for knowledge-based organizations?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

- Agree
- Disagree
- Not Sure

64.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing potential social behavioral costs resulting from EGIAD should be included in the objective hierarchy?**
(Important Definitions - always open the link in a new window)
*

- Agree
- Disagree
- Not Sure

Level 3, Objective 1.3.1: Minimize possible negative impacts of EGIAD on social responsiveness of knowledge workers.

In the literature, social responsiveness or helping attitude of humans towards their fellow humans has been explained via many theoretical models like cognitive overload model, Maslow's hierarchy of needs etc. According to the cognitive overload model, when attentional overload occurs it results in a focusing of attention on environmental inputs that are relevant to one's own goals, neglecting other cues social and nonsocial alike. So, in case of attentional overload all those social cues are typically ignored that carries information concerning the moods and subtly expressed needs of others. Therefore, attentional overload or distractions result in lack of cooperation and negate helping attitudes of individuals towards their fellows, which are argued to be important components of success in knowledge work. A number of studies support the argument that a person is less likely to offer simple assistance under environmental stress than under comfortable ambient conditions because under stressful conditions social cues may be seen as irrelevant to the primary task and thus ignored (Page, 1977, Cohen and Lezak, 1977, Cohen, 1978).

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.3.1.

65.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing possible negative impacts of EGIAD**

65.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on social responsiveness of knowledge workers is a a valid sub-objective of the objective "minimize potential social behavioral costs of distractions (EGIAD)"?
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

66.
Do you agree that minimizing possible negative impacts of EGIAD on social responsiveness of knowledge workers is important to minimize the potential social behavioral costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

67.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on social responsiveness of knowledge workers should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 1.3.1

Objective 1.3.1 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowled workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of impact of EGIAD on their helping attitu 1 = "extremely significant" is the worst level of the attribute, and 5 = "not at all or very little" is the best level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on social responsiveness of knowledge workers.	Measure the perceived impact of EGIAD on social responsiveness of knowledge workers.	1	Extremely significant	EGIAD is perceived to cause an extremely significant change in helping attitude of knowledge workers towards their fellows, which cannot be ignored in reference to negative impact on overall productivity.
		2	Significant	EGIAD is perceived to cause a significant change in helping attitude of knowledge workers towards their fellows, which cannot be ignored in reference to negative impact on overall productivity.
		3	Moderate	EGIAD is perceived to cause a moderate change in helping attitude of knowledge workers towards their fellows, which cannot be ignored in reference to negative impact on overall productivity.
		4	A little	EGIAD is perceived to cause a little change in helping attitude of knowledge workers towards their fellows, which is ignorable in reference to negative impact on overall productivity.
		5	Not at all or very little	EGIAD is perceived to cause no or very little change in helping attitude of knowledge workers towards their fellows, which is ignorable in reference to negative impact on overall productivity.

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68. **Do you agree that the attribute is measuring the objective?**
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)*

Agree Disagree Not Sure

69.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

70.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

71.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Level 3, Objective 1.3.2: Minimize possible negative impacts of EGIAD on interpersonal relationships.

Interpersonal relationship refers to any transient or lasting bond between individuals, either job-related or personal. Distractions are shown to impair this relationship by building up hostility among co-workers who feel overwhelmed by their colleagues creating distractions in neighboring workspaces. Such surroundings are shown to eventually result in complete isolation of an individual and a significant loss of important threads of communication between co-workers, in-spite of the fact that good communications helps to build good interpersonal relationships, which is one among the key factors to successful knowledge work outcome. Bill Sims, a Cornell University Professor of facility management and planning explains the phenomenon as: "if people can't control the communications, they actually communicate less".

Guided by the above description and in your expert opinion, please answer the following question(s) regarding objective 1.3.2.

72.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing possible negative impacts of EGIAD on interpersonal relationships is a a valid sub-objective of the objective "minimize potential social behavioral costs of distractions (EGIAD)"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

73.
Do you agree that minimizing possible negative impacts of EGIAD on interpersonal relationships of knowledge workers is important to minimize the potential social behavioral costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

74.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing possible negative impacts of EGIAD on interpersonal relationships of knowledge workers should be included in the objective hierarchy?**

74.
In the stated decision context (decision context - always open the link in a new window), do you agree that minimizing possible negative impacts of EGIAD on interpersonal relationships of knowledge workers should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 1.3.2

Objective 1.3.2 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowlec workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of impact of EGIAD on their interperso relationships. 1 = "not at all or very little" is the best level of the attribute, and 5 = "extremely significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on interpersonal relations of knowledge workers.	Measure the perceived impact of EGIAD on interpersonal relations of knowledge workers.	1	Not at all or very little	EGIAD doesn't impair communications and interpersonal relations at all or to a very little extent, which is ignorable in reference to negative impact on overall productivity.
		2	A little	EGIAD is perceived to impair communications and interpersonal relations a little, which is ignorable in reference to negative impact on overall productivity.
		3	Moderate	EGIAD is perceived to impair communications and interpersonal relations moderately. This cannot be ignored in reference to negative impact on overall productivity.
		4	Significant	EGIAD is perceived to impair communications and interpersonal relations significantly. This cannot be ignored in reference to negative impact on overall productivity.
		5	Extremely significant	EGIAD is perceived to impair communications and interpersonal relations extremely significantly. This cannot be ignored in reference to negative impact on overall productivity.

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75.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree Disagree Not Sure

76.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

77.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

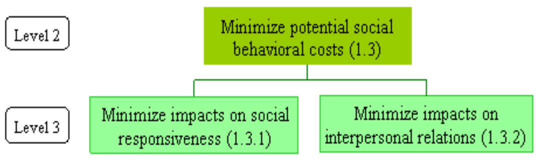
Agree Disagree Not Sure

78.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Completeness and Redundancy checks for Partial OH at Level 3

The partial objective hierarchy at level 3 for "potential social behavioral costs" is shown below.



Note: For reference, the description for objectives 1.3.1 and 1.3.2. are copied below. If you remember these from above, you may skip reading the same.

Objective 1.3.1: Minimize possible negative impacts of EGIAD on social responsiveness of knowledge workers.
In the literature, social responsiveness or helping attitude of humans towards their fellow humans has been explained via many theoretical models like cognitive overload model, Maslow's hierarchy of needs etc. According to the cognitive overload model, when attentional overload occurs it results in a focusing of attention on environmental inputs that are relevant to one's own goals, neglecting other cues social and nonsocial alike. So, in case of attentional overload all those social cues are typically ignored that carries information concerning the moods and subtly expressed needs of others. Therefore, attentional overload or distractions result in lack of cooperation and negate helping attitudes of individuals towards their fellows, which are argued to be important components of success in knowledge work. A number of studies support the argument that a person is less likely to offer simple assistance under environmental stress than under comfortable ambient conditions because under stressful conditions social cues may be seen as irrelevant to the primary task and thus ignored (Page, 1977, Cohen and Lezak, 1977, Cohen, 1978).

Objective 1.3.2: Minimize possible negative impacts of EGIAD on interpersonal relationships.
Interpersonal relationship refers to any transient or lasting bond between individuals, either job-related or personal. Distractions are shown to impair this relationship by building up hostility among co-workers who feel overwhelmed by their colleagues creating distractions in neighboring workspaces. Such surroundings are shown to eventually result in complete isolation of an individual and a significant loss of important threads of communication between co-workers, in-spite of the fact that good communications helps to build good interpersonal relationships, which are among the key factors to successful knowledge work outcome. Bill Sims, a Cornell University Professor of facility management and planning explains the phenomenon as: "if people can't control the communications, they actually communicate less".

Please answer the following questions regarding this partial objective hierarchy.

79.
Do you agree that the two sub-objectives 1.3.1 and 1.3.2 are sufficient to cover all the significant aspects of objective 1.3?
*

Agree Disagree Not Sure

80.
According to the descriptions for sub-objectives 1.3.1 and 1.3.2 **(decsriptions are copied above for reference)**, **do you agree that the two sub-objectives are mutually exclusive?**
(Note: i.e. a particular behavioral cost like building up of hostility among neighboring co-workers due to often happening uncontrollable chit-chat in the neighboring workspace, can be assigned to exactly one of the two sub-objectives, which in this case will be objective 1.3.2)
*

Agree Disagree Not Sure

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AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Page 6 - VALIDATION OF LEVELS 2 AND 3 OF THE OBJECTIVE HIERARCHY Continued

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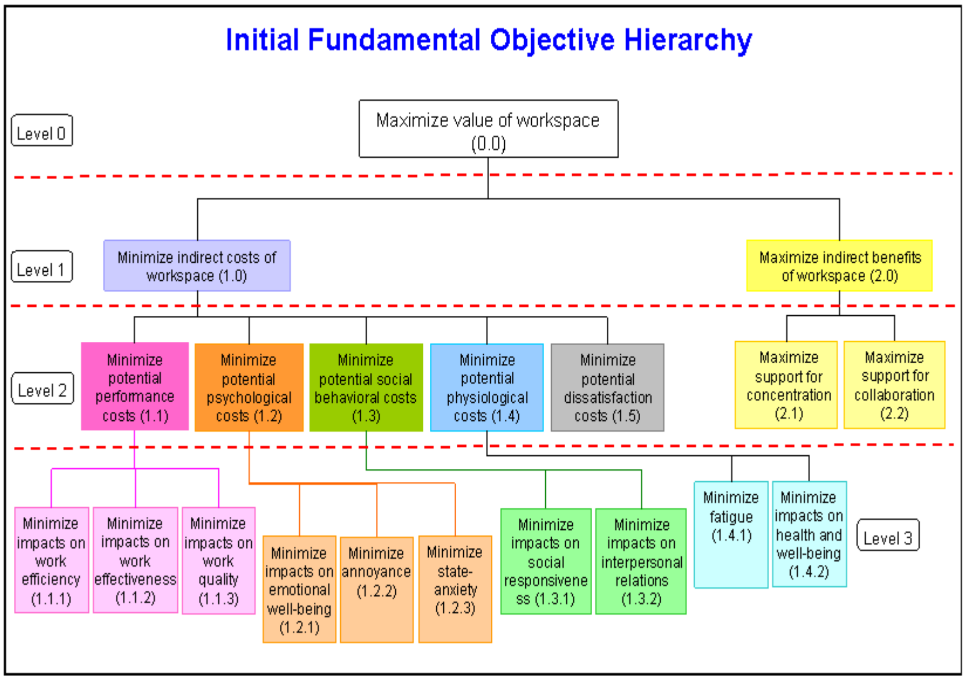
Step III – Validation of Levels 2 and 3 Continued

Note: The objective hierarchy is copied below for reference.



Descriptions and Questions for Objective 1.4 and further down the hierarchy

Note: Description of objective 1.0 at level 1 is copied below for reference.

Level 1, Objective 1.0: Minimize indirect costs of workspace.

EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur huge intangible (indirect/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997).

Because, negative impacts of EGIAD are many such as, cognitive, emotional, health, etc, these are grouped into five categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under the broader concept, physiological impacts whereas mental well-being impacts like negative emotions, annoyance, are grouped under the broader concept, psychological impacts. Therefore, this parent objective has five children 1.1 through 1.5 as listed below.
1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,

1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions,
1.5 Minimize potential dissatisfaction costs of distractions.

Level 2, Objective 1.4: Minimize potential physiological well-being costs of distractions (EGIAD).

Physiological well-being costs include all negative impacts of distractions that pertain to the physical state of an individual. For instance, Evans and Johnson (2000) showed a significant correlation between office noise and stress, which is shown to increase risk of musculoskeletal injuries, result in higher heart-rate, and higher blood pressure. Generally, subjects have expressed these costs through complaints of increased fatigue and low feelings about health and well-being, which influences their productivity negatively. Therefore, it is assumed that if the possible negative impacts of distractions on physiological components can be minimized, then the potential loss of productivity (indirect cost) resulting from exposure to EGIAD can be minimized. To this end, this parent objective is proposed to have two children, 1.4.1 and 1.4.2, as listed below.

1.4.1 Minimize possible fatigue resulting from EGIAD, and
1.4.2 Minimize possible negative impacts of EGIAD on health and well-being of knowledge workers.

However, before we go further down the hierarchy, please answer the following questions regarding objective 1.4.

81.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing potential physiological well-being costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

82.
Do you agree that minimizing potential physiological well-being costs resulting from EGIAD is important to minimize the potential indirect costs of workspace for knowledge-based organizations?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

83.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing potential physiological well-being costs resulting from EGIAD should be included in the objective hierarchy?**
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Level 3, Objective 1.4.1: Minimize fatigue resulting from EGIAD.

Fatigue is defined as "an experience of tiredness, dislike of present activity, and unwillingness to continue" (Bartley 1970), or as a "disinclination to continue to performing the task at hand and a progressive withdrawal of attention from environmental demands" (Brown, 1994). Fatigue is generally characterized by a need for rest, and a feeling of exhaustion. A number of studies have shown a significant correlation between fatigue and auditory distractions in workplace settings, like Witterseh et al. (2004) and Saeki et al. (2004) showed that office noise (speech plus non-speech) in open plan office increases fatigue. The explanation is that EGIAD expedites the process of getting tired because for individuals who are working on complex cognitive tasks distractions come as an overload. They challenge the abilities of the individual to concentrate and continue working on the task at hand. Consequently, over a short period of time subjects complain of excess expenditure of energy or reduced energy and decreased energy to continue work, which are rather symptoms of acute fatigue. Acute fatigue is a normal phenomenon that disappears after a period of rest, when tasks are switched, or when particular strategies are used – for example, working at a slower pace (Beurskens, et al 2000). However, fatigue also accrues long term direct and indirect consequences for individuals and these include: emotional exhaustion described as feeling worn out and feeling empty due to the work situation (Lee and Ashforth, 1993; Leiter, 1993, Beurskens, et al 2000); reduced competence and willingness to develop or maintain goal directed behavior aimed at adequate performance (Vries, 2003); reduced motivation; increase in sick leaves, and work disability (Michielsen et. al, 2002) etc.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.4.1.

84.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing fatigue resulting from EGIAD is a valid sub-objective of the objective "minimize potential physiological well-being costs of distractions (EGIAD)"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

85.
Do you agree that minimizing fatigue resulting from EGIAD is important to minimize the potential physiological costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

86.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing fatigue resulting from EGIAD should be included in the objective hierarchy?**
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 1.4.1

Objective 1.4.1 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowled workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of impact of EGIAD on fatigue. "extremely significant" is the worst level of the attribute, and 5 = "not at all or very little" is the best level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize fatigue resulting from EGIAD.	Measure the perceived fatigue resulting from EGIAD.	1	Extremely significant	EGIAD is perceived to cause extremely significant fatigue. This cannot be ignored in reference to negative impact on knowledge workers and thus overall productivity of the organization.
		2	Significant	EGIAD is perceived to cause significant fatigue. This cannot be ignored in reference to negative impact on knowledge workers and thus overall productivity of the organization.
		3	Moderate	EGIAD is perceived to cause moderate fatigue. This cannot be ignored in reference to negative impact on knowledge workers and thus overall productivity of the organization.
		4	A little	EGIAD is perceived to cause a little fatigue, which is ignorable for its negative impact on knowledge workers and thus overall productivity of the organization.
		5	Not at all or very little	EGIAD is perceived to cause no fatigue or a very little fatigue, which is ignorable for its negative impact on knowledge workers and thus overall productivity of the organization.

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87.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

88.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

89.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

90.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Level 3, Objective 1.4.2: Minimize possible negative impacts of EGIAD on health and well-being of knowledge workers.

Researchers and managers have recognized that health and well-being of knowledge workers is a very important aspect as it can potentially affect both workers and organizations in negative ways. For example, workers having poor health and well-being in the workplace may be less productive, be more prone to absence from work (Boyd, 1997), and make consistently diminishing overall contributions to the organization (Price and Hooijberg, 1992). Furthermore, distractions in the workplace have been shown to potentially increase health risks and reduce the feeling of well-being. Subjects complain of distress, increased heart rate, increased blood pressure, etc. Literature uncovers many studies that have dealt with the health and well-being impacts of being exposed to office noise. Some of these studies have examined vegetative responses – e.g. effects on respiration, heart-rate, etc. and others have examined the biochemical effects – e.g. blood lipid functions, adrenalin, dopamine and calcium levels etc. Evans (2000) has shown a much worse health risk of exposure to office noise. According to the study, "individuals exposed to typical, low-level open-office noise are substantially less likely (by 50%) to adjust ergonomic work-station features that allow postural variability while working", thereby putting these individuals at higher risks of musculoskeletal problems. The other potential health impacts resulting from surrounding noise are: increased risk for heart disease due to chronically elevated urinary epinephrine level (Evans, 2000); increased risk of chronic depression; sleep deprivation etc.

Guided by the above description and in your expert opinion, please answer the following question(s) regarding objective 1.4.2.

91.
In the stated decision context (decision context - **always open the link in a new window**), **do you agree that minimizing possible negative impacts on health and well-being of knowledge workers is a a valid sub-objective of the objective "minimize potential physiological well-being costs of distractions (EGIAD)"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

92.
Do you agree that minimizing possible negative impacts on health and well-being of knowledge workers is important to minimize the potential physiological costs of distractions?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

93.
In the stated decision context (decision context - **always open the link in a new window**), **do you agree that minimizing possible negative impacts on health and well-being of knowledge workers should be included in the objective hierarchy?**

93.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing possible negative impacts on health and well-being of knowledge workers should be included in the objective hierarchy?**
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 1.4.2

Objective 1.4.2 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowlec workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of impact of EGIAD on their health and w being. 1 = "not at all or very little" is the best level of the attribute, and 5 = "extremely significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize possible negative impacts of EGIAD on health and well-being of knowledge workers.	Measure the perceived impact of EGIAD on health and well-being of knowledge workers.	1	Not at all or very little	EGIAD is perceived to have no or very little impact on health and well-being of knowledge workers, which is ignorable in reference to negative impact on knowledge workers and thus overall productivity of the organization
		2	A little	EGIAD is perceived to have a little impact on health and well-being of knowledge workers, which is ignorable in reference to negative impact on knowledge workers and thus overall productivity of the organization.
		3	Moderate	EGIAD is perceived to have moderate impact on health and well-being. This cannot be ignored in reference to negative impact on knowledge workers and thus overall productivity of the organization.
		4	Significant	EGIAD is perceived to have significant impact on health and well-being. This cannot be ignored in reference to negative impact on knowledge workers and thus overall productivity of the organization.
		5	Extremely significant	EGIAD is perceived to have extremely significant impact on health and well-being. This cannot be ignored in reference to negative impact on knowledge workers and thus overall productivity of the organization.

Ple ans the follo que req

94.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree Disagree Not Sure

95.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

96.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

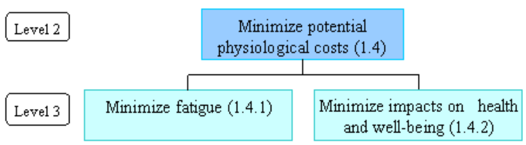
Agree Disagree Not Sure

97.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent the significant categories of measurement of the objective?
*

Agree   Disagree   Not Sure

Completeness and Redundancy checks for Partial OH at Level 3

The partial objective hierarchy at level 3 for "potential physiological costs" is shown below.



Note: For refrerence, the descriptions for objectives 1.4.1 and 1.4.2 are copied below. If you remember these from above, you may skip reading the same.

Objective 1.4.1: Minimize fatigue resulting from EGIAD.
Fatigue is defined as "an experience of tiredness, dislike of present activity, and unwillingness to continue" (Bartley 1970), or as a "disinclination to continue to performing the task at hand and a progressive withdrawal of attention from environmental demands" (Brown, 1994). Fatigue is generally characterized by a need for rest, and a feeling of exhaustion. A number of studies have shown a significant correlation between fatigue and auditory distractions in workplace settings, like Witterseh et al. (2004) and Saeki et al. (2004) showed that office noise (speech plus non-speech) in open plan office increases fatigue. The explanation is that EGIAD expedites the process of getting tired because for individuals who are working on complex cognitive tasks distractions come as an overload. They challenge the abilities of the individual to concentrate and continue working on the task at hand. Consequently, over a short period of time subjects complain of excess expenditure of energy or reduced energy and decreased energy to continue work, which are rather symptoms of acute fatigue. Acute fatigue is a normal phenomenon that disappears after a period of rest, when tasks are switched, or when particular strategies are used – for example, working at a slower pace (Beurskens, et al 2000). However, fatigue also accrues long term direct and indirect consequences for individuals and these include: emotional exhaustion (described as feeling worn out and feeling empty due to the work situation (Lee and Ashforth, 1993; Leiter, 1993, Beurskens, et al 2000); reduced competence and willingness to develop or maintain goal directed behavior aimed at adequate performance (Vries, 2003); reduced motivation; increase in sick leaves, and work disability (Michielsen et. al, 2002).

Objective 1.4.2: Minimize possible negative impacts of EGIAD on health and well-being of knowledge workers.
Researchers and managers have recognized that health and well-being of knowledge workers is a very important aspect as it can potentially affect both workers and organizations in negative ways. For example, workers having poor health and well-being in the workplace may be less productive, be more prone to absence from work (Boyd, 1997), and make consistently diminishing overall contributions to the organization (Price and Hooijberg, 1992). Furthermore, distractions in the workplace have been shown to potentially increase health risks and reduce the feeling of well-being. Subjects complain of distress, increased heart rate, increased blood pressure, etc. Literature uncovers many studies that have dealt with the health and well-being impacts of being exposed to office noise. Some of these studies have examined vegetative responses – e.g. effects on respiration, heart-rate, etc. and others have examined the biochemical effects – e.g. blood lipid functions, adrenalin, dopamine and calcium levels etc. Evans (2000) has shown a much worse health risk of exposure to office noise. According to the study, "individuals exposed to typical, low-level open-office noise are substantially less likely (by 50%) to adjust ergonomic work-station features that allow postural variability while working", thereby putting these individuals at higher risks of musculoskeletal problems. The other potential health impacts resulting from surrounding noise are: increased risk for heart disease due to chronically elevated urinary epinephrine level (Evans, 2000); increased risk of chronic depression; sleep deprivation etc.

Please answer the following questions regarding this partial objective hierarchy.

98.
Do you agree that the two sub-objectives 1.4.1 and 1.4.2 are sufficient to cover all the significant aspects of objective 1.4?
*

Agree   Disagree   Not Sure

99.
According to the descriptions for sub-objectives 1.4.1 and 1.4.2 (decsriptions are copied above for reference)**, do you agree that the two sub-objectives are mutually exclusive?**
(Note: i.e. a particular physiological cost like feeling exhausted because had to work really hard to avoid distractions to keep up with the work at hand, can be assigned to exactly one of the two sub-objectives, which in this case will be objective 1.4.1)
*

Agree   Disagree   Not Sure

Go to the Previous page   Go to the Next Page

75%

AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Page 7 - VALIDATION OF LEVELS 2 AND 3 OF THE OBJECTIVE HIERARCHY Continued

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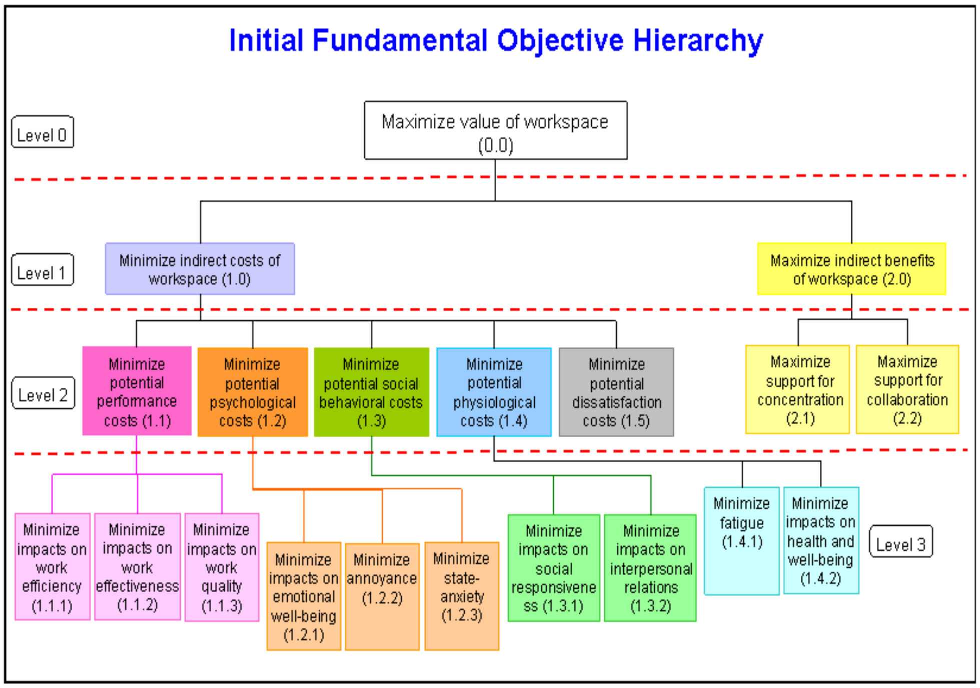
Step III – Validation of Levels 2 and 3 Continued

Note: The objective hierarchy is copied below for reference.



Descriptions and Questions for Objective 1.5 and further down the hierarchy

Note: Description of objective 1.0 at level 1 is copied below for reference.

Level 1, Objective 1.0: Minimize indirect costs of workspace.

EGIAD (externally generated involuntary auditory distractions) is one workspace aspect that is shown to have many negative impacts on knowledge workers ranging from lowered motivation to reduced performance to lowered feeling of overall well-being. This implies that EGIAD possesses the potential to incur huge intangible (indirect/subjective) costs for knowledge-based organizations. Generally, these costs are expressed in terms of lost/reduced productivity (Gifford, 1997).

Because, negative impacts of EGIAD are many such as, cognitive, emotional, health, etc, these are grouped into five categories depending on the broad field where the impact belongs. For instance, physical well-being impacts are grouped under the broader concept, physiological impacts whereas mental well-being impacts like negative emotions, annoyance, are grouped under the broader concept, psychological impacts. Therefore, this parent objective has five children 1.1 through 1.5 as listed below.

1.1 Minimize potential performance costs of distractions,
1.2 Minimize potential psychological costs of distractions,
1.3 Minimize potential social behavioral costs of distractions,
1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

1.4 Minimize potential physiological costs of distractions, and
1.5 Minimize potential dissatisfaction costs of distractions.

Level 2, Objective 1.5: Minimize potential dissatisfaction costs of distractions (EGIAD).

Job satisfaction as defined by Landy and Trumbo (1976) and Locke (1983) "refers to the worker's evaluation of his or her job as a whole or of general quality of life at work". It represents an amalgamation of many types of satisfaction, including satisfaction with the physical work environment. EGIAD because of its very nature of being encroaching invokes negative feelings about environment and thus is shown to influence job satisfaction. In 1970, (Keighley) showed that office noise is the worst rated feature in terms of environmental satisfaction of employees. Also, claims have been made that "the workplace environment is responsible for 24 percent of job satisfaction" (CABE, 2005, Nemecek and Grandjean, 1973). The feeling of lack of architectural privacy, i.e. noise and speech privacy, negatively impacts actions of a worker because either there is a fear of being overheard (i.e., disclosed to surroundings) or there is an intention to overhear neighboring conversations (Allen and Gerstberger, 1973, Brennan et al., 2002). In either case, environmental satisfaction of a knowledge worker is negatively affected, which incurs intangible costs in terms of job dissatisfaction because environmental satisfaction affects job satisfaction (Hedge, 1989). The findings suggest that dissatisfaction with environment due to office noise is a potent enough source of dissatisfaction to affect attitudes towards the job as a whole. Furthermore, people who are dissatisfied with their jobs are more likely to show less commitment, more inclined towards finding another job, and experience more health problems than people who are satisfied, thereby further adding to dissatisfaction costs. These costs can be many ranging from costs for hiring to costs of exit, reduced productivity because of learning curve, and increase in absenteeism etc. Nevertheless, the outcome is the same, negative impact on organizational productivity.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 1.5.

100.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing potential dissatisfaction costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

101.
Do you agree that minimizing potential dissatisfaction costs resulting from EGIAD is important to minimize the potential indirect costs of workspace?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

102.
In the stated decision context (decision context - always open the link in a new window), **do you agree that minimizing potential dissatisfaction costs resulting from EGIAD should be included in the objective hierarchy?**
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 1.5

Objective 1.5 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowle workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of impact of EGIAD on their satisfactio = "not at all or very little" is the best level of the attribute, and 5 = "extremely significant" is the worst level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize potential	Measure the perceived	1	Not at all or very little	EGIAD is perceived to have no or very little impact on satisfaction of knowledge workers, which is ignorable in reference to negative impact on overall productivity.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize potential dissatisfaction costs of distractions (EGIAD).	Measure the perceived impact of EGIAD on satisfaction of knowledge workers.	1	Not at all or very little	EGIAD is perceived to have no or very little impact on satisfaction of knowledge workers, which is ignorable in reference to negative impact on overall productivity.
		2	A little	EGIAD is perceived to have a little impact on satisfaction of knowledge workers, which is ignorable in reference to negative impact on overall productivity.
		3	Moderate	EGIAD is perceived to have a moderate impact on satisfaction of knowledge workers. This cannot be ignored in reference to negative impact on overall productivity.
		4	Significant	EGIAD is perceived to have a significant impact on satisfaction of knowledge workers. This cannot be ignored in reference to negative impact on overall productivity.
		5	Extremely significant	EGIAD is perceived to have an extremely significant impact on satisfaction of knowledge workers. This cannot be ignored in reference to negative impact on overall productivity.

103. **Do you agree that the attribute is measuring the objective?**
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)*

Agree Disagree Not Sure

104.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

105.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

106.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Go to the Previous page | Go to the Next Page

83%

AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Page 8 - VALIDATION OF LEVELS 2 AND 3 OF THE OBJECTIVE HIERARCHY Continued

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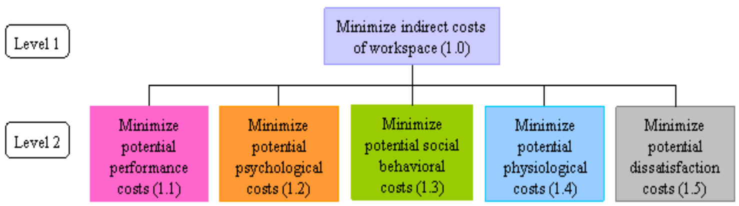
Completeness and Redundancy checks for Partial OH at Level 2

The partial objective hierarchy at level 2 for "indirect costs of workspace" is shown below.



Note: For reference, the description for objectives 1.1 through 1.5 are copied below. If you remember from the previous pages, you may skip reading the same.

Objective 1.1: Minimize potential performance costs of distractions (EGIAD) for knowledge workers.
In the literature, performance of knowledge workers is generally measured through work efficiency (speed to work), work quality (errors), and work effectiveness (newness or novelty). Research shows that EGIAD negatively impacts all the three components of knowledge worker's performance, where worker's performance in knowledge-based organizations is shown to have direct positive correlation with organizational productivity. Therefore, it is assumed that if the possible impacts of EGIAD on work efficiency, work quality, and work effectiveness are minimized, then the potential performance costs of distractions (EGIAD) for knowledge workers can be minimized.

Obejctive 1.2: Minimize potential psychological costs of distractions (EGIAD) for knowledge workers.
In medical care literature, "psychological well-being pertains to positive and negative affective states such as feeling enthusiastic, cheerful, interested, happy, anxious, depressed, or blue etc". These states are considered good indicators of mental health at a particular moment or as a whole. Research on non-auditory impacts (other than hearing loss) of noise identifies EGIAD as potential stimuli for reducing psychological well-being of knowledge workers. These impacts are indirect like, reduced task motivation, reduced aspiration etc. and subjective in nature and depend very much on the subject's sensitivity on the whole or on a particular day. Nevertheless, the shown outcomes are the same, reduced or lost productivity because of increased absenteeism, increased attrition, or reduced aspiration etc. Generally, subjects have expressed these costs through negative emotional states (alike medical care literature), increased annoyance, and increased anxiety. Therefore, it is assumed that if the possible impacts of distractions on emotional state, annoyance, anxiety are minimized, then the potential psychological well-being costs of distractions for knowledge workers can be minimized.

Objective 1.3: Minimize potential social behavioral costs of distractions (EGIAD) for knowledge workers.
Social behavior is behavior directed towards, or taking place between, members of the same species. Research in psychology and social sciences show that EGIAD negatively affects the social behavior of individuals more specifically the individuals who are easily irritated by distractions. The negative bearings are mostly expressed as change in helping attitude towards fellow workers and building of hostility or bitterness among fellow workers. These negative impacts possess the potential to misalign human behavior and key requirements of successful knowledge work: i.e. collaboration and communication. Therefore, it is assumed that if the possible negative impacts of distractions on helping attitude, also called social responsiveness in many studies, and interpersonal relations are minimized, then the potential social behavioral costs of distractions for knowledge workers can be minimized.

Objective 1.4: Minimize potential physiological costs of distractions (EGIAD) for knowledge workers.
Physiological well-being costs include all negative impacts of distractions that pertain to the physical state of an individual. For instance, Evans and Johnson (2000) showed a significant correlation between office noise and stress, which is shown to increase the risk of musculoskeletal injuries, higher heart-rate, and higher blood pressure. Generally, subjects have expressed these costs through complaints of increased fatigue and low feelings about health and well-being, which influences their productivity negatively. Therefore, it is assumed that if the possible negative impacts of distractions on physiological components can be minimized, then the potential loss of productivity (indirect cost) resulting from exposure to EGIAD can be minimized.

Objective 1.5: Minimize potential dissatisfaction costs of distractions (EGIAD) for knowledge workers.
Job Satisfaction as defined by Landy and Trumbo (1976) and Locke (1983) "refers to the worker's evaluation of his or her job as a whole or of general quality of life at work". It represents an amalgamation of many types of satisfaction, including satisfaction with the physical work environment. EGIAD because of its very nature of being encroaching invokes negative feelings about environment and thus is shown to influence job satisfaction. In 1970, (Keighley) showed that office noise is the worst rated feature in terms of environmental satisfaction of employees. Also, claims have been made that "the workplace environment is responsible for 24 percent of job satisfaction" (CABE, 2005, Nemecek and Grandjean, 1973). The feeling of lack of architectural privacy, i.e. noise and speech privacy, negatively impacts actions of a worker because either there is a fear of being overheard (i.e., disclosed to surroundings) or there is an intention to overhear neighboring conversations (Allen and Gerstberger, 1973, Brennan et al., 2002). In either case, environmental satisfaction of a knowledge worker is negatively affected, which incurs intangible costs in terms of job dissatisfaction because environmental satisfaction affects job satisfaction (Hedge, 1989). The findings suggest that dissatisfaction with environment due to office noise is a potent enough source of dissatisfaction to affect attitudes towards the job as a whole. Furthermore, people who are dissatisfied with their jobs are more likely to show less commitment, more inclined towards finding another job, and experience more health problems than people who are satisfied, thereby further adding to dissatisfaction costs.

work quality, and work effectiveness are minimized, then the potential performance costs of distractions (EGIAD) for knowledge workers can be minimized.

Obejctive 1.2: Minimize potential psychological costs of distractions (EGIAD) for knowledge workers.

In medical care literature, "psychological well-being pertains to positive and negative affective states such as feeling enthusiastic, cheerful, interested, happy, anxious, depressed, or blue etc". These states are considered good indicators of mental health at a particular moment or as a whole. Research on non-auditory impacts (other than hearing loss) of noise identifies EGIAD as potential stimuli for reducing psychological well-being of knowledge workers. These impacts are indirect like, reduced task motivation, reduced aspiration etc. and subjective in nature and depend very much on the subject's sensitivity on the whole or on a particular day. Nevertheless, the shown outcomes are the same, reduced or lost productivity because of increased absenteeism, increased attrition, or reduced aspiration etc. Generally, subjects have expressed these costs through negative emotional states (alike medical care literature), increased annoyance, and increased anxiety. Therefore, it is assumed that if the possible impacts of distractions on emotional state, annoyance, anxiety are minimized, then the potential psychological well-being costs of distractions for knowledge workers can be minimized.

Objective 1.3: Minimize potential social behavioral costs of distractions (EGIAD) for knowledge workers.

Social behavior is behavior directed towards, or taking place between, members of the same species. Research in psychology and social sciences show that EGIAD negatively affects the social behavior of individuals more specifically the individuals who are easily irritated by distractions. The negative bearings are mostly expressed as change in helping attitude towards fellow workers and building of hostility or bitterness among fellow workers. These negative impacts possess the potential to misalign human behavior and key requirements of successful knowledge work: i.e. collaboration and communication. Therefore, it is assumed that if the possible negative impacts of distractions on helping attitude, also called social responsiveness in many studies, and interpersonal relations are minimized, then the potential social behavioral costs of distractions for knowledge workers can be minimized.

Objective 1.4: Minimize potential physiological costs of distractions (EGIAD) for knowledge workers.

Physiological well-being costs include all negative impacts of distractions that pertain to the physical state of an individual. For instance, Evans and Johnson (2000) showed a significant correlation between office noise and stress, which is shown to increase the risk of musculoskeletal injuries, higher heart-rate, and higher blood pressure. Generally, subjects have expressed these costs through complaints of increased fatigue and low feelings about health and well-being, which influences their productivity negatively. Therefore, it is assumed that if the possible negative impacts of distractions on physiological components can be minimized, then the potential loss of productivity (indirect cost) resulting from exposure to EGIAD can be minimized.

Objective 1.5: Minimize potential dissatisfaction costs of distractions (EGIAD) for knowledge workers.

Job Satisfaction as defined by Landy and Trumbo (1976) and Locke (1983) "refers to the worker's evaluation of his or her job as a whole or of general quality of life at work". It represents an amalgamation of many types of satisfaction, including satisfaction with the physical work environment. EGIAD because of its very nature of being encroaching invokes negative feelings about environment and thus is shown to influence job satisfaction. In 1970, (Keighley) showed that office noise is the worst rated feature in terms of environmental satisfaction of employees. Also, claims have been made that "the workplace environment is responsible for 24 percent of job satisfaction" (CABE, 2005, Nemecek and Grandjean, 1973). The feeling of lack of architectural privacy, i.e. noise and speech privacy, negatively impacts actions of a worker because either there is a fear of being overheard (i.e., disclosed to surroundings) or there is an intention to overhear neighboring conversations (Allen and Gerstberger, 1973, Brennan et al., 2002). In either case, environmental satisfaction of a knowledge worker is negatively affected, which incurs intangible costs in terms of job dissatisfaction because environmental satisfaction affects job satisfaction (Hedge, 1989). The findings suggest that dissatisfaction with environment due to office noise is a potent enough source of dissatisfaction to affect attitudes towards the job as a whole. Furthermore, people who are dissatisfied with their jobs are more likely to show less commitment, more inclined towards finding another job, and experience more health problems than people who are satisfied, thereby further adding to dissatisfaction costs. These costs can be many ranging from costs for hiring, to costs of exit, reduced productivity because of learning curve, and increase in absenteeism etc., nevertheless outcome is the same, negative impact on organizational productivity.

Please answer the following questions regarding this partial objective hierarchy.

107.

Do you agree that the five sub-objectives 1.1 through 1.5 are sufficient to cover all the significant aspects of objective 1.0?
*

- Agree
- Disagree
- Not Sure

108.

According to the descriptions for objectives 1.1 through 1.5 (descriptions are copied above from previous pages)**, do you agree that the five sub-objectives are mutually exclusive?**

(Note: i.e. a particular subjective cost like feeling emotionally low, can be assigned to exactly one of the five sub-objectives, which in this case will be objective 1.2)
*

- Agree
- Disagree
- Not Sure

Go to the Previous page | Go to the Next Page

91%

AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Page 9 - VALIDATION OF LEVELS 2 AND 3 OF THE OBJECTIVE HIERARCHY Continued

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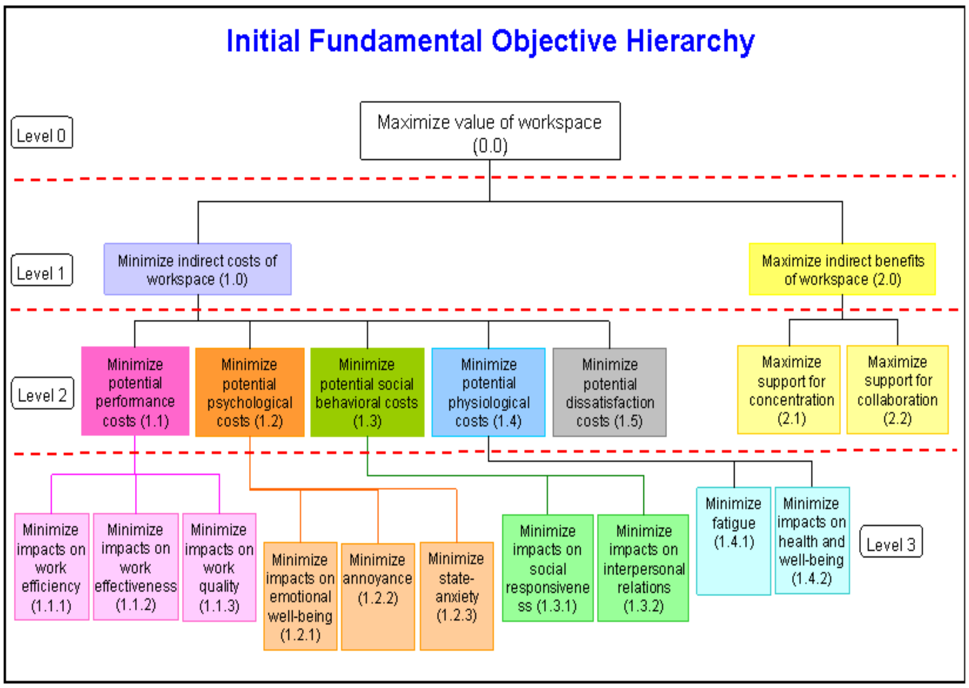
Step III – Validation of Levels 2 and 3 Continued

Note: The objective hierarchy is copied below for reference.



Descriptions and Questions for Objective 2.1 and 2.2

Note: Description of objective 2.0 at level 1 is copied below for reference.

Level 1, Objective 2.0: Maximize indirect benefits of workspace.

Two important input components of knowledge-based work are: individual work and group work. In terms of importance of one component over the other for their contribution to the output (knowledge worker's productivity), both the components have been shown to carry equal importance towards the outcome, i.e. productivity. Therefore, in knowledge-based organizations to achieve optimal productivity, both the components of knowledge work should be equally supported by a workspace. A number of field studies provide evidence for this argument, where knowledge workers establish the support for anytime anywhere concentration and collaboration as the top most requirements from their workspace (Olson 2005, Heerwagen et. al 2004, Paul et al 2001). Consequently, this objective is proposed to have two sub-objectives 2.1 and 2.2 as listed below:

2.1 Maximize workspace's support for individual concentrated work,

2.2 Maximize workspace's support for collaborative group work.

Level 2, Objective 2.1: Maximize workspace's support for individual concentrated work.

Level 2, Objective 2.1: Maximize workspace's support for individual concentrated work.

The term "individual means a person who works in an organization, analytically separate from his or her social context" (Sundstrom and Sundstrom, 1986). A number of studies have shown that one of the two key requirements of knowledge workers from their workspace is the support for individual concentrated work without having to leave ones workspace. The explanation is that knowledge workers believe that they will be most productive when they can carry on with their work without any unintended and involuntary disturbance or interruption.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 2.1.

109.
In the stated decision context (decision context - always open the link in a new window), **do you agree that maximizing workspace's support for individual concentrated work is a valid sub-objective of the objective "maximize indirect benefits of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

110.
Do you agree that maximizing workspace's support for individual concentrated work is important to maximize the potential indirect benefits of workspace?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

111.
In the stated decision context (decision context - always open the link in a new window), **do you agree that maximizing workspace's support for individual concentrated work should be included in the objective hierarchy?**
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 2.1

Objective 2.1 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowlec workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of workspace's support for individ concentrated work. 1 = "not at all or very little" is the worst level of the attribute and 5 = "extremely significant' is the best level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Maximize workspace's support for individual concentrated work.	Measure the perceived support of workspace for individual concentrated work.	1	Not at all or very little	Workspace doesn't provide any support or very little support for individual concentrated work.
		2	A little	Workspace provides a little support for individual concentrated work.
		3	Moderate	Workspace provides moderate support for individual concentrated work
		4	Significant	Workspace provides significant support for individual concentrated work.
		5	Extremely	Workspace provides extremely significant support for individual concentrated work.

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112.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree Disagree Not Sure

113.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

114.
Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

115.
Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent the significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Level 2, Objective 2.2: Maximize workspace's support for collaborative group work.

The term group means collection of two or more than two individuals. A number of studies have shown that the other (other than objective 2.1) key requirement of knowledge workers from their workspace is the support for group communication and collaboration without having to move to some other space and without disturbing neighboring coworkers. The explanation is that knowledge workers believe that they will be most productive when they can pursue task related discussion with their colleagues at their own workspaces without having to look for vacant meeting rooms or collaboration spaces.

Guided by the above description and in your expert opinion, please answer the following questions regarding objective 2.2.

116.
In the stated decision context (decision context - always open the link in a new window), **do you agree that maximizing workspace's support for collaborative group work is a valid sub-objective of the objective "maximize indirect benefits of workspace"?**
(Note: This question is to seek your opinion about the validity of hierarchical positioning of the parent and the child in the objective hierarchy, i.e. if the child to parent relationship is ok, please select "agree"; or if it should be vice-versa in the hierarchy, please select from the other two choices.)
*

Agree Disagree Not Sure

117.
Do you agree that maximizing workspace's support for collaborative group work is important to maximize the potential indirect benefits of workspace?
(Note: This question is to seek your opinion if you think that this objective is important to achieve its parent objective.)
*

Agree Disagree Not Sure

118.
In the stated decision context (decision context - always open the link in a new window), **do you agree that maximizing workspace's support for**

118.
In the stated decision context (decision context - always open the link in a new window), do you agree that maximizing workspace's support for collaborative group work should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

119.
In the stated decision context (decision context - always open the link in a new window), do you agree that maximizing workspace's support for collaborative group work should be included in the objective hierarchy?
(Important Definitions - always open the link in a new window)
*

Agree Disagree Not Sure

Attribute for Objective 2.2

Objective 2.2 is the lowest level objective (criterion for lowest level objective - always open the link in a new window) therefore; it has a measurement scale (attribute) measure the degree of achievement of the objective. The attribute and measurement levels are shown in the table below. According to the scale, knowled workers (i.e. users of workspace) will be asked to respond on a 5-point Likert scale (from 1 to 5) about their perception of workspace's support for collaborat group work. 1 = "not at all or very little" is the worst level of the attribute and 5 = "extremely significant' is the best level of the attribute.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Maximize workspace's support for collaborative group work.	Measure the perceived support of workspace for collaborative group work.	1	Not at all or very little	Workspace doesn't provide any support or very little support for collaborative group work.
		2	A little	Workspace provides a little support for collaborative group work.
		3	Moderate	Workspace provides moderate support for collaborative group work.
		4	Significant	Workspace provides significant support for collaborative group work.
		5	Extremely significant	Workspace provides extremely significant support for collaborative group work.

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120.
Do you agree that the attribute is measuring the objective?
(Note: An objective is measured through its attribute. The various levels of the attribute describe the various consequences of an action.)
*

Agree Disagree Not Sure

121.
Do you agree with the response format for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

122.

Do you agree with the description for various levels, 1 through 5, of the attribute?
*

Agree Disagree Not Sure

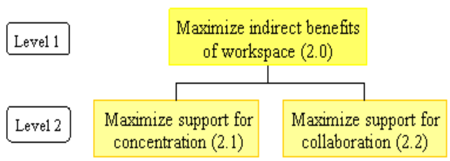
123.

Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?
*

Agree Disagree Not Sure

Completeness and Redundancy checks for Partial OH at Level 2

The partial objective hierarchy at level 2 for "potential indirect benefits of workspace" is shown below.



Note: For reference, the description for objectives 2.1 and 2.2 are copied below. If you remember these from above, you may skip reading the same.

Objective 2.1: Maximize workspace's support for individual concentrated work.
The term "individual means a person who works in an organization, analytically separate from his or her social context" (Sundstrom and Sundstrom, 1986). A number of studies have shown that one of the two key requirements of knowledge workers from their workspace is the support for individual concentrated work without having to leave ones workspace. The explanation is that knowledge workers believe that they will be most productive when theycan carry on with their work without any unintended and involuntary disturbance or interruption.

Objective 2.2: Maximize workspace's support for collaborative group work.
The term group means collection of two or more than two individuals. A number of studies have shown that the other (other than objective 2.1) key requirement of knowledge workers from their workspace is the support for group communication and collaboration without having to move to some other space and without disturbing neighboring coworkers. The explanation is that knowledge workers believe that they will be most productive when they can pursue task related discussion with their colleagues at their own workspaces without having to look for vacant meeting rooms or collaboration spaces.

Please answer the following questions regarding this partial objective hierarchy.

124.

Do you agree that the two sub-objectives 2.1 and 2.2 are sufficient to cover all the significant aspects of objective 2.0?
*

Agree Disagree Not Sure

125.

According to the descriptions for sub-objectives 2.1 and 2.2 (decsriptions are copied above for reference), do you agree that the two sub-objectives are mutually exclusive?
(Note: i.e. a particular indirect benefit can be assigned to exactly one of the two sub-objectives and not to both.
*

Agree Disagree Not Sure

Go to the Previous page | Finished? Submit your Questionnaire.

AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Thank You Note for you!

We are deeply thankful to you for successfully completing phase - I. This wouldn't have happened without your generous intent to make this study a successful endeavor.

With your input, we are already half-way through. I will consolidate the results and get back to you with the second phase of the study. This should take at the most two weeks.

Many Thanks.

Close the Questionnaire.

100%

APPENDIX D

STATISTICS FOR WEB-BASED DELPHI STUDY - PHASE I

This Appendix presents the responses of Phase I of the Delphi study. There were three categories of response: agree; not sure; and disagree. Table D.1 shows the frequency of subjects in each response category.

Table D.1 – Statistics for Phase I Delphi Study

Question		Response frequency		
		Agree	Not sure	Disagree
1	Do you agree that the objective maximize the value of workspace is an appropriate top-level objective for this decision problem?	11 (100%)	0	0
2	In the stated decision context, do you agree that minimizing potential indirect costs of workspace is a valid sub objective of the objective "maximize the value of workspace"?	9 (82%)	0	2
3	Do you agree that minimizing indirect costs of workspace is important to maximize the value of workspace for knowledge-based organization?	11 (100%)	0	0
4	Do you agree that minimizing potential indirect costs of workspace should be included in the objective hierarchy?	10 (91%)	1	0
5	In the stated decision context, do you agree that maximizing potential indirect benefits of workspace is a valid sub-objective of the objective "maximize the value of workspace"?	10 (91%)	0	1
6	Do you agree that maximizing potential indirect benefits of workspace is important to maximize the value of workspace for knowledge-based organization?	10 (91%)	1	0
7	In the stated decision context, do you agree that maximizing indirect benefits of workspace should be included in the objective hierarchy?	11 (100%)	0	0
8	Do you agree that the two sub-objectives 1.0 and 2.0 are sufficient to cover all the significant aspects of objective 0.0?	8 (73%)	1	2
9	According to the descriptions for sub-objectives 1.0 and 2.0, do you agree that the two sub-objectives are mutually exclusive?	5 (45%)	3	3
10	In the stated decision context, do you agree that minimizing potential performance costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?	9 (82%)	1	1
11	Do you agree that minimizing potential performance costs resulting from EGIAD is important to minimize the potential indirect costs of workspace for knowledge-based organizations?	9 (82%)	2	0

Question		Response frequency		
		Agree	Not sure	Disagree
12	In the stated decision context, do you agree that minimizing potential performance costs resulting from EGIAD should be included in the objective hierarchy?	11 (100%)	0	0
13	In the stated decision context, do you agree that minimizing potential negative impacts of EGIAD on work efficiency of knowledge workers is a valid sub-objective of the objective "minimize potential performance costs of distractions (EGIAD)"?	11 (100%)	0	0
14	Do you agree that minimizing potential negative impacts of EGIAD on work efficiency of knowledge workers when they are concentrating is important to minimize the potential performance costs of distractions?	11 (100%)	0	0
15	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on work efficiency of knowledge workers should be included in the objective hierarchy?	11 (100%)	0	0
16	Do you agree that the attribute is measuring the objective?	8 (73%)	1	2
17	Do you agree with the response format for various levels, 1 through 5, of the attribute?	9 (82%)	1	1
18	Do you agree with the description for various levels, 1 through 5, of the attribute?	7 (64%)	3	1
19	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	10 (91%)	0	1
20	In the stated decision context, do you agree that minimizing potential negative impacts of EGIAD on work effectiveness of knowledge workers is a valid sub-objective of the objective "minimize potential performance costs of distractions (EGIAD)"?	10 (91%)	1	0
21	Do you agree that minimizing potential negative impacts of EGIAD on work effectiveness of knowledge workers is important to minimize the potential performance costs of distractions?	10 (91%)	1	0
22	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on work effectiveness of knowledge workers should be included in the objective hierarchy?	10 (91%)	1	0
23	Do you agree that the attribute is measuring the objective?	7 (64%)	3	1
24	Do you agree with the response format for various levels, 1 through 5, of the attribute?	8 (73%)	1	2
25	Do you agree with the description for various levels, 1 through 5, of the attribute?	7 (64%)	1	3
26	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	9 (82%)	2	0
27	In the stated decision context, do you agree that minimizing potential negative impacts of EGIAD on work quality of knowledge workers is a valid sub-objective of the objective "minimize potential performance costs of distractions (EGIAD)"?	9 (82%)	0	2

Question		Response frequency		
		Agree	Not sure	Disagree
28	Do you agree that minimizing potential negative impacts of EGIAD on work quality of knowledge workers is important to minimize the potential performance costs of distractions?	10 (91%)	0	1
29	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on work quality of knowledge workers should be included in the objective hierarchy?	8 (73%)	1	2
30	Do you agree that the attribute is measuring the objective?	7 (64%)	1	3
31	Do you agree with the response format for various levels, 1 through 5, of the attribute?	8 (73%)	2	1
32	Do you agree with the description for various levels, 1 through 5, of the attribute?	8 (73%)	2	1
33	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	10 (91%)	1	0
34	Do you agree that the three sub-objectives 1.1.1 through 1.1.3 are sufficient to cover all the significant aspects of objective 1.1?	10 (91%)	0	1
35	According to the descriptions for sub-objectives 1.1.1, 1.1.2 and 1.1.3, do you agree that the three sub-objectives are mutually exclusive?	6 (55%)	1	4
36	In the stated decision context, do you agree that minimizing potential psychological costs resulting from EGIAD is a valid sub-objective of the objective “minimize indirect costs of workspace”?	11 (100%)	0	0
37	Do you agree that minimizing potential psychological costs resulting from EGIAD is important to minimize the potential indirect costs of workspace?	11 (100%)	0	0
38	In the stated decision context, do you agree that minimizing potential psychological costs resulting from EGIAD should be included in the objective hierarchy?	11 (100%)	0	0
39	In the stated decision context, do you agree that minimizing potential negative impacts of EGIAD on emotional well-being of knowledge workers is a valid sub-objective of the objective “minimize potential psychological costs of distractions (EGIAD)”?	10 (91%)	1	0
40	Do you agree that minimizing potential negative impacts of EGIAD on emotional well-being of knowledge workers is important to minimize the potential psychological costs of distractions?	10 (91%)	1	0
41	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on emotional well-being of knowledge workers should be included in the objective hierarchy?	11 (100%)	0	0
42	Do you agree that the attribute is measuring the objective?	7 (64%)	1	3
43	Do you agree with the response format for various levels, 1 through 5, of the attribute?	9 (82%)	2	0
44	Do you agree with the description for various levels, 1 through 5, of the attribute?	8 (73%)	2	1

	Question	Response frequency		
		Agree	Not sure	Disagree
45	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	11 (100%)	0	0
46	In the stated decision context, do you agree that minimizing annoyance resulting from EGIAD is a valid sub-objective of the objective "minimize potential psychological costs of distractions (EGIAD)"?	9 (82%)	2	0
47	Do you agree that minimizing annoyance resulting from EGIAD is important to minimize the potential psychological costs of distractions?	10 (91%)	1	0
48	In the stated decision context, do you agree that minimizing annoyance resulting from EGIAD should be included in the objective hierarchy?	11 (100%)	0	0
49	Do you agree that the attribute is measuring the objective?	8 (73%)	1	2
50	Do you agree with the response format for various levels, 1 through 5, of the attribute?	10 (91%)	1	0
51	Do you agree with the description for various levels, 1 through 5, of the attribute?	9 (82%)	1	1
52	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	10 (91%)	1	0
53	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on state-anxiety of knowledge workers is a valid sub-objective of the objective "minimize potential psychological costs of distractions (EGIAD)"?	10 (91%)	1	0
54	Do you agree that minimizing possible negative impacts of EGIAD on state-anxiety of knowledge workers is important to minimize the potential psychological costs of distractions?	11 (100%)	0	0
55	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on state-anxiety of knowledge workers should be included in the objective hierarchy?	11 (100%)	0	0
56	Do you agree that the attribute is measuring the objective?	8 (73%)	1	2
57	Do you agree with the response format for various levels, 1 through 5, of the attribute?	9 (82%)	2	0
58	Do you agree with the description for various levels, 1 through 5, of the attribute?	9 (82%)	2	0
59	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	10 (91%)	1	0
60	Do you agree that the three sub-objectives, 1.2.1 through 1.2.3, are sufficient to cover all the significant aspects of objective 1.2?	6 (55%)	4	1
61	According to the descriptions for sub-objectives 1.2.1, 1.2.2 and 1.2.3, do you agree that the three sub-objectives are mutually exclusive?	6 (55%)	4	1

Question		Response frequency		
		Agree	Not sure	Disagree
62	In the stated decision context, do you agree that minimizing potential social behavioral costs resulting from EGIAD is a valid sub-objective of the objective “minimize indirect costs of workspace”?	11 (100%)	0	0
63	Do you agree that minimizing potential social behavioral costs resulting from EGIAD is important to minimize the potential indirect costs of workspace for knowledge-based organizations?	11 (100%)	0	0
64	In the stated decision context, do you agree that minimizing potential social behavioral costs resulting from EGIAD should be included in the objective hierarchy?	11 (100%)	0	0
65	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on social responsiveness of knowledge workers is a a valid sub-objective of the objective “minimize potential social behavioral costs of distractions (EGIAD)”?	11 (100%)	0	0
66	Do you agree that minimizing possible negative impacts of EGIAD on social responsiveness of knowledge workers is important to minimize the potential social behavioral costs of distractions?	11 (100%)	0	0
67	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on social responsiveness of knowledge workers should be included in the objective hierarchy?	11 (100%)	0	0
68	Do you agree that the attribute is measuring the objective?	5 (45%)	3	2
69	Do you agree with the response format for various levels, 1 through 5, of the attribute?	9 (82%)	2	0
70	Do you agree with the description for various levels, 1 through 5, of the attribute?	7 (64%)	3	1
71	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	11 (100%)	0	0
72	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on interpersonal relationships is a a valid sub-objective of the objective “minimize potential social behavioral costs of distractions (EGIAD)"?	11 (100%)	0	0
73	Do you agree that minimizing possible negative impacts of EGIAD on interpersonal relationships of knowledge workers is important to minimize the potential social behavioral costs of distractions?	11 (100%)	0	0
74	In the stated decision context, do you agree that minimizing possible negative impacts of EGIAD on interpersonal relationships of knowledge workers should be included in the objective hierarchy?	9 (82%)	2	0
75	Do you agree that the attribute is measuring the objective?	6 (55%)	3	2
76	Do you agree with the response format for various levels, 1 through 5, of the attribute?	9 (82%)	2	0
77	Do you agree with the description for various levels, 1 through 5, of the attribute?	8 (73%)	2	1

Question		Response frequency		
		Agree	Not sure	Disagree
78	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	11 (100%)	0	0
79	Do you agree that the two sub-objectives 1.3.1 and 1.3.2 are sufficient to cover all the significant aspects of objective 1.3?	7 (64%)	3	1
80	According to the descriptions for sub-objectives 1.3.1 and 1.3.2 , do you agree that the two sub-objectives are mutually exclusive?	7 (64%)	2	2
81	In the stated decision context , do you agree that minimizing potential physiological well-being costs resulting from EGIAD is a valid sub-objective of the objective “minimize indirect costs of workspace”?	11 (100%)	0	0
82	Do you agree that minimizing potential physiological well-being costs resulting from EGIAD is important to minimize the potential indirect costs of workspace for knowledge-based organizations?	11 (100%)	0	0
83	In the stated decision context , do you agree that minimizing potential physiological well-being costs resulting from EGIAD should be included in the objective hierarchy?	11 (100%)	0	0
84	In the stated decision context, do you agree that minimizing fatigue resulting from EGIAD is a valid sub-objective of the objective “minimize potential physiological well-being costs of distractions (EGIAD)”?	11 (100%)	0	0
85	Do you agree that minimizing fatigue resulting from EGIAD is important to minimize the potential physiological costs of distractions?	11 (100%)	0	0
86	In the stated decision context, do you agree that minimizing fatigue resulting from EGIAD should be included in the objective hierarchy?	11 (100%)	0	0
87	Do you agree that the attribute is measuring the objective?	8 (73%)	1	2
88	Do you agree with the response format for various levels, 1 through 5, of the attribute?	8 (73%)	2	1
89	Do you agree with the description for various levels, 1 through 5, of the attribute?	8 (73%)	2	1
90	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	10 (91%)	0	1
91	In the stated decision context, do you agree that minimizing possible negative impacts on health and well-being of knowledge workers is a valid sub-objective of the objective “minimize potential physiological well-being costs of distractions (EGIAD)”?	11 (100%)	0	0
92	Do you agree that minimizing possible negative impacts on health and well-being of knowledge workers is important to minimize the potential physiological costs of distractions?	11 (100%)	0	0
93	In the stated decision context, do you agree that minimizing possible negative impacts on health and well-being of knowledge workers should be included in the objective hierarchy?	11 (100%)	0	0

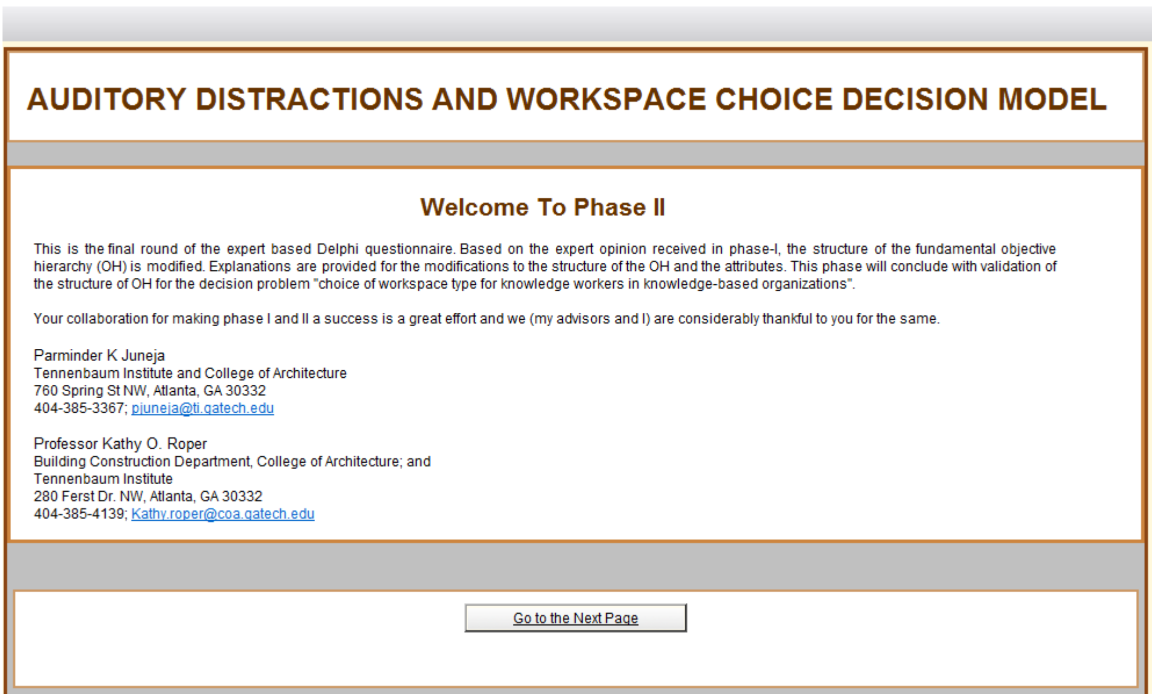
Question		Response frequency		
		Agree	Not sure	Disagree
94	Do you agree that the attribute is measuring the objective?	8 (73%)	1	2
95	Do you agree with the response format for various levels, 1 through 5, of the attribute?	9 (82%)	1	1
96	Do you agree with the description for various levels, 1 through 5, of the attribute?	8 (73%)	1	2
97	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	9 (82%)	1	1
98	Do you agree that the two sub-objectives 1.4.1 and 1.4.2 are sufficient to cover all the significant aspects of objective 1.4?	8 (73%)	2	1
99	According to the descriptions for sub-objectives 1.4.1 and 1.4.2, do you agree that the two sub-objectives are mutually exclusive?	8 (73%)	1	2
100	In the stated decision context, do you agree that minimizing potential dissatisfaction costs resulting from EGIAD is a valid sub-objective of the objective "minimize indirect costs of workspace"?	7 (64%)	1	3
101	Do you agree that minimizing potential dissatisfaction costs resulting from EGIAD is important to minimize the potential indirect costs of workspace?	9 (82%)	1	1
102	In the stated decision context, do you agree that minimizing potential dissatisfaction costs resulting from EGIAD should be included in the objective hierarchy?	7 (64%)	2	2
103	Do you agree that the attribute is measuring the objective?	7 (64%)	2	2
104	Do you agree with the response format for various levels, 1 through 5, of the attribute?	11 (100%)	0	0
105	Do you agree with the description for various levels, 1 through 5, of the attribute?	8 (73%)	2	1
106	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	11 (100%)	0	0
107	Do you agree that the five sub-objectives 1.1 through 1.5 are sufficient to cover all the significant aspects of objective 1.0?	9 (82%)	2	0
108	According to the descriptions for objectives 1.1 through 1.5, do you agree that the five sub-objectives are mutually exclusive?	6 (55%)	2	3
109	In the stated decision context, do you agree that maximizing workspace's support for individual concentrated work is a valid sub-objective of the objective "maximize indirect benefits of workspace"?	11 (100%)	0	0
110	Do you agree that maximizing workspace's support for individual concentrated work is important to maximize the potential indirect benefits of workspace?	11 (100%)	0	0
111	In the stated decision context, do you agree that maximizing workspace's support for individual concentrated work should be included in the objective hierarchy?	11 (100%)	0	0
112	Do you agree that the attribute is measuring the objective?	9 (82%)	1	1

Question		Response frequency		
		Agree	Not sure	Disagree
113	Do you agree with the response format for various levels, 1 through 5, of the attribute?	11 (100%)	0	0
114	Do you agree with the description for various levels, 1 through 5, of the attribute?	9 (82%)	2	0
115	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	9 (82%)	2	0
116	In the stated decision context, do you agree that maximizing workspace's support for collaborative group work is a valid sub-objective of the objective "maximize indirect benefits of workspace"?	9 (82%)	2	0
117	Do you agree that maximizing workspace's support for collaborative group work is important to maximize the potential indirect benefits of workspace?	9 (82%)	2	0
118	In the stated decision context, do you agree that maximizing workspace's support for collaborative group work should be included in the objective hierarchy?	9 (82%)	2	0
119	In the stated decision context, do you agree that maximizing workspace's support for collaborative group work should be included in the objective hierarchy?	9 (82%)	2	0
120	Do you agree that the attribute is measuring the objective?	9 (82%)	1	1
121	Do you agree with the response format for various levels, 1 through 5, of the attribute?	11 (100%)	0	0
122	Do you agree with the description for various levels, 1 through 5, of the attribute?	9 (82%)	2	0
123	Do you agree that the various levels of attribute, 1 through 5, are sufficient to represent significant categories of measurement of the objective?	11 (100%)	0	0
124	Do you agree that the two sub-objectives 2.1 and 2.2 are sufficient to cover all the significant aspects of objective 2.0?	9 (82%)	1	1
125	According to the descriptions for sub-objectives 2.1 and 2.2, do you agree that the two sub-objectives are mutually exclusive?	9 (82%)	1	1

APPENDIX E

WEB-BASED DELPHI STUDY – PHASE II

The research instrument for Phase II of the Delphi study was a Web-based questionnaire that was designed and developed using online survey software SurveyGizmo. This Appendix presents the snapshots of the instrument.



AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Welcome To Phase II

This is the final round of the expert based Delphi questionnaire. Based on the expert opinion received in phase-I, the structure of the fundamental objective hierarchy (OH) is modified. Explanations are provided for the modifications to the structure of the OH and the attributes. This phase will conclude with validation of the structure of OH for the decision problem "choice of workspace type for knowledge workers in knowledge-based organizations".

Your collaboration for making phase I and II a success is a great effort and we (my advisors and I) are considerably thankful to you for the same.

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AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Introduction to Phase II

Goals of Phase II

- To reach consensus on criterions (objectives in the objective hierarchy) to be considered when evaluating workspace alternatives for knowledge workers in knowledge based organizations.
- To reach consensus on the structure of the objective hierarchy.
- To reach consensus on the attributes for lowest level objectives.

Decision Context

Please read carefully the decision context stated below. The decision context is specified by the decision activity under consideration, which in this study is, "the choice of workspace type for knowledge workers in knowledge-based organizations". It also identifies the boundaries for the activity under consideration.

Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results:

1. Knowledge workers are the key assets of knowledge-based organizations.
2. Auditory distractions coming from surrounding work environment incur huge intangible costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics:
   Originator - workspace environment;
   Occurrence - random;
   Discrete, i.e. these have a start time and an end time;
   Knowledge worker's control - none;
   Impact - detrimental and involuntary, since it cannot be controlled by the worker.
3. Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.

Note: Please click on the following link to open it in a new window, "Decision Context". Save the document on your system for future reference to decision context description.

Important Definitions

A few important definitions are provided below. Please click on the following link to open it in a new window, "Important Definitions". Save the document on your system for reference in the future while answering the remaining questionnaire.

Fundamental objective
Fundamental objective is the explicit value that one desires to achieve. It is any criterion that is "significant enough" to be taken into account while evaluating alternatives. It is important to an individual /organization simply because it is important.

Fundamental objective hierarchy
Fundamental objective hierarchy is the hierarchy that arranges objectives from broad, overarching concept at the top to lower-level, specific accomplishments or actions. Objectives at the upper levels of the hierarchy reflect broad or inclusive values and progress towards these objectives is achieved by meeting lower-level sub-objectives.

Attribute
The degree of achievement of an objective is measured through its attribute. Ideally, all the lowest level objectives are measurable either objectively or subjectively. Other terms used for an attribute are: measure of effectiveness; performance measure; metric; evaluation measure.

Workspace
Workspace refers to a work-station assigned to a specific individual at a particular time. A work-station is defined "as a place designated for an individual to work, such as a desk and chair in an office. Workspace and workstation include furniture, machinery, equipment, supplies, decorative items, and other things that occupy the area designated for the person who works there" (Sundstrom and Sundstrom, 1986).

Static workspace
A workspace, like open plan workspace, that doesn't't provide control over externally generated auditory distractions.

1. Knowledge workers are the key assets of knowledge-based organizations.
2. Auditory distractions coming from surrounding work environment incur huge intangible costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics:
   Originator - workspace environment;
   Occurrence - random;
   Discrete, i.e. these have a start time and an end time;
   Knowledge worker's control - none;
   Impact - detrimental and involuntary, since it cannot be controlled by the worker.
3. Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.

Note: Please click on the following link to open it in a new window, "Decision Context". Save the document on your system for future reference to decision context description.

Important Definitions

A few important definitions are provided below. Please click on the following link to open it in a new window, "Important Definitions". Save the document on your system for reference in the future while answering the remaining questionnaire.

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Attribute

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Workspace

Workspace refers to a work-station assigned to a specific individual at a particular time. A work-station is defined "as a place designated for an individual to work, such as a desk and chair in an office. Workspace and workstation include furniture, machinery, equipment, supplies, decorative items, and other things that occupy the area designated for the person who works there" (Sundstrom and Sundstrom, 1986).

Static workspace

A workspace, like open plan workspace, that doesn't't provide control over externally generated auditory distractions.

Adaptable workspace

An adaptable workspace is a workspace that allows (and/or assists) the user to exercise control over distractions coming from one's surrounding work environment. It supports the conflicting requirements of collaboration and concentration by allowing the environment to adapt to functional needs of the user or by allowing the user to adjust the micro-environment to suit to ones various needs such as functional, psychological, physiological, etc. The prototypes are: "Attentive Office Cubicle" from Human Media Lab at Queen University; and "BlueSpace" from IBM and Steelcase.
To gain information about these prototypes, you are requested to visit the following URLs (Please open the below URL's in a new window.)

1. Attentive Office Cubicle: This is a video from Queen University's Human media lab.

   www.hml.queensu.ca/files/videos/Mamuji_Vertegaal_Dickie_Sohn_Danninger_2004.mp4

2. BlueSpace: Each URL below is dedicated to explaining how a BlueSpace provides concentration, collaboration and personalization.

   www.research.ibm.com/bluespace/concen.html
   www.research.ibm.com/bluespace/collab.html
   www.research.ibm.com/bluespace/person.html

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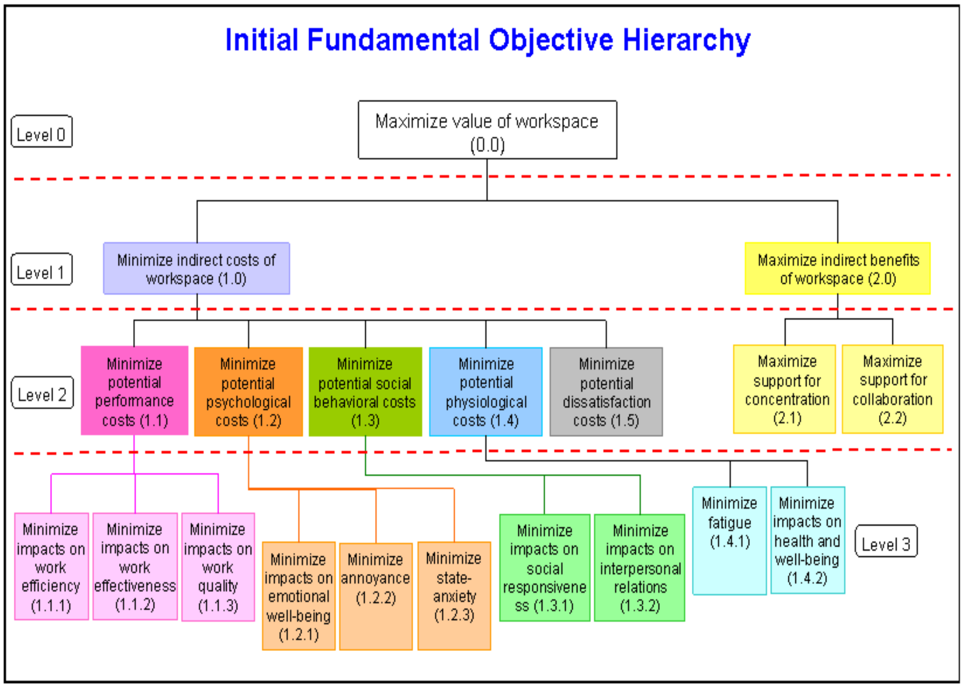
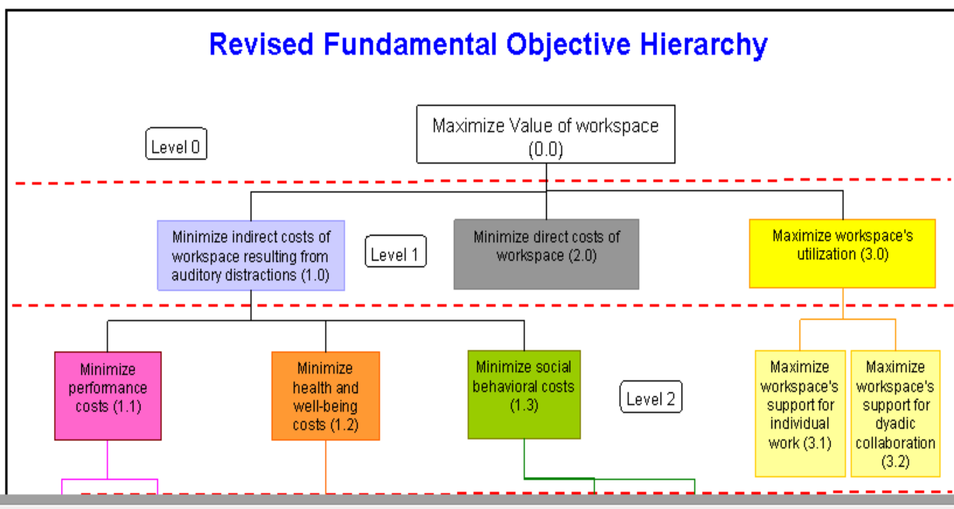
AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

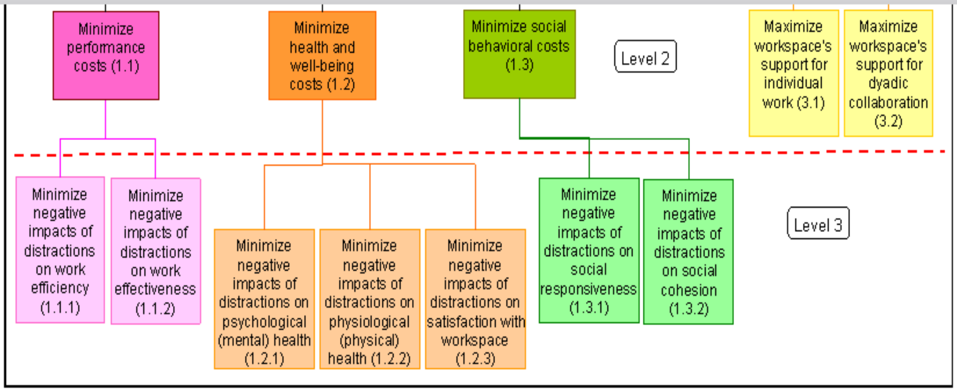
Validation of the objective hierarchy and the attributes

Objective Hierarchy

The initial and modified objective hierarchies are shown in the figures below. The objectives are selected because it is deduced that these are the important criterions to be considered when choosing a workspace for knowledge workers within the scope of the stated decision context.







Structure of Objective Hierarchy (OH)

Characteristics of OH

- Objectives at the upper level reflect broad values of organization or decision makers for an organizations.
- Meaning of upper level objective is explained and bounded by the lower level objectives (sub-objectives).
- Structure of OH is such that how an alternative performs with respect to the lowest level objectives tells how an alternative will perform with respect to the overall decision objective.
- Lowest level objectives should be measurable i.e. have qualitative or quantitative attribute or measurement scale.
- OH should be complete, concise, and non-redundant.
  -A set of objectives in each layer is complete if all the criterions that are important to the decision problem are included in the objective hierarchy.
  -A set of objectives in each layer is concise if all the criterions that are important to the decision problem but will not make a difference in evaluating alternatives are excluded from the objective hierarchy.
  -A set of objectives in each layer is nonredundant if an evaluation consideration can be included in exactly one criterion. For instance, if cost is divided into three sub-objectives training costs, software costs, and hardware costs; then any cost consideration within the scope of the three sub-objectives shall fall in exactly one criterion: training or software or hardware.

Why Validate Objective Hierarchy (OH)

Structuring and validating objective hierarchy is a prerequisite to applying multi attribute utility theory (MAUT) for evaluating various alternatives. MAUT measurement allows simultaneous capturing of objective and subjective criterions in one single equation, which makes MAUT a relevant methodology for this decision problem. MAUT not only spells out explicitly what the values and risk attitudes of each participant (decision maker, expert group, user group, government, etc.) are; but also provides a procedure for systematic evaluation of utility of each alternative.
Two parameters will be captured in the process: weights (relative importance) given to the attribute, and marginal utility values for the different levels of the attributes. Finally, the decision model provides a single overall score for every alternative by aggregating the single attribute evaluations thus providing a quantitative basis for the final decision.

Points to remember

- Distractions are limited to auditory distractions coming from surrounding work environment.

Validation of Objective Hierarchy

To validate the objective hierarchy, please answer all the questions on this page.

Remember that the decision context is:
Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results.

- *Knowledge workers are the key assets of knowledge-based organizations.*
- *Auditory distractions coming from surrounding work environment incur huge indirect costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics: Originator - workspace environment; Occurrence - random; Discrete, i.e. these have a start time and an end time; Knowledge worker's control - none; Impact - detrimental and involuntary since it cannot be controlled by the worker.*
- *Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-*

1.

Do you agree that "negative impacts of distractions on work efficiency of knowledge workers" is an important evaluation criteria to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?

Work efficiency as suggested by many researchers is related to "utilization of resources". For knowledge work, some of the key input resources are knowledge worker's time, concentration, and effort spent on a particular task. Auditory distractions coming from surrounding work environment are shown to negatively impact work efficiency of knowledge workers when trying to concentrate on a complex cognitive task. It is shown that once distracted, a person can take up to fifteen minutes of ramp-up time to reach the same state of concentration (attention and involvement) as before thereby resulting in increased time and effort to finish the task. It is also suggested that sometimes people don't get back to the same work until the next day. These marginal impacts are difficult to recognize, however when these are analyzed over a period of time they are shown to result in significant productivity losses.

Statistics from Phase I - 100% agreement

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

2.

Measurement index

Statistics and expert explanations from phase I

- 56 % of the experts suggested that the measurement index is too complex to respond because of complex language, lengthy text, and use of complex sentences. In view of the expert feedback, the measurement index is modified to make it simple and straightforward.
- 56% of the experts questioned the reliability of subjective measurement index and self reports. In view of the same, below i have provided explanation for how the measurement index will be used and by whom.

Guided by the comments and statistics from phase I, the measurement index for impact on work efficiency is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Minimize negative impacts of distractions on work efficiency***	Participant's perception about strength of impacts of distractions on work efficiency***	1	Not at all	I feel distractions have no impact on work efficiency.
		2	A little	I feel distractions have a little impact on work efficiency.
		3	Moderate	I feel distractions have a moderate impact on work efficiency.
		4	Significant	I feel distractions have a significant impact on work efficiency.
		5	Very significant	I feel distractions have a very significant impact on work efficiency.

*** Measure of work efficiency	Description of items
Work efficiency is related to	Time to accomplish task
	Concentration
	Task speed
	Task effort

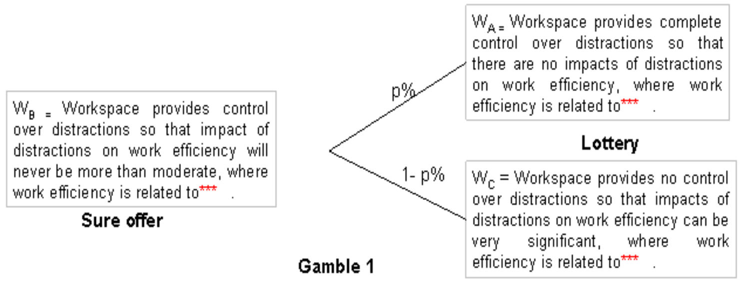
Explanation for reliability of subjective measurement index

The marginal impacts of distractions on work efficiency are difficult to recognize, subjective in nature, and their significance depends on a number of factors like work type, emotional state of an individual, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on work efficiency are difficult to recognize, subjective in nature, and their significance depends on a number of factors like work type, emotional state of an individual, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

- A multi attribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on work efficiency" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) work efficiency is impacted because of distractions. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This prefernce is guided by ones perception about the strength of impact of distractions on work efficiency. An illustration of the gamble and the type of questions that will asked are shown in Gamble 1 below.
- MAU theory allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.



*** Measure of work efficiency	Description of items
Work efficiency is related to	Time to accomplish a task
	Concentration
	Task speed
	Task effort

For the above gamble, the participant will answer questions as follows (note: a small training session or a demonstration on how to play the gamble is a prerequisite to this data collection method) :

What is the largest value p1 for which you will definitely prefer the sure offer (i.e. workspace W_B) to the lottery? p1 is in percentage.
(i.e if the chance of getting the best (i.e. workspace W_A) in the lottery is only ----% or lower, then you will prefer to accept the sure offer)
-------------------------%
What is the smallest value p2 for which you will definitely prefer lottery to the sure offer (i.e. workspace W_B)? p2 is in percentage
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least ------%, then you will definitely go for the lottery).
------------------------- %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in percentage?
------------------------- %

Answers to above questions will provide two types of information for the MAUT assessment:
1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impacts of distractions on work efficiency?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

3.

3.

Do you agree that "negative impacts of distractions on work effectiveness of knowledge workers" is an important evaluation criterion to be considered when evaluating workspace alternatives in knowledge-based organizations?

Work effectiveness as suggested by many researchers is related to "creation of value by doing the right things". Other concepts include novelty, innovation, creativity, sharing and disseminating new ideas etc. Auditory distractions coming from surrounding work environment exert extra demand on cognitive abilities of a person resulting in cognitive fatigue, which reduces person's subsequent readiness to perform. The attention narrows down and works on easily available routine cues rather than exploring in detail complex alternative ways to finish the task. The phenomenon is called cognitive economy. The impacts are subjective in nature depending on a number of critierions, however the result is that a key characteristic of knowledge work, i.e. novelty, creativity, is compromised.

Statistics from Phase I - 90% agreement

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

4.

Measurement index

Guided by the comments from phase I, the measurement index for impact on work effectiveness is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Minimize negative impacts of distractions on work effectiveness ***	Participant's perception about strength of impacts of distractions on work effectiveness ***	1	Not at all	I feel distractions have no impact on work effectiveness.
		2	A little	I feel distractions have a little impact on work effectiveness.
		3	Moderate	I feel distractions have a moderate impact on work effectiveness.
		4	Significant	I feel distractions have a significant impact on work effectiveness.
		5	Very significant	I feel distractions have a very significant impact on work effectiveness.

*** Measure of work effectiveness	Description of items
Work effectiveness is related to	Generating new methods, idea, concepts.
	Exploring alternatives rather than adopting routine.
	Creating value for customers, organization.
	Creativity
	Innovation

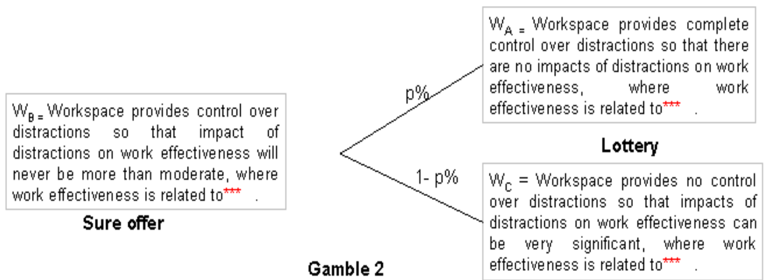
Explanation for reliability of subjective measurement index

The marginal impacts of distractions on work effectiveness are difficult to recognize, subjective in nature, and their significance depends on a number of factors like work type, mood of a person, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

- A multi attribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on work effectiveness" while evaluating workspace alternatives.

The marginal impacts of distractions on work effectiveness are difficult to recognize, subjective in nature, and their significance depends on a number of factors like work type, mood of a person, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

- A multi attribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on work effectiveness" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) work effectiveness is impacted because of distractions. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This preference is guided by ones perception about the strength of impact of distractions on work effectiveness. An illustration of the gamble and type of questions that will be asked are shown in Gamble 2 below.
- MAU theory allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.



*** Measure of work effectiveness	Description of items
Work effectiveness is related to	Generating new methods, ideas, concepts.
	Exploring alternatives rather than adopting routine.
	Creating value for customers, organization.
	Creativity.
	Innovation.

For the above gamble, the participant will answer questions as follows (note: a small training session or a demonstration on how to play the gamble is a prerequisite to this data collection method) :

What is the largest value p1 for which you will definitely prefer the sure offer (i.e. workspace W_B) to the lottery? p1 is in percentage.
(i.e if the chance of getting the best (i.e. workspace W_A) in the lottery is only ----% or lower, then you will prefer to accept the sure offer)
-------------------------%
What is the smallest value p2 for which you will definitely prefer lottery to the sure offer (i.e. workspace W_B)? p2 is in percentage.
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least ------%, then you will definitely go for the lottery).
------------------------- %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in percentage?
------------------------- %

Answers to above questions will provide two types of information for MAUT assessment:
1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impacts of distractions on work effectiveness?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

5.
"Negative impacts of distractions on work quality of knowledge workers" is deleted from the objective hierarchy. Summarily, following comments were provided by 50% of the expert participants.

in percentage.
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least ------%, then you will definitely go for the lottery).
------------------------- %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in percentage?
------------------------- %

assessment:
1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impacts of distractions on work effectiveness?

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

5.
"Negative impacts of distractions on work quality of knowledge workers" is deleted from the objective hierarchy. Summarily, following comments were provided by 50% of the expert participants.

- For knowledge work, work quality is a component of work efficiency and work effectiveness.
- Measuring errors is not a criteria for knowledge work. It is assessed in terms of creativity, new ideas etc., which is encompassed in the definition of work effectiveness.

Do you agree with the modification: delete objective "negative impacts of distractions on work quality" from the objective hierarchy?

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

6.
Do you agree that negative impacts of distractions on work efficiency and work effectiveness are sufficient to capture key performance costs resulting due to distractions?

Statistics from phase I - 100% agreement

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

7.
Do you agree that negative impacts of distractions on work efficiency (utilization of resources) **and work effectiveness** (novelty, creativity, doing the right things) **are mutually exclusive evaluation criterions?**

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

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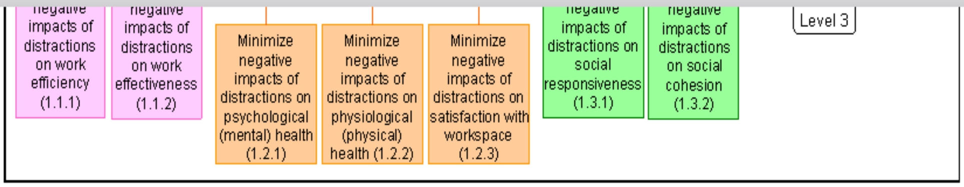


Points to remember

- Distractions are limited to auditory distractions coming from surrounding work environment.

Validation of Objective Hierarchy

To validate the objective hierarchy, please answer all the questions on this page.

Remember that the decision context is:
Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results.

- *Knowledge workers are the key assets of knowledge-based organizations.*
- *Auditory distractions coming from surrounding work environment incur huge indirect costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics: Originator - workspace environment; Occurrence - random; Discrete, i.e. these have a start time and an end time; Knowledge worker's control - none; Impact - detrimental and involuntary since it cannot be controlled by the worker.*
- *Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.*

Statistics and expert feedback summary from phase I

Following feedback was provided by the expert participants regarding objectives 1.2 "minimize potential psychological well-being costs", 1.4 "minimize potential physiological costs", and 1.5 "minimize potential dissatisfaction costs".

1. Dissatisfaction costs is a sub-objective of psychological well-being costs (Klitzman and Stellman 1989), therefore should not be considered as a separate criterion at the same tier, i.e. level in the initial objective hierarchy.
2. Sub-objectives "emotional well-being (1.2.1), annoyance (1.2.2), and state-anxiety (1.2.3)" of the objective "minimize psychological well-being costs (1.2)" are not mutually exclusive.
3. Sub-objectives "annoyance (1.2.2)" and "state-anxiety (1.2.3)" are contained in the sub-objective "emotional well-being", therefore these cannot be in the same tier, i.e. level 3 in the initial objective hierarchy.
4. Sub-objectives fatigue (1.4.1) and health and well-being (1.4.2) are not mutually exclusive.

According to multiattribute utility (MAU) assessment technology, three desirable properties of objective hierarchy are: completeness, conciseness, and nonredundancy. In addition, a smaller objective hierarchy is always preferred over complex big hierarchies because it can be communicated more easily and requires fewer resources to estimate the performance of alternatives.

Modifications to the OH

In accordance with the above feedback, the desirable properties of OH, and the suggested references (Klitzman and Stellman,1989) and (Danna and Griffin, 1999), the structure of the objective hierarchy is revised as follows.

- To gain conciseness and non-redundancy, sub-objectives emotional well-being (1.2.1), anxiety (1.2.2), and annoyance (1.2.3) are combined under the parent construct "psychological health (1.2.1)" in the revised OH;
- To gain conciseness and non-redundancy, sub-objectives fatigue (1.4.1) and health and well-being (1.4.2) are combined under the parent construct "physiological health (1.2.2)" in the revised OH;
- Dissatisfaction costs (1.5) is deleted from level 1. Satisfaction with workspace is added under the parent objective "minimize impacts on health and well-being (1.2)" in the revised OH.

8.

Do you agree that "negative impacts of distractions on psychological (mental) health" is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?

Literature from medical sciences, management sciences, and organizational, environmental psychology suggest psychological or mental health as a construct that pertains to emotional states of a person subsuming a broad range of moods such as feeling enthusiastic, full of energy, excited, cheerful, happy, anxious, depressed, guilty, fearful, angry, frustrated, irritated, or blue, etc. These states are considered good indicators of mental health at a particular moment (state quality) or as a whole (trait quality). Research on non-auditory impacts (other than hearing loss) of noise identifies auditory distractions coming from surrounding work environment as potential stimuli for reducing psychological health of knowledge workers. The impacts are indirect like, reduced motivation, reduced aspiration, reduced self-esteem, etc. and are subjective in nature. In addition, the intensity of impact depends very much on a subject's sensitivity to distractions on the whole or on a particular day. The shown outcomes are reduced or lost organizational productivity because of increased proneness to remain absent from work; lower quality decisions; increased turnover; diminishing overall contributions to the organization, etc.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

9.

Measurement index

Guided by the comments from phase I, the measurement index for impact on psychological health is modified and is provided in the table below.

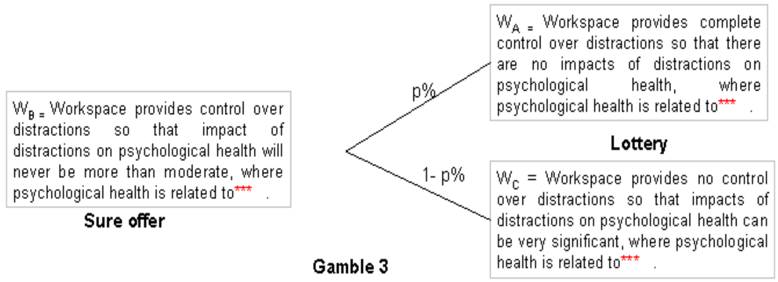
Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize negative impacts of distractions on psychological (mental) health***	Participant's feeling about strength of impacts of distractions on psychological (mental) health***	1	Not at all	I feel distractions have no impact on psychological health.
		2	A little	I feel distractions have a little impact on psychological health.
		3	Moderate	I feel distractions have a moderate impact on psychological health.
		4	Significant	I feel distractions have a significant impact on psychological health.
		5	Very significant	I feel distractions have a very significant impact on psychological health.

*** Measure of psychological health	Description of Items. (Source: Klitzman &Stellman, 1989)
Generalized distress	Sad or depressed
	Worried
	In low spirits
	Nervous
	Lonely
	Feel like crying
	Anxious
Irritation	Angry
	Irritated
	Aggravated
	Frustrated

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on psychological (mental) health are difficult to recognize, subjective in nature, and their significance depends on a number of complex individual factors like mood of a person, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with alternatives.

- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) psychological health is impacted because of distractions. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This preference is guided by ones perception about the strength of impact of distractions on psychological health. An illustration of the gamble and type of questions that will be asked are shown in Gamble 3 below.
- MAU theory allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.



***Measure of psychological health	Description of Items. (Source: Klitzman &Stellman, 1989)
Generalized distress	Sad or depressed
	Worried
	In low spirits
	Nervous
	Lonely
	Feel like crying
	Anxious
Irritation	Angry
	Irritated
	Aggravated
	Frustrated

For the above gamble, the participant will answer questions as follows (note: a small training session or a demonstration on how to play the gamble is a prerequisite to this data collection method) :

What is the largest value p1 for which you will definitely prefer the sure offer (i.e. workspace W_B) to the lottery? p1 is in percentage.
(i.e if the chance of getting the best (i.e. workspace W_A) in the lottery is only ----% or lower, then you will prefer to accept the sure offer)
------------------------%
What is the smallest value p2 for which you will definitely prefer lottery to the sure offer (i.e. workspace W_B)? p2 is in percentage
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least -----%, then you will definitely go for the lottery).
------------------------ %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in percentage?
------------------------ %

Answers to the gamble questions will provide two types of information for the MAUT assessment:
1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impact of distractions on psychological health?

Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

10.

Do you agree that "negative impacts of distractions on physiological (physical) health" is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?

Physiological health include all negative impacts of distractions that pertain to the physical health of an individual. Literature uncovers many studies that have analyzed the impacts of office noise on physical health. Some of these studies have examined vegetative responses – e.g. effects on respiration, heart-rate, etc. and others have examined the biochemical effects – e.g. blood lipid functions, adrenalin, dopamine and calcium levels etc. Evans and johnson (2000) have shown a much worse health risk of exposure to office noise. According to the study, "individuals exposed to typical, low-level open-office noise are substantially less likely (by 50%) to adjust ergonomic work-station features that allow postural variability while working", thereby putting these individuals at higher risks of musculoskeletal problems. Spurgeon et al (1996) have discussed the negative impacts as increase in the frequency and severity of a variety of non-specific symptoms including "headcahe, backache, tiredness, memory problems, and poor concentration".

Accodring to Danna and Griffin (1999), the organizational costs of negative impacts on physical helath of knowledge workers are in terms of lost productivity due to increased absenteeism, reduced productivity, compensation claims, health insurance costs, and direct medical expenses.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree

11. **Measurement index**

Guided by the comments and statstics from phase I, the measurement index for impact of distractions on physiological health is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize negative impacts of distractions on physiological (physical) health***	Participant's feeling about strength of impacts of distractions on physiological (physical) health***	1	Not at all	I feel distractions have no impact on physiological health.
		2	A little	I feel distractions have a little impact on physiological health.
		3	Moderate	I feel distractions have a moderate impact on physiological health.
		4	Significant	I feel distractions have a significant impact on physiological health.
		5	Very significant	I feel distractions have a very significant impact on physiological health.

*** Measure of physiological health	Description of Items. (Source: Spurgeon et al. 1996)
Increase in frequency or severity of symptoms	Headache
	Backache
	Other musculoskeletal problems
	Easily tired
	Unusual fatigue
	Concentration difficulty
	Memory problems
	Physical irritation
	Gastrointestinal disturbance
	Low in energy
	Unusual stress

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on physiological (physical) health are difficult to recognize, subjective in nature, and their significance depends on a number of complex individual factors like tolerance to stress, sensitivity to auditory distractions, personality characteristics, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

- A multiattribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on physiological health" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) physiological health is impacted because of distractions. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This preference is guided by ones perception about the strength of impact of distractions on physiological health. An illustration of the gamble and type of questions that will be asked is not provided here as it will be similar to the illustrations provided for the previously discussed attributes except that physiological impacts will be the attribute under consideration.
- MAU thoery allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.

Answers to the gamble questions will provide two types of information for the MAUT assessment:

1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impact of distractions on physiological health?

Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

12.

Do you agree that "negative impacts of distractions on satisfaction with physical workspace" is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?

Satisfaction with workspace is a dimension of physical environment satisfaction, which is not the prominent but is a significant factor in affecting job satisfaction. For this study, satisfaction with workspace is specifically referring to contentment in terms of being able to concentrate and collaborate at the same workspace without being bothered or disturbed by auditory distractions coming from the surrounding work environment and without any fear of getting overheard.

Research suggests that disturbance due to office noise is a significant source of environmental dissatisfaction and is a potent enough source to cause job dissatisfaction. It is further argued that people who are dissatisfied with their jobs are more likely to show less commitment to their work, more inclined towards finding another job, and experience more health problems than people who are satisfied. These affects are subjective and depends a lot on the personality of an individual, however the resulting costs for an organization can be many ranging from costs for hiring to costs of exit, reduced productivity because of learning curve, and increase in absenteeism etc., eventually impacting the financial bottom line of an organization.

Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

13. **Measurement index**

Guided by the comments and statistics from phase I, the measurement index for impacts of distractions on satisfaction with workspace is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize negative impacts of distractions on satisfaction with workspace***	Participant's feeling about strength of impacts of distractions on satisfaction with workspace***	1	Not at all	I feel distractions have no impact on satisfaction with workspace.
		2	A little	I feel distractions have a little impact on satisfaction with workspace.
		3	Moderate	I feel distractions have a moderate impact on satisfaction with workspace.
		4	Significant	I feel distractions have significant impact

*** Measure of workspace satisfaction	Description of Items.
Workspace satisfaction is related to	Speech privacy
	Privacy from auditory distractions coming from the surroundings
	Difficult to do job in workspace
	Like a different type of workspace

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on satisfaction with workspace are difficult to recognize, subjective in nature, and their significance depends on a number of complex individual factors like state and trait personality of a person, sensitivity of a person to auditory distractions, type of work, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

- A multiattribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on satisfaction with physical workspace" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) satisfaction is getting impacted because of distractions. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This preference is guided by ones perception about the strength of impact of distractions on satisfaction with workspace. An illustration of the gamble and type of questions that will be asked is not provided here as it will be similar to the illustrations provided for previously discussed attributes except that satisfaction with workspace will be the attribute under consideration.
- MAU theory allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.

Answers to the gamble questions will provide two types of information for the MAUT assessment:

1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impact of distractions on satisfaction with workspace?

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
○	○	○	○	○

14.
Do you agree that negative impacts of distractions on psychological (mental) health, physiological (physical) health, and satisfaction with workspace are sufficient to capture key health and well-being costs resulting due to distractions?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

15.
Do you agree that negative impacts of distractions on psychological (mental) health, physiological (physical) health, and satisfaction with workspace are mutually exclusive evaluation criterions?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

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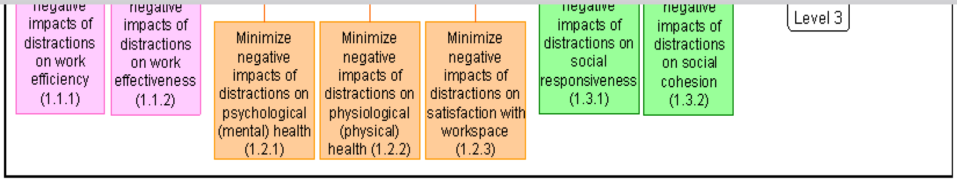


Points to remember

- Distractions are limited to auditory distractions coming from surrounding work environment.

Validation of Objective Hierarchy

To validate the objective hierarchy, please answer all the questions on this page.

Remember that the decision context is:
Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results.

- *Knowledge workers are the key assets of knowledge-based organizations.*
- *Auditory distractions coming from surrounding work environment incur huge indirect costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD)because these possess the following characteristics: Originator - workspace environment; Occurrence - random; Discrete, i.e. these have a start time and an end time; Knowledge worker's control - none; Impact - detrimental and involuntary since it cannot be controlled by the worker.*
- *Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.*

Expert feedback summary from phase I

Following feedback was provided by the expert participants regarding objective 1.3 "minimize social behavioral costs" and its sub-objectives.

1. Sub-objectives "minimize impacts on social responsiveness (1.3.1)" and "minimize impacts on interpersonal relations (1.3.2)" are not mutually exclusive.
2. Interpersonal relations and communication are two different concepts meausred by the same scale.

According to multiattribute utility (MAU) assessment technology, some desirable properties of an objective hierarchy are: completeness, conciseness, and nonredundancy.

Modifications to the OH

In accordance with the above feedback and the key properties of OH, following modifications are made.

1. Definition and description of sub-objective social responsiveness (1.3.1) is refined.
2. Interpersonal relations and communications are two important dimensions of "social cohesion". This knowledge is explicitly captured by incorpoarting the two crterions under the parent objective "social cohesion (1.3.2)".

16.

Do you agree that "negative impacts of distractions on social responsiveness" is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?

Social responsiveness is defined as the nature and degree of help offered to those in need. It is analogous to organizational citizenship behavior (OCB) in the organizational literature. OCB is a special type of individual behavior that is discretionary and is considered to promote the efficient and effective functioning of the teams and the organizations, therefore contributing to the overall productivity of the organization. OCB's have individual and organizational components; however this study is limited to individual components only.
Research argues that noise changes the helping attitude of humans towards their fellow humans. The results have been explained via many theoretical models including cognitive overload model and Maslow's hierarchy of needs. According to the cognitive overload model, when attentional overload occurs (because of distractions) it results in a focusing of attention on environmental inputs that are relevant to one's own goals, neglecting other cues social and nonsocial alike. All those social cues are typically ignored that carries information concerning the moods and subtly expressed needs of others. Therefore, distractions result in lack of cooperation and negate helping

literature. OCB is a special type of individual behavior that is discretionary and is considered to promote the efficient and effective functioning of the teams and the organizations, therefore contributing to the overall productivity of the organization. OCB's have individual and organizational components; however this study is limited to individual components only.

Research argues that noise changes the helping attitude of humans towards their fellow humans. The results have been explained via many theoretical models including cognitive overload model and Maslow's hierarchy of needs. According to the cognitive overload model, when attentional overload occurs (because of distractions) it results in a focusing of attention on environmental inputs that are relevant to one's own goals, neglecting other cues social and nonsocial alike. All those social cues are typically ignored that carries information concerning the moods and subtly expressed needs of others. Therefore, distractions result in lack of cooperation and negate helping attitudes of individuals towards their fellows, which are argued to be important components of success in knowledge work. A number of studies support the argument that a person is less likely to offer simple assistance under environmental stress (noise is recognized as a significant occupational stressor) than under comfortable ambient conditions because under stressful conditions social cues may be seen as irrelevant to the primary task and thus ignored.

Statistics from Phase I - 100% agreement

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

17.

Measurement index

Guided by the comments from phase I, the measurement index for impact of distractions on social responsiveness is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Minimize negative impacts of distractions on social responsiveness***	Participant's feeling about strength of impacts of distractions on social responsiveness***	1	Not at all	I feel distractions have no impact on social responsiveness.
		2	A little	I feel distractions have a little impact on social responsiveness.
		3	Moderate	I feel distractions have a moderate impact on social responsiveness.
		4	Significant	I feel distractions have a significant impact on social responsiveness.
		5	Very significant	I feel distractions have a very significant impact on social responsiveness.

***Measure of social responsiveness	Description of Items. Source: Williams and Anderson, 1991; Dylan M. Jones 1983
Social responsiveness is related to	Willingness to help
	Willingness to cooperate
	Attitude towards co-worker
	Behavior towards co-worker

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on social responsiveness are difficult to recognize, subjective in nature, and their significance depends on a number of complex individual factors like trait and state personlaity of an individual, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

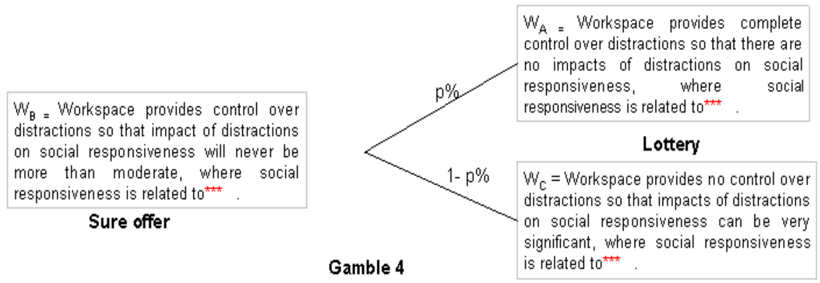
- A multi attribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on social responsiveness" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) social responsiveness is impacted. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This preference is guided by ones perception about the strength of impact of distractions on social responsiveness. An illustration of the gamble and type of questions that will be asked are shown in Gamble 4 below.
- MAU thoery allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.

W_A = Workspace provides complete control over distractions so that there are no impacts of distractions on social responsiveness, where social responsiveness is related to***

p%

W... Workspace provides control over

- MAU thoery allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.



***Measure of social responsiveness	**Description of Items.** Source: Williams and Anderson, 1991; Dylan M. Jones 1983
Social responsiveness is related to	Willingness to help
	Willingness to cooperate
	Attitude towards co-worker
	Behavior towards co-worker

For the above gamble, the participant will answer questions as follows (note: a small training session or a demonstration on how to play the gamble is a prerequisite to this data collection method) :

What is the largest value p1 for which you will definitely prefer the sure offer (i.e. workspace W_B) to the lottery? p1 is in percentage.
(i.e if the chance of getting the best (i.e. workspace W_A) in the lottery is only ----% or lower, then you will prefer to accept the sure offer)
------------------------%
What is the smallest value p2 for which you will definitely prefer lottery to the sure offer (i.e. workspace W_B)? p2 is in percentage.
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least -----%, then you will definitely go for the lottery).
------------------------ %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in percentage?
------------------------ %

Answers to the gamble questions will provide two types of information for the MAUT assessment:

1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impact of distractions on social responsiveness?

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

18.

Do you agree that "negative impacts of distractions on social cohesion" is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?
Social cohesion is the bond that brings people together in a particular group. Communication and interpersonal attraction are two important components of social cohesion. Researchers from social psychology argue that individuals communicate more when physical characteristics of buildings or settings, like absence of walls in open plan workplace, encourage them to do so. High interaction produces interpersonal attraction which furthers social cohesion. The members of a highly cohesive group, in

18.

Do you agree that "negative impacts of distractions on social cohesion" is an important evaluation criterion to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?

Social cohesion is the bond that brings people together in a particular group. Communication and interpersonal attraction are two important components of social cohesion. Researchers from social psychology argue that individuals communicate more when physical characteristics of buildings or settings, like absence of walls in open plan workplace, encourage them to do so. High interaction produces interpersonal attraction which furthers social cohesion. The members of a highly cohesive group, in contrast to one with a low level of cohesiveness, are more concerned with their membership and are therefore more strongly motivated to contribute to the group's welfare, to advance its objectives, and to participate in its activities. In knowledge organizations, these groups are called high performing teams.

However, researchers from organizational psychology counter argue that open workplace settings are high in distractions due to surrounding noise. These distractions impair group cohesion by building up hostility among co-workers because they feel overwhelmed by not being able to concentrate, stop neighboring conversations, whistles, etc. Researchers argue that moving into open plan offices creates increased interaction only for a short period and people soon revert to earlier habits of interaction as they adapt to the les private conditions and develop ways of regulating social contact. Such surroundings are also shown to eventually result in complete isolation of an individual and a significant loss of important threads of communication between co-workers, in-spite of the fact that good communications helps to build good social cohesion, which is one among the key factors to successful knowledge work. Bill Sims, a Cornell University Professor of facility management and planning explains the phenomenon as: "if people can't control the communications, they actually communicate less".

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

19.

Measurement index

Guided by the comments from phase I, the measurement index for impact of distractions on social cohesion is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Minimize negative impacts of distractions on social cohesion***	Participant's feeling about strength of impacts of distractions on social cohesion ***	1	Not at all	I feel distractions have no impact on social cohesion.
		2	A little	I feel distractions have a little impact on social cohesion.
		3	Moderate	I feel distractions have a moderate impact on social cohesion.
		4	Significant	I feel distractions have a significant impact on social cohesion.
		5	Very significant	I feel distractions have a very significant impact on social cohesion.

***Measure of social cohesion	Description of Items. (Source: Chang and Bordia, 2001)
Group members	Communicate freely
	Rather work as a team rather than going out on their own
	Like to spend time outside of work hours
	Stick together outside of the team project
	Often socialize together

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on social cohesion are difficult to recognize, subjective in nature, and their significance depends on a number of factors like trait personality of a person, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

- A multi attribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on social cohesion" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) social cohesion is impacted because of distractions. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This preference is guided by ones perception about the strength of impact of distractions on social cohesion. An illustration of the gamble and type of questions that will be asked is not provided here as it will be similar to the illustrations provided for the previously discussed attributes except that impacts on social cohesion will be the attribute under consideration.

		4	Significant	impact on social cohesion.
		5	Very significant	I feel distractions have a very significant impact on social cohesion.

***Measure of social cohesion	Description of Items. (Source: Chang and Bordia, 2001)
Group members	Communicate freely
	Rather work as a team rather than going out on their own
	Like to spend time outside of work hours
	Stick together outside of the team project
	Often socialize together

Explanation for reliability of subjective measurement index

The marginal impacts of distractions on social cohesion are difficult to recognize, subjective in nature, and their significance depends on a number of factors like trait personality of a person, sensitivity of a person to auditory distractions, etc. Therefore, it is very difficult to measure these impacts directly and precisely with some tangible measurement index. In reference:

- A multi attribute utility (MAU) model is proposed to capture this subjective criterion "impacts of distractions on social cohesion" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how ones (his/her/somebody's) social cohesion is impacted because of distractions. Rather, one plays a gamble to provide preference for a workspace type that allows control over distractions from the surroundings. This preference is guided by ones perception about the strength of impact of distractions on social cohesion. An illustration of the gamble and type of questions that will be asked is not provided here as it will be similar to the illustrations provided for the previously discussed attributes except that impacts on social cohesion will be the attribute under consideration.
- MAU theory allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.

Answers to the gamble questions will provide two types of information for the MAUT assessment:

1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for impact of distractions on social cohesion?

Strongly Disagree ○ Disagree ○ Undecided ○ Agree ○ Strongly Agree ○

20.

Do you agree that negative impacts of distractions on social responsiveness and social cohesion are sufficient to capture key social behavioral costs resulting due to distractions?

Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree ○

21.

Do you agree that negative impacts of distractions on social responsiveness and social cohesion are mutually exclusive evaluation criterions?

Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree ○

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Points to remember

- Distractions are limited to auditory distractions coming from surrounding work environment.

Validation of Objective Hierarchy

To validate the objective hierarchy, please answer all the questions on thsi page.

Remember that the decision context is:
Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results.

- *Knowledge workers are the key assets of knowledge-based organizations.*
- *Auditory distractions coming from surrounding work environment incur huge indirect costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics: Originator - workspace environment; Occurrence - random; Discrete, i.e. these have a start time and an end time; Knowledge worker's control - none; Impact - detrimental and involuntary since it cannot be controlled by the worker.*
- *Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.*

22.
Do you agree that "maximizing workspace's support for individual work" is an important evaluation criteria to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?
The term individual work means any work for which a person prefers to work in a private environment rather than in social setting. This work may include a confidential telephone that requires speech privacy or a complex task that requires continuous concentration or even a simple task but the person requires privacy because of psychological, physiological, or emotional reasons. Researchers argue that to maximize workspace's utilization, one of the key requirements of knowledge workers from their workspace is to be able to continue individual work that requires privacy and concentration from their workspace without having to look for a private enclosure.

Statistics from Phase I - 100% agreement

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

23.
Measurement index

Guided by the comments from phase I, the measurement index for workspace's support for individual work is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	Description
Maximize workspace's support for individual work***	Participant's feeling about strength of workspace's support for individual work***	1	Not at all	I feel workspace provides no support for individual work.
		2	A little	I feel workspace provides a little support for individual work.
		3	Moderate	I feel workspace provides moderate support for individual work.
		4	Significant	I feel workspace provides significant support for individual work.
		5	Very significant	I feel workspace provides very significant support for individual work.

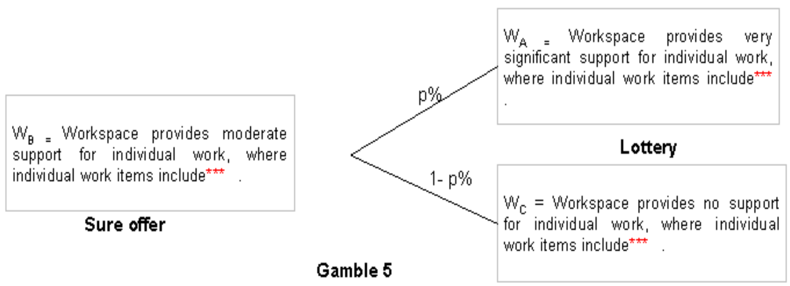
*** Measure of support for individual work	Description of items

another private enclosure	Privacy from co-workers conversations
	Privacy from other auditory distractions including sound and speech
	Privacy on demand
	Confidentiality
	Concentration without drive-by interruptions
	Concentration without involuntary distraction from auditory sources
	Individual's differential response to noise
	Individual's subjective response to noise

Explanation for reliability of measurment index

The perceptions about workspace's support for individual work are subjective in nature and depend on a number of complex individual factors. An individual may rate a workspace as providing significant support on one day and may rate the same workspace as providing very little support for individual work on the next day. In reference:

- A multi attribute utility (MAU) model is proposed to capture this subjective criterion "workspace's support for individual work" while evaluating workspace alternatives.
- A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about how a workspace supports individual work but plays a gamble to provide preference for a workspace type that supports individual work at different levels. An illustration of the gamble and type of questions that will be asked are shown in Gamble 5 below.
- MAU theory allows implicit capturing of the uncertainty involved in the estimation of subjective feelings at any particular time.



Gamble 5

*** Measure of support for individual work	Description of items
A Workspace supports the following items (right side column) without having to find another private enclosure	Privacy from being heard
	Privacy from overhearing
	Privacy from co-workers conversations
	Privacy from other auditory distractions including sound and speech
	Privacy on demand
	Confidentiality
	Concentration without drive-by interruptions
	Concentration without involuntary distraction from auditory sources
	Individual's differential response to noise
	Individual's subjective response to noise

For the above gamble, the participant will answer questions as follows (note: a small training session or a demonstration on how to play the gamble is a prerequisite to this data collection method) :

What is the largest value p1 for which you will definitely prefer the sure offer (i.e. workspace W_B) to the lottery? p1 is in percentage.
(i.e if the chance of getting the best (i.e. workspace W_A) in the lottery is only ----% or lower, then you will prefer to accept the sure offer)
-------------------------%
What is the smallest value p2 for which you will definitely prefer lottery to the sure offer (i.e. workspace W_B)? p2 is in percentage.
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least -----%, then you will definitely go for the lottery).
------------------------- %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in

Answers to the gamble questions will provide two types of information for the MAUT assessment:
1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for workspace's support for individual work?

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

24.
Do you agree that "maximizing workspace's support for dyadic group work" is an important evaluation criteria to be considered when evaluating workspace alternatives for knowledge workers in knowledge-based organizations?
A number of studies have argued that to maximize the utilization of a workspace, the other (other than objective 2.1) key requirement of knowledge workers from their workspace is the support for dyadic communication and collaboration without having to move to some other space and without disturbing neighboring coworkers. These may include impromptu meetings, short consultations, telephonic meetings with clients, etc. The explanation is that knowledge workers believe that they will be most productive when they can pursue task related discussion with their colleagues at their own workspaces without having to look for vacant meeting rooms or collaboration spaces and without disturbing their colleagues.

Statistics from Phase I - 90% agreement.
Expert suggestion: Collaboration beyond two workers is not something that should occur in an individual's work place; the group should seek out an appropriate space designed for group work.

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

25.
Measurement index

Guided by the comments from phase I, the measurement index for workspace's support for dyadic group work is modified and is provided in the table below.

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Maximize workspace's support for dyadic group work***	Participant's feeling about strength of workspace's support for dyadic group work***	1	Not at all	I feel workspace provides no support for dyadic group work.
		2	A little	I feel workspace provides a little support for dyadic group work.
		3	Moderate	I feel workspace provides moderate support for dyadic group work.
		4	Significant	I feel workspace provides significant support for dyadic group work.
		5	Very significant	I feel workspace provides very significant support for dyadic group work.

*** **Measure of support for dyadic group work**	**Description of items**
A Workspace supports the following items (right side column) without having to find another collaboration space and without disturbing those who are concentrating	Serendipitous interactions
	Privacy of telephonic conversations/meetings
	Privacy for meetings between two people
	Short consultations between two people such as fact checking, passing on information, and asking questions.
	Brief social interactions such as quick personal exchanges, bantering, and joking

Drive-by interruptions

For the above gamble, the participant will answer questions as follows (note: a small training session or a demonstration on how to play the gamble is a prerequisite to this data collection method) :

What is the largest value p1 for which you will definitely prefer the sure offer (i.e. workspace W_B) to the lottery? p1 is in percentage.
(i.e if the chance of getting the best (i.e. workspace W_A) in the lottery is only ----% or lower, then you will prefer to accept the sure offer)
------------------------%
What is the smallest value p2 for which you will definitely prefer lottery to the sure offer (i.e. workspace W_B)? p2 is in percentage.
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least -----%, then you will definitely go for the lottery).
------------------------ %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in percentage?
------------------------ %

Answers to the gamble questions will provide two types of information for the MAUT assessment:
1. The risk attitude of the participant towards the attribute, and
2. Marginal utility values for each measurement level of the attribute. These utility values are the building blocks for MAUT (multiattribute utility theory) methodology.

Do you agree with the measurement index for workspace's support for group work?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

26.
Do you agree that workspace's support for individual work and dyadic group work are sufficient to capture key workspace utilization requirements of knowledge workers in knowledge based organization?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

27.
Do you agree that workspace's support for individual work and workspace support for dyadic group work are mutually exclusive evaluation criterions?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

Go to the Previous page   Go to the Next Page

Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results.

- *Knowledge workers are the key assets of knowledge-based organizations.*
- *Auditory distractions coming from surrounding work environment incur huge indirect costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics: Originator - workspace environment; Occurrence - random; Discrete, i.e. these have a start time and an end time; Knowledge worker's control - none; Impact - detrimental and involuntary since it cannot be controlled by the worker.*
- *Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.*

Statistics and expert feedback summary from phase I

Following feedback was provided by the expert participants regarding the group of objectives at level 1.

1. At level 1 of the hierarchy, direct costs of workspace should be included in the hierarchy along with the indirect costs of workspace resulting from distractions. It is suggested that inclusion of direct costs is important in the stated decision context and it will not divert evaluators from giving necessary importance to subjective non-monetary criterions indirect costs).

According to multiattribute utility (MAU) assessment technology, desirable properties of an objective hierarchy are: completeness, conciseness, and non redundancy.

Modifications to the OH

In accordance with the above feedback and the desirable properties of OH, the structure of the objective hierarchy is revised as follows.

- To gain completeness, sub-objective "minimize direct costs of workspace (1.2)" is included in the revised objective hierarchy under its parent "maximize the value of workspace".
- Title of the sub-objective "maximize benefits of workspace" is changed to "maximize utilization of workspace" as it was misrepresenting the objective.

28.

Do you agree with the modification: add objective "minimize direct costs of workspace" to the objective hierarchy under its parent "maximize the value of a workspace"?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

29.

Measurement index

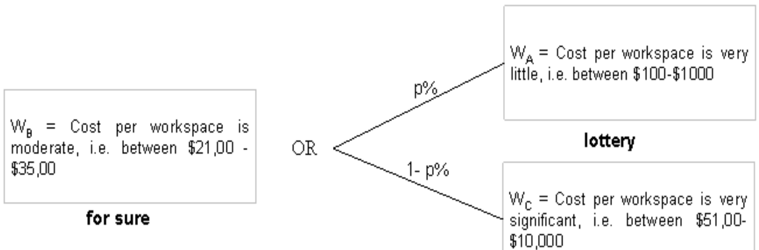
For this study, direct cost is measured as cost of acquiring and installing a workspace. A very conservative approach is taken because higher initial cost is suggested as one of the fundamental limitation when it comes to selling adaptable workspaces to organizations. The cost benefit analysis doesn't provide the exact value of adaptable workspaces as most of the benefits are subjective in nature that pose a problem of conversion into specific dollar figures to be included in a single cost-benefit equation. The utility measurement through this study is intended to overcome this drawback as it will provide a single number that will include both subjective and objective factors to rank various workspace alternatives.

The direct costs can be further sub-divided into many sub-components like maintenance costs, environmental costs etc., but that is outside the scope of this study. To capture direct costs in the MAU model for evaluating workspace choices, following measurement index is prepared:

Objective	Attribute	Attribute Levels / Measurement Index		
			Response Format	**Description**
Minimize direct costs of workspace	Cost of acquiring and installing a workspace	1	Very little	Cost per workspace is very little, i.e. between $100 - $1000.
		2	A little	Cost per workspace is a little, i.e. between $1100 - $2000.
		3	Moderate	Cost per workspace is moderate, i.e.

				between $3000 - $5000.
		5	Very significant	Cost per workspace is very significant, i.e. between $5100 - $10,000.

A participant (decision maker, user group, expert group, or government agency, etc) doesn't directly judge and report about the cost per workspace per year, rather one plays a gamble to provide preference for a workspace type depending on its cost. An illustration of the gamble and type of questions that will be asked are shown in Gamble 7 below.



Gamble 7

For the above gamble, the participant will answer questions as follows (note: a small training session or a demonstration on how to play the gamble is a prerequisite to this data collection method) :

What is the largest value p1 for which you will definitely prefer the sure offer (i.e. workspace W_B) to the lottery? p1 is in percentage.
(i.e if the chance of getting the best (i.e. workspace W_A) in the lottery is only ----% or lower, then you will prefer to accept the sure offer)
-------------------------%
What is the smallest value p2 for which you will definitely prefer lottery to the sure offer (i.e. workspace W_B)? p2 is in percentage.
(i.e. if the probability of winning the best (i.e. workspace W_A) in the lottery is at least ------%, then you will definitely go for the lottery).
------------------------- %
In the above two question your preference changed from accepting the certain result to accepting the lottery. Therefore, there shall be a p (such that, p2<=p<=p1), for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer? What is this value of p, where p is in percentage?
------------------------- %

Do you agree with the measurement index for direct cost of workspace?

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
○	○	○	○	○

30.
Do you agree that the three objectives at level 1, "minimize indirect costs of workspace resulting due to auditory distractions (1.0)", "minimize direct costs of workspace(2.0)", and "maximize workspace's utilization (3.0)" are sufficienct to capture key vlaue components of a workspace when evaluating workspace choices in the stated decision context?
Decision context is copied below for reference.
Choice of workspace type, static vs. adaptable, for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results.

- Knowledge workers are the key assets of knowledge-based organization.
- Auditory distractions coming from surrounding work environment incur huge indirect costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics: Originator - workspace environment; Occurrence - random; Discrete, i.e. these have a start time and an end time; Knowledge worker's control - none; Impact - detrimental and involuntary since it cannot be controlled by the worker.
- Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.

30.
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- Knowledge workers state that their key requirement from their workspace is the support for concentration and collaboration without moving from their workspace. This implies co-existence of conflicting requirements of a good communication and good speech privacy.

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

31.
Do you agree that the three objectives at level 1, "minimize indirect costs of workspace resulting due to auditory distractions (1.0)", "minimize direct costs of workspace(2.0)", and "maximize workspace's utilization (3.0)" are mutually exclusive value objectives?

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

32.
Do you agree that the three objectives at level 2, "minimize performance costs resulting due to distractions (1.1)", "minimize health and well-being costs resulting due to distractions (1.2)", and "minimize social behavioral costs resulting due to distractions (1.3)" are sufficient to capture key indirect costs of workspace resulting due to auditory distractions?

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

33.
Do you agree that the three objectives at level 2, "minimize performance costs resulting due to distractions (1.1)", "minimize helath and well-being costs resulting due to distractions (1.2)" and "minimize social behavioral costs resulting due to distractions (1.3)" are mutually exclusive value objectives?

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

34.
Characteristics of OH

- Objectives at the upper level reflect broad values of organization or decision makers for an organizations.
- Meaning of upper level objective is explained and bounded by the lower level objectives (sub-objectives).
- Structure of OH is such that how an alternative performs with respect to the lowest level objectives tells how an alternative will perform with respect to the overall decision objective.
- Lowest level objectives should be measurable i.e. have qualitative or quantitative attribute or measurement scale.
- MAUT allows inclusion of all criterons (either subjective or objective, parallel or not parallel) important to the decision problem in single objective hierarchy.
- OH should be complete, concise, and non-redundant

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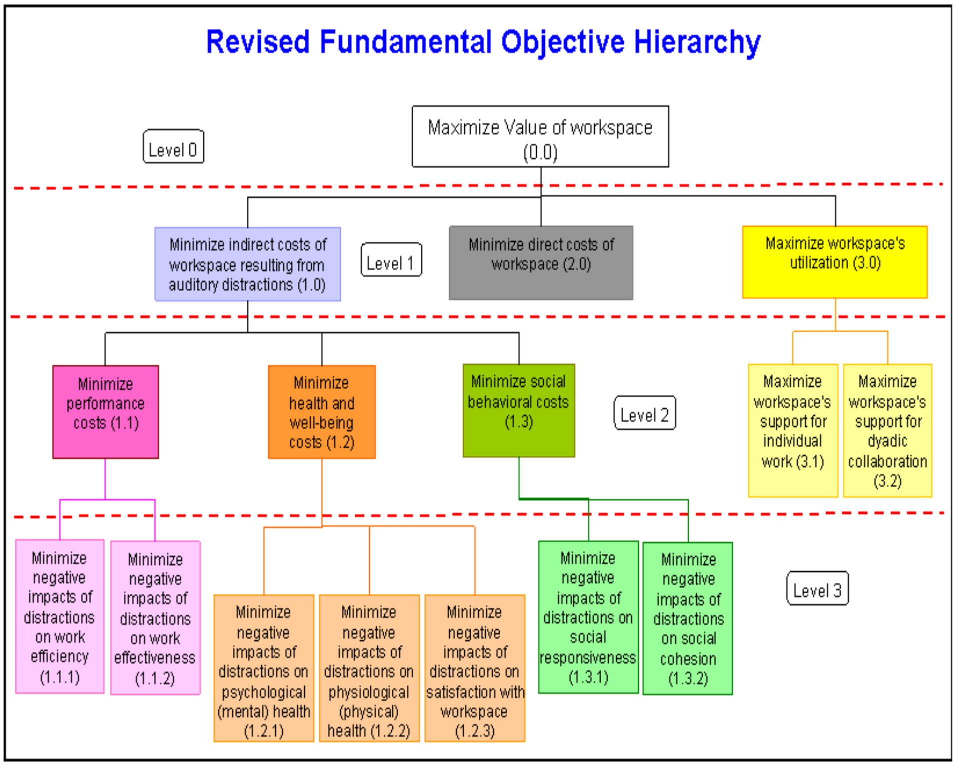
- MAUT allows inclusion of all criterons (either subjective or objective, parallel or not parallel) important to the decision problem in single objective hierarchy.
- OH should be complete, concise, and non-redundant.

- A set of objectives in each layer is complete if all the criterions that are important to the decision problem are included in the objective hierarchy.
- A set of objectives in each layer is concise if all the criterions that are important to the decision problem but will not make a difference in evaluating alternatives are excluded from the objective hierarchy.
- A set of objectives in each layer is nonredundant (mutually exclusive) if an evaluation consideration can be included in exactly one criterion. For instance, if cost is divided into three sub-objectives training costs, software costs, and hardware costs; then any cost consideration within the scope of the three sub-objectives shall fall in exactly one criterion: training or software or hardware.



Do you agree with the overall structure of the revised objective hierarchy?

Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree

Go to the Previous page | Finished? Submit your Questionnaire.

AUDITORY DISTRACTIONS AND WORKSPACE CHOICE DECISION MODEL

Thank You Note for you!

We are deeply thankful to you for successfully completing phase - II. This wouldn't have happened without your generous intent to make this study a successful endeavor.

Many Thanks.

Close the Questionnaire.

APPENDIX F (A)

DEMOGRAPHICS FOR PHASE III

Class: BC .

Please complete the following information. The information is required to assign the role of a decision maker or a knowledge worker for the PhD study “Auditory distractions in workplaces: Decision modeling for choice of workspace type in knowledge based organizations”.

Many Thanks.

<table>
<tr><td>Last name</td><td colspan="3"></td></tr>
<tr><td>First name</td><td colspan="3"></td></tr>
<tr><td>Title (Dr./Prof/ Ms./Mr.)</td><td colspan="3"></td></tr>
<tr><td>Email</td><td colspan="3"></td></tr>
<tr><td>Highest degree earned (like masters in build. Cons.)</td><td colspan="3"></td></tr>
<tr><td>Current degree sought (like, masters in mech. Eng.)</td><td colspan="3"></td></tr>
<tr><td rowspan="3">Current job title/designation</td><td rowspan="3"></td><td>organization</td><td></td></tr>
<tr><td>Industry</td><td></td></tr>
<tr><td>City, state</td><td></td></tr>
<tr><td>Current job role and responsibility</td><td colspan="3"></td></tr>
<tr><td>Previous job roles and responsibilities</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Total professional experience (in years)</td><td rowspan="2"></td><td>Is the total professional experience in the same field?</td><td></td></tr>
<tr><td>If “No”, please mention all the fields.</td><td></td></tr>
<tr><td>Areas of expertise</td><td colspan="3"></td></tr>
<tr><td>Experience in areas of expertise (in years)</td><td colspan="3"></td></tr>
</table>

Question: Have you ever been involved in any decision making strategy regarding workplace/ workspace/ facility in your organization? Please provide brief description about your role and responsibility?

Please provide any other information which you think will help me in assigning the correct role for you, i.e. the role of a decision maker or a knowledge worker in an organization?

APPENDIX F (B)

MAU DATA COLLECTION STUDY INSTRUMENT

Dear Title First name Last name

You are cordially invited to participate in a research study conducted by Parminder Juneja and Kathy O. Roper, from Tennenbaum Institute at the Georgia Institute of Technology. The results are sought to be used in the PhD dissertation only. You are selected as a potential participant because you are a valuable knowledge worker of today's knowledge based economy.

RESEARCH CONSENT

Your participation in this study is completely voluntary and you are free to choose whether to be in it or not. If you choose to be in this study, you may subsequently withdraw from it at any time without penalty or consequences of any kind. There is no monetary compensation; however the results of the study and the proposed decision model will be made available to the subjects. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. When the study has been completed, all such identifying information will be destroyed, and none of your responses will be in any way traceable back to you. There are no monetary costs involved, except the time that you will spend on filling out the questionnaire, which is the only but the most important requirement to make this study a success.

If you have any questions or concerns about the research, please feel free to contact:

Parminder K Juneja (Co-Investigator)
Tennenbaum Institute
760 Spring St NW, Atlanta, GA 30332
404-385-3367; pjuneja@ti.gatech.edu

Professor Kathy O. Roper (Principal Investigator)
Building Construction Department, COA and
Tennenbaum Institute
280 Ferst Dr. NW, Atlanta, GA 30332
404-385-4139; Kathy.roper@coa.gatech.edu

You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you feel you have been treated unfairly, or you have questions regarding your rights as a research subject, you may contact compliance officer Ms. Melanie Clark at melanie.clark@gtrc.gatech.edu or (404) 894-6942. The office is located 505 Tenth Street, NW, Atlanta, Georgia 30318.

You may start the questionnaire now. Completion of the questionnaire implies that you have read the information contained in this consent form and would like to be a volunteer in this research study. Thank you very much for your participation.

Parminder K Juneja (Co-Investigator)
Professor Kathy O. Roper (Principal Investigator)

SUMMARY OF THE RESEARCH

Auditory distractions coming from surrounding work environment are shown to have significant negative bearings on knowledge workers, such as upsetting mood, affecting health, negating satisfaction and performance, etc. These negative bearings on knowledge workers result in a plunge in overall productivity of an organization because in knowledge-based organizations employees are the key components of overall costs (76% of annual operating costs) and revenue generation. The negative bearings are generally subjective in nature and are driven by many personal factors like state and trait personality, state and trait sensitivity to noise, overall well-being etc. Therefore, rationally the negative bearings of distractions on knowledge workers shall form a basis for decision making when selecting a workspace type for knowledge workers. However, in organizational world decisions are generally guided by cost effectiveness model in which subjective bearings of distractions cannot be included because these cannot be converted into precise dollar figures. Therefore, to this end a multiattribute utility decision model of workspace choice is proposed that will allow investigation of both subjective and objective factors for their utility* while selecting the best appropriate workspace for an organization.

YOUR ROLE

You are assigned the role of a 'knowledge worker' or 'decision maker' in your organization and therefore you are asked to participate in this study as it involves selecting a workspace for you. Please read carefully the decision context stated below. The decision context is specified by the decision activity under consideration, which in this study is, "the choice of workspace type for knowledge workers in knowledge-based organizations". It also identifies the boundaries for the activity under consideration.

DECISION CONTEXT

Choice of workspace type for knowledge workers in knowledge-based organizations in view of the following consistently and repeatedly shown research results:

1. Knowledge workers are the key assets of knowledge-based organizations in terms of costs (salaries +benefits) to the organization and the revenue (productivity) they generate for their organization.
2. Auditory distractions coming from surrounding work environment incur huge intangible costs for knowledge workers and thus negatively impact the business mission of knowledge-based organizations. In this study, these distractions are referred to as externally generated involuntary auditory distractions (EGIAD) because these possess the following characteristics: Originator - workspace environment; Occurrence - random; Discrete, i.e. these have a start time and an end time; Knowledge worker's control - none; Impact - detrimental and involuntary, since it cannot be controlled by the worker.

GOALS OF THE QUESTIONNAIRE

Guided by the objective of this questionnaire, the goals identified are as follows:

1. To elicit single attribute utility functions using hypothetical games;
2. To obtain relative importance of attributes;
3. To seek probability judgments for various consequences;
4. To seek preference for levels of attributes;
5. To obtain ranking of workspace alternatives

IMPORTANT DEFINITIONS

Workspace

Workspace refers to a work-station assigned to a specific individual at a particular time. A work-station is defined "as a place designated for an individual to work, such as a desk and chair in an office. Workspace and workstation include furniture, machinery, equipment, supplies, decorative items, and other things that occupy the area designated for the person who works there" (Sundstrom and Sundstrom, 1986).

Static Workspace

A workspace, like open plan workspace, that doesn't provide control over externally generated auditory distractions.

Adaptable Workspace

An adaptable workspace is a workspace that allows (and/or assists) the user to exercise control over distractions coming from one's surrounding work environment. It supports the conflicting requirements of collaboration and concentration by allowing the environment to adapt to functional needs of the user or by allowing the user to adjust the micro-environment to suit to ones various needs such as functional, psychological, physiological, etc. The prototypes are: "Attentive Office Cubicle" from Human Media Lab at Queen University; and "BlueSpace" from IBM and Steelcase. More details about these workspaces can be found at the following URLs.

www.hml.queensu.ca/files/videos/Mamuji_Vertegaal_Dickie_Sohn_Danninger_2004.mp4

www.research.ibm.com/bluespace/concen.html

www.research.ibm.com/bluespace/collab.html

www.research.ibm.com/bluespace/person.html

ATTRIBUTES FOR EVALUATING WORKSPACES

Table 1 provides a summary of all ten attributes that have been validated in the phase I and II of the study for their contribution to maximizing the value of a workspace for knowledge organization.

Table 1. Summary of validated attributes for evaluating workspaces.

<table>
<tr><th rowspan="2">Notation</th><th rowspan="2">Attribute</th><th rowspan="2">Items of attribute</th><th rowspan="2">Measurement of attribute</th><th colspan="2">Measurement levels of attribute</th></tr>
<tr><th>Worst</th><th>Best</th></tr>
<tr><td rowspan="4">A1</td><td rowspan="4">Impact of distractions on work efficiency, i.e. distractions impact</td><td>Time to accomplish task</td><td rowspan="4">Strength of perception about impact of distractions on work efficiency</td><td rowspan="4">Very Significant</td><td rowspan="4">Not at all or very little</td></tr>
<tr><td>Ability to concentrate</td></tr>
<tr><td>Speed to finish task</td></tr>
<tr><td>Efforts to finish task</td></tr>
<tr><td rowspan="4">A2</td><td rowspan="4">Impact of distractions on work effectiveness, i.e. distractions impact</td><td>Desirability to generate new ideas, methods, concepts etc.</td><td rowspan="4">Strength of perception about impact of distractions on work effectiveness</td><td rowspan="4">Very Significant</td><td rowspan="4">Not at all or very little</td></tr>
<tr><td>Desirability to explore alternatives rather than adopting routine</td></tr>
<tr><td>Desirability to create value for customers, organization etc.</td></tr>
<tr><td>Desirability to be creative and innovative.</td></tr>
<tr><td rowspan="11">A3</td><td rowspan="11">Impact of distractions on psychological health, i.e. distractions make you feel</td><td>Sad or depressed</td><td rowspan="11">Strength of perception about impact of distractions on psychological health</td><td rowspan="11">Very Significant</td><td rowspan="11">Not at all or very little</td></tr>
<tr><td>Worried</td></tr>
<tr><td>In low spirits</td></tr>
<tr><td>Nervous</td></tr>
<tr><td>Lonely</td></tr>
<tr><td>Feel like crying</td></tr>
<tr><td>Anxious</td></tr>
<tr><td>Angry</td></tr>
<tr><td>Irritated</td></tr>
<tr><td>Aggravated</td></tr>
<tr><td>Frustrated</td></tr>
<tr><td rowspan="9">A4</td><td rowspan="9">Impact of distractions on physical health, i.e. you feel distractions increases frequency or severity of</td><td>Headache</td><td rowspan="9">Strength of perception about impact of distractions on physical health</td><td rowspan="9">Very Significant</td><td rowspan="9">Not at all or very little</td></tr>
<tr><td>Backache</td></tr>
<tr><td>Other musculoskeletal problems</td></tr>
<tr><td>Easily tired</td></tr>
<tr><td>Unusual fatigue</td></tr>
<tr><td>Physical irritation</td></tr>
<tr><td>Gastrointestinal disturbance</td></tr>
<tr><td>Low in energy</td></tr>
<tr><td>Unusual stress</td></tr>
</table>

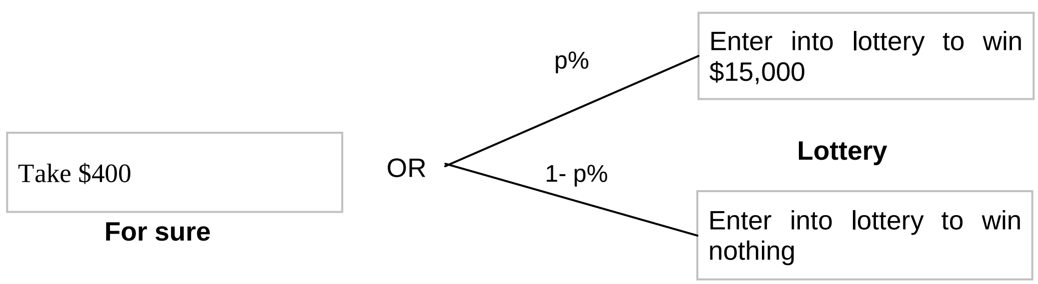
Notation	Attribute	Items of attribute	Measurement of attribute	Measurement levels of attribute	
				Worst	**Best**
A5	Impact of distractions on workspace satisfaction, i.e. you do not feel satisfied with	Speech privacy	Strength of perception about impact of distractions on satisfaction with workspace	Very Significant	Not at all or very little
		Privacy from auditory distractions coming from the surroundings			
		Working in the workspace			
		Design of workspace and micro-environment			
A6	Impact of distractions on social responsiveness, i.e. distractions impact	Willingness to help colleague	Strength of perception about impact of distractions on social responsiveness	Very Significant	Not at all or very little
		Willingness to cooperate			
		Attitude towards co-worker			
		Behavior towards co-worker			
A7	Impact of distractions on social cohesion, i.e. distractions impact	Free communication between colleagues	Strength of perception about impact of distractions on social cohesion	Very Significant	Not at all or very little
		Preference to work as a team rather than alone			
		Preference to spend time outside workplace and work hours			
		Preference to stick together after the project is over			
		Preference to socialize often			
A8	Workspace's support for individual work , i.e., workspace supports the following items without having to find another private enclosure	On demand opaqueness from environmental distractions	Strength of perception about workspace's support for individual work	Not at all or very little	Very Significant
		On demand concentration without drive-by interruptions			
A9	Workspace's support for collaborative work , i.e., workspace supports the following items without having to find another collaboration space and without disturbing surroundings	Serendipitous interactions	Strength of perception about workspace's support for collaborative group work	Not at all or very little	Very Significant
		Short consultations between colleagues			
		Brief social interactions			
		Drive-by interruptions			
A10	Direct costs of workspace		Cost of acquiring and installing a workspace	Very Significant i.e. $51,00 - $10,000	Very Little, i.e. $100 - $500

SINGLE ATTRIBUTE UTILITY ASSESSMENT

Gamble based elicitation is used to obtain your utility for each measurement level (five for this study) of an attribute. According to the technique, the worst and best level of an attribute are given the utilities of 0 and 1 (as shown in table below) and these are used as anchor points to obtain your utilities for intermediate levels of measurement. An illustration is provided below to explain how the gambles are designed to seek your utility values for various levels of attributes.

GAMBLE ILLUSTRATION

Suppose you are offered the following gamble: you may take $400 for sure or enter into a lottery in which you have p% chance of winning $15,000 (best possibility) and (1-p)% chance to win nothing, i.e. $0 (worst possibility).



A set of question the above gamble are shown in the table below. My reasoning and answers are also provided.

Question	**My reasoning**	**My answer**
What is the smallest value of p (say p1) for which you will definitely prefer lottery to the sure offer? p1 is in percentage. (i.e., if the probability of winning the best price in the lottery is at least p1%, then you will definitely go for the lottery.)	I am getting $400 for sure. However, $15,000 is a big amount. I think that if the chance to win the best bet is even 40%, then I would go for the lottery.	40
What is the largest value of p (say p2) for which you will definitely prefer the sure offer to the lottery? p2 is in percentage. (i.e., if the chance of getting the best price in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	On the other hand, if the chance to win the best bet is only 20% or lower, then I will definitely accept the sure offer, i.e. take $400.	20

Question	**My reasoning**	**My answer**
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p, where p is in percentage?	Furthermore, I strongly believe that I will be indifferent between the lottery and the sure offer if the chance to win $15,000 is 30%.	30

The data in the above table help me calculate my utility for the above gamble.

In the following sections, similar gambles are designed for the attributes that have been validated through phase I and II of this study. You are requested to fill in your choices. Your data will help me calculate the utilities for all intermediate levels of an attribute. I will advise using pencil as you may play with numbers.

Attribute A1

Impact of distractions (auditory distractions coming from surrounding work environment) on work efficiency, where work efficiency is defined in terms of the following items:

Time to accomplish task,

Ability to concentrate,

Speed to finish task, and

Efforts to finish task.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Not at all: Distractions have no or very little impact on work efficiency.

(4) A little: Distractions have a little impact on work efficiency.

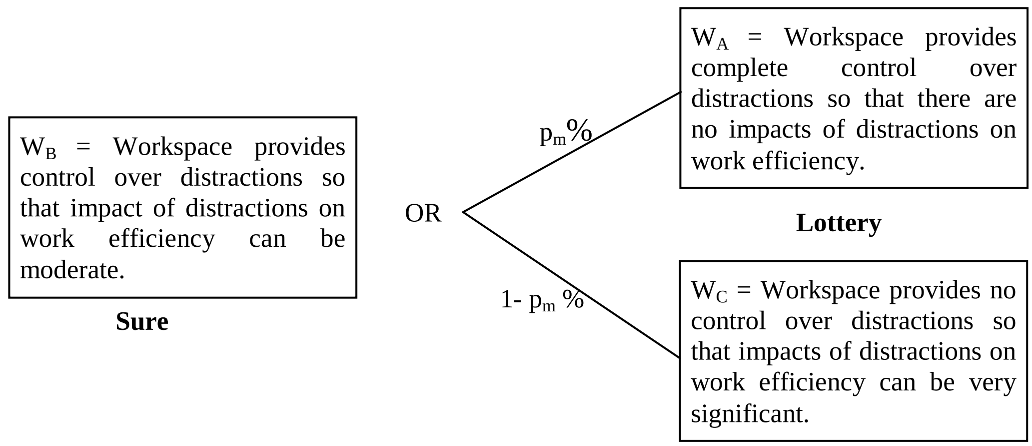
(3) Moderate: Distractions have a moderate impact on work efficiency.

(2) Significant: Distractions have a significant impact on work efficiency.

(1) Very Significant: Distractions have a very significant impact on work efficiency.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble.

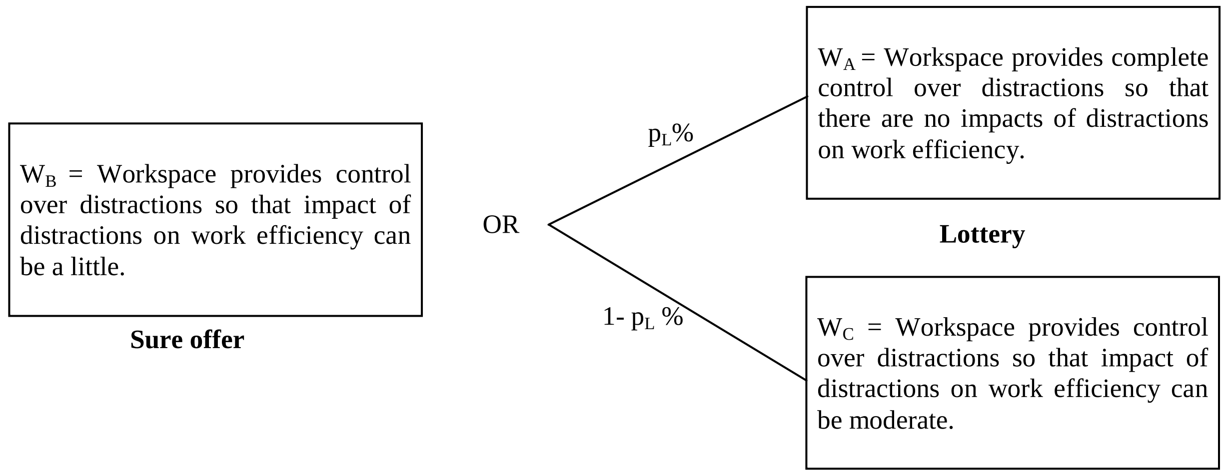
Attribute A1: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A1.

Question	**Answer**
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. $W_{B)}$? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A1: GAMBLE 2



Please answer the following questions regarding Gamble 2 for attribute A1.

Question	Answer
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L , where p_L is in percentage?	45
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A1: GAMBLE 3

W_B = Workspace provides control over distractions so that impact of distractions on work efficiency can be significant.

Sure offer

OR

$p_h\%$

W_A = Workspace provides control over distractions so that impact of distractions on work efficiency can be moderate.

Lottery

$1 - p_h\ \%$

W_C = Workspace provides control over distractions so that impact of distractions on work efficiency can be very significant.

Please answer the following questions regarding Gamble 3 for attribute A1.

Question	Answer
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p is in percentage?	35
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A2

Impact of distractions (auditory distractions coming from surrounding work environment) on work effectiveness, where work effectiveness is defined in terms of the following items:

Desirability to generate new ideas, methods, concepts etc,

Desirability to explore alternatives rather than adopting routine,

Desirability to create value for customers, organization etc,

Desirability to be creative and innovative.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Not at all: Distractions have no or very little impact on work effectiveness.

(4) A little: Distractions have a little impact on work effectiveness.

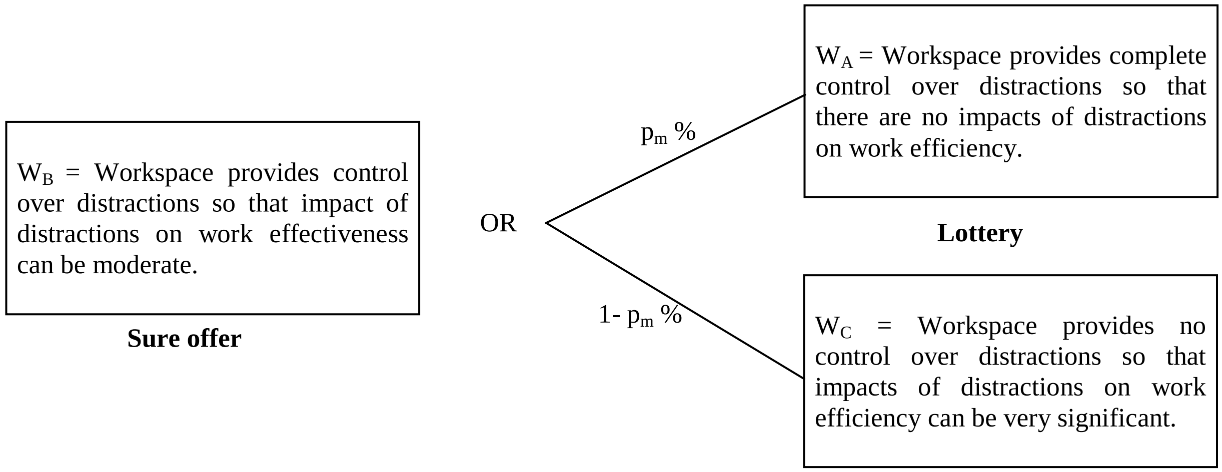
(3) Moderate: Distractions have a moderate impact on work effectiveness.

(2) Significant: Distractions have a significant impact on work effectiveness.

(1) Very Significant: Distractions have a very significant impact on work effectiveness.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble.

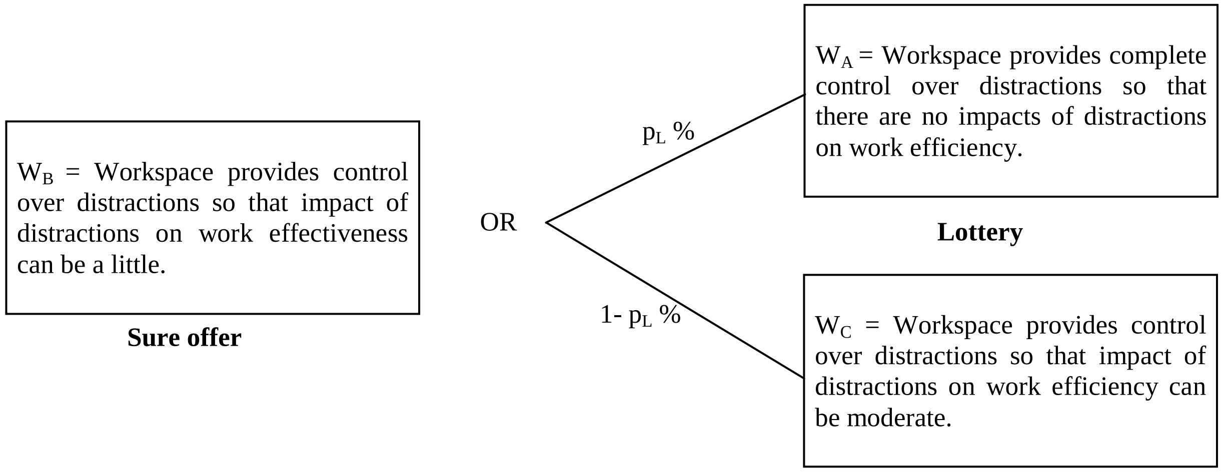
Attribute A2: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A2.

Question	**Answer**
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

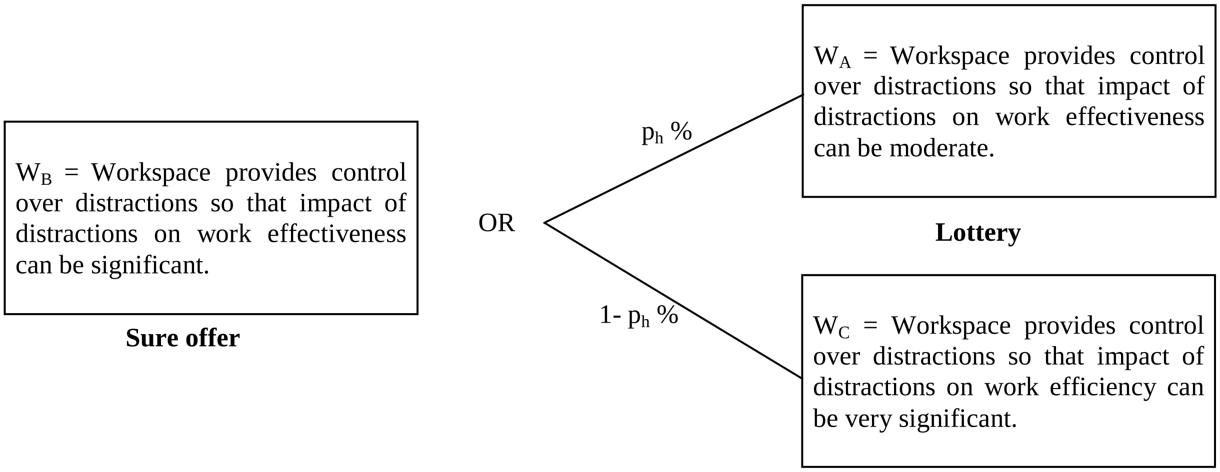
Attribute A2: GAMBLE 2



Please answer the following questions regarding Gamble 2 for attribute A2.

Question	**Answer**
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A2: GAMBLE 3



Please answer the following questions regarding Gamble 3 for attribute A2.

Question	**Answer**
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A3

Impact of distractions (auditory distractions coming from surrounding work environment) on psychological health, where psychological health is defined in terms of the following items:

Distractions make you feel

Sad or depressed,

Worried,

In low spirits,

Nervous,

Lonely,

Feel like crying,

Anxious,

Angry,

Irritated,

Aggravated,

Frustrated.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Not at all: Distractions have no or very little impact on psychological health.

(4) A little: Distractions have a little impact on psychological health.

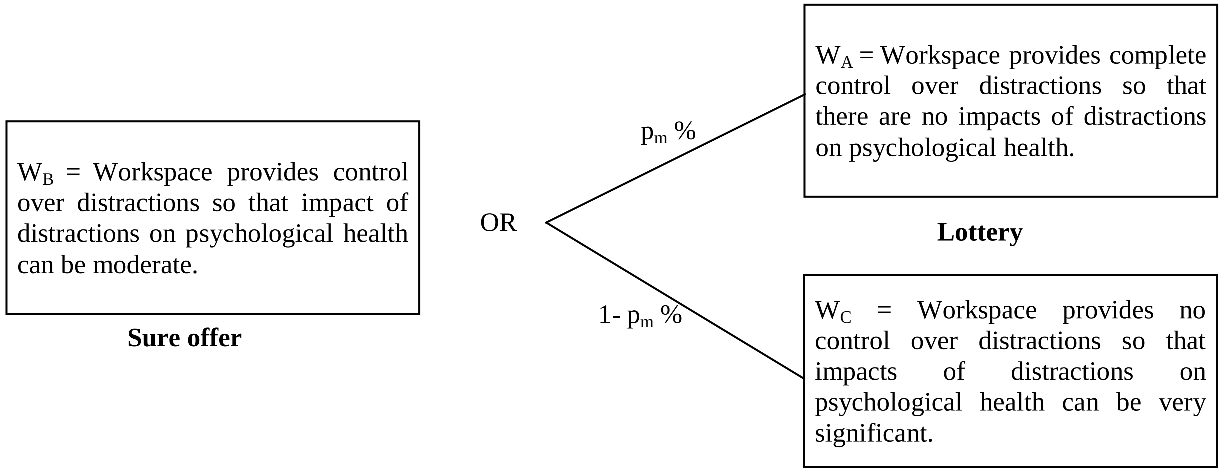
(3) Moderate: Distractions have a moderate impact on psychological health.

(2) Significant: Distractions have a significant impact on psychological health.

(1) Very Significant: Distractions have a very significant impact on psychological health.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble

Attribute A3: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A3.

Question	**Answer**
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m , where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A3: GAMBLE 2

W_B = Workspace provides control over distractions so that impact of distractions on psychological health can be a little.

Sure offer

OR

p_L %

W_A = Workspace provides complete control over distractions so that there are no impacts of distractions on psychological health.

Lottery

1- p_L %

W_C = Workspace provides control over distractions so that impact of distractions on psychological health can be moderate.

Please answer the following questions regarding Gamble 2 for attribute A3.

Question	**Answer**
What is the smallest value of pL (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of pL (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A3: GAMBLE 3

W_B = Workspace provides control over distractions so that impact of distractions on psychological health can be significant.

Sure offer

OR

p_h %

W_A = Workspace provides control over distractions so that impact of distractions on psychological health can be moderate.

Lottery

1- p_h %

W_C = Workspace provides control over distractions so that impact of distractions on psychological health can be very significant.

Please answer the following questions regarding Gamble 3 for attribute A3.

Question	**Answer**
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A4

Impact of distractions (auditory distractions coming from surrounding work environment) on physical health, where physical health is defined in terms of the following items:

Distractions seem to increase the frequency or severity of;

Headache,

Backache,

Other musculoskeletal problems,

Easily tired,

Unusual fatigue,

Concentration difficulty,

Memory problems,

Physical irritation,

Gastrointestinal disturbance,

Low in energy,

Unusual stress.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Not at all: Distractions have no or very little impact on physical health.

(4) A little: Distractions have a little impact on physical health.

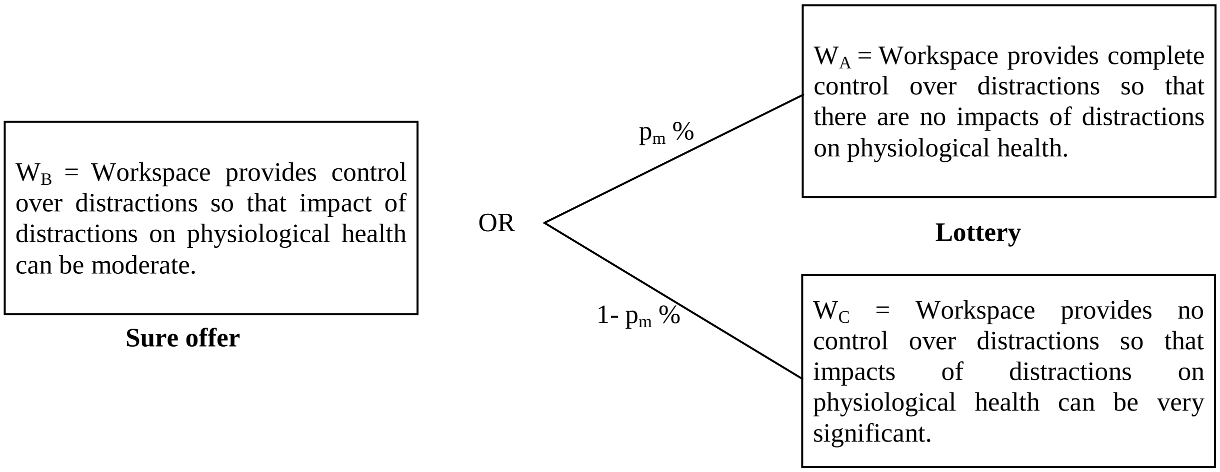
(3) Moderate: Distractions have a moderate impact on physical health.

(2) Significant: Distractions have a significant impact on physical health.

(1) Very Significant: Distractions have a very significant impact on physical health.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble

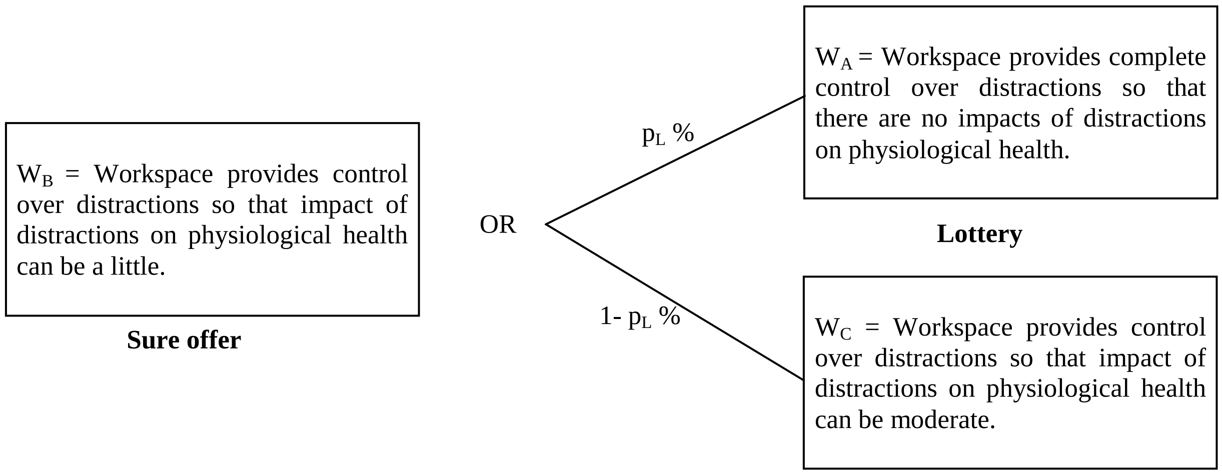
Attribute A4: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A4.

Question	**Answer**
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

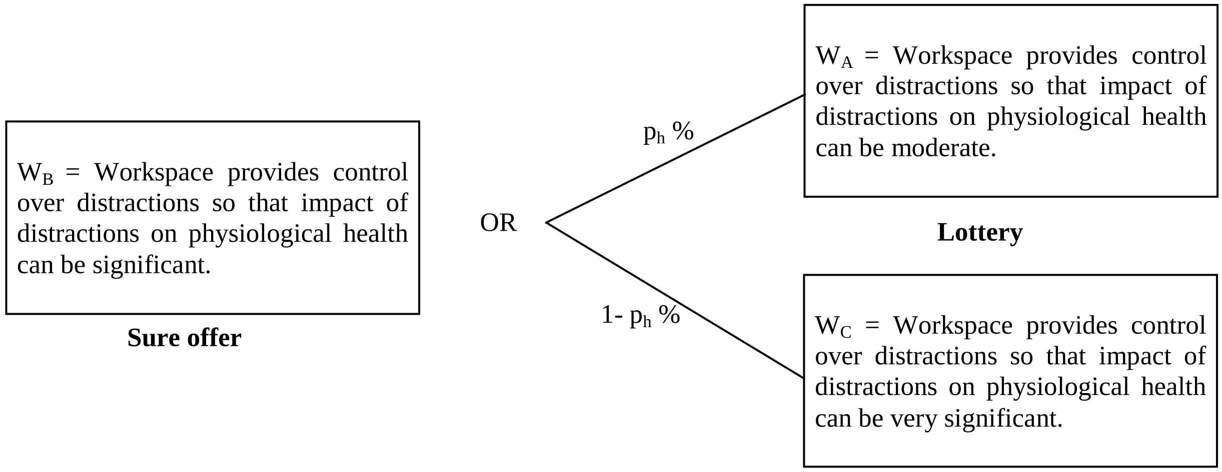
Attribute A4: GAMBLE 2



Please answer the following questions regarding Gamble 2 for attribute A4.

Question	Answer
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L , where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A4: GAMBLE 3



Please answer the following questions regarding Gamble 3 for attribute A4.

Question	**Answer**
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A5

Impact of distractions (auditory distractions coming from surrounding work environment) on workspace satisfaction, where workspace satisfaction is defined in terms of the following items:

Speech privacy,

Privacy from auditory distractions coming from the surroundings,

Working in the workspace,

Type of workspace, i.e., open, enclosed, convertible, etc.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Not at all: Distractions have no or very little impact on workspace satisfaction.

(4) A little: Distractions have a little impact on workspace satisfaction.

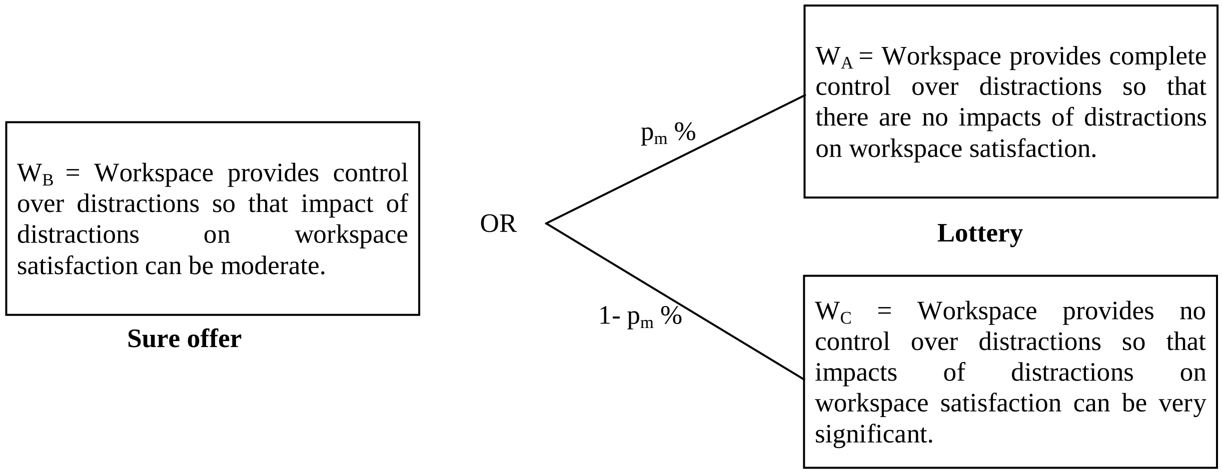
(3) Moderate: Distractions have a moderate impact on workspace satisfaction.

(2) Significant: Distractions have a significant impact on workspace satisfaction.

(1) Very Significant: Distractions have a very significant impact on workspace satisfaction.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble

Attribute A5: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A5.

Question	Answer
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A5: GAMBLE 2

W_B = Workspace provides control over distractions so that impact of distractions on workspace satisfaction can be a little.

Sure offer

OR

p_L %

W_A = Workspace provides complete control over distractions so that there are no impacts of distractions on workspace satisfaction.

Lottery

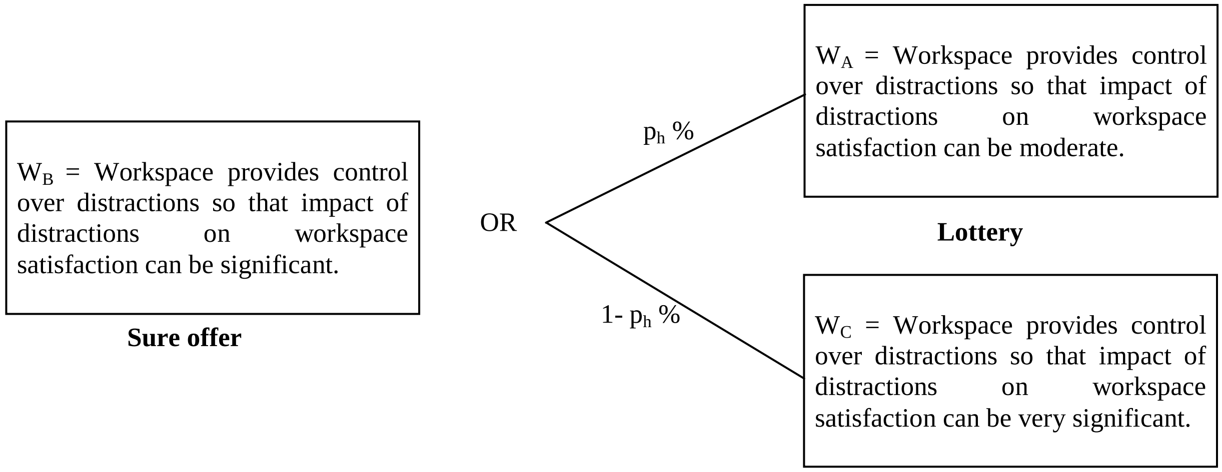
1- p_L %

W_C = Workspace provides control over distractions so that impact of distractions on workspace satisfaction can be moderate.

Please answer the following questions regarding Gamble 2 for attribute A5.

Question	Answer
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A5: GAMBLE 3



Please answer the following questions regarding Gamble 3 for attribute A5

Question	**Answer**
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A6

Impact of distractions (auditory distractions coming from surrounding work environment) on social responsiveness, where social responsiveness is defined in terms of the following items:

Willingness to help colleague,

Willingness to cooperate,

Attitude towards co-worker,

Behavior towards co-worker.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Not at all: Distractions have no or very little impact on social responsiveness.

(4) A little: Distractions have a little impact on social responsiveness.

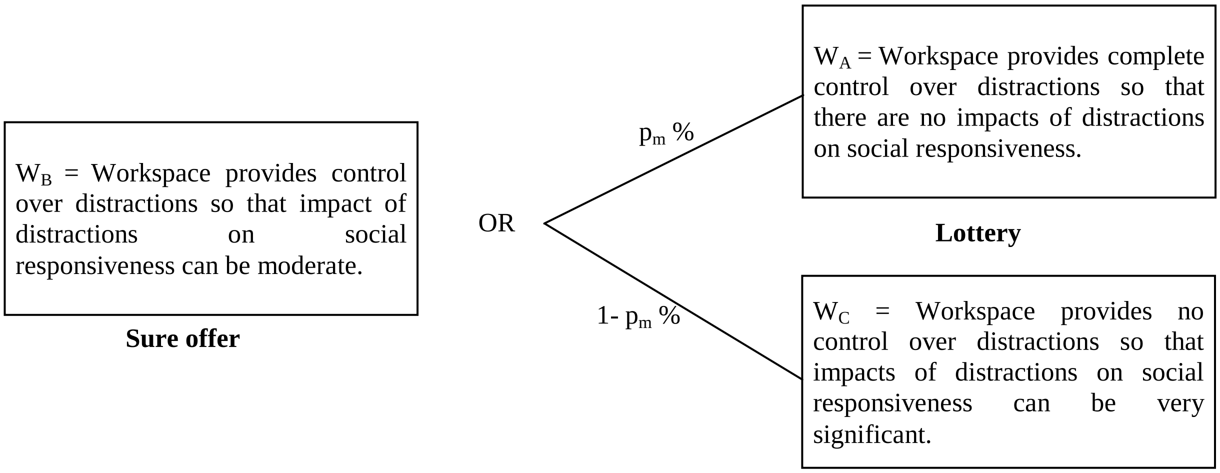
(3) Moderate: Distractions have a moderate impact on social responsiveness.

(2) Significant: Distractions have a significant impact on social responsiveness.

(1) Very Significant: Distractions have a very significant impact on social responsiveness.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble.

Attribute A6: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A6.

Question	**Answer**
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A6: GAMBLE 2

W_B = Workspace provides control over distractions so that impact of distractions on social responsiveness can be a little.

Sure offer

OR

p_L %

W_A = Workspace provides complete control over distractions so that there are no impacts of distractions on social responsiveness.

Lottery

1- p_L %

W_C = Workspace provides control over distractions so that impact of distractions on social responsiveness can be moderate.

Please answer the following questions regarding Gamble 2 for attribute A6.

Question	Answer
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A6: GAMBLE 3

W_B = Workspace provides control over distractions so that impact of distractions on social responsiveness can be significant.

Sure offer

OR

p_h %

W_A = Workspace provides control over distractions so that impact of distractions on social responsiveness can be moderate.

Lottery

1- p_h %

W_C = Workspace provides control over distractions so that impact of distractions on social responsiveness can be very significant.

Please answer the following questions regarding Gamble 3 for attribute A6.

Question	**Answer**
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A7

Impact of distractions (auditory distractions coming from surrounding work environment) on social cohesion, where social cohesion is defined in terms of the following items:

Free communication between colleagues,
Preference to work as a team member rather than alone,
Preference to spend outside workplace and work hours,
Preference to stick together after the project is over,
Preference to socialize often.

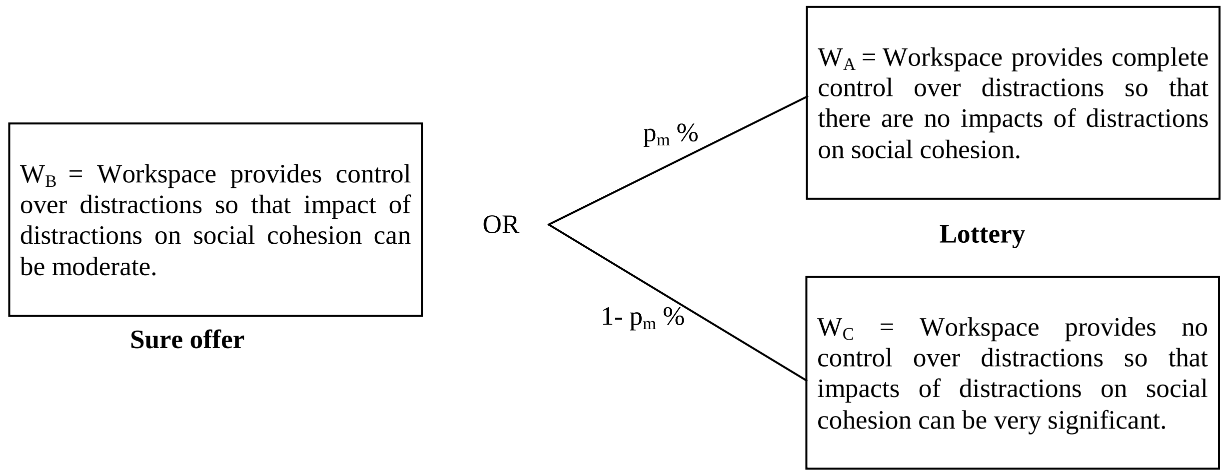
Measurement levels of attribute

The attribute is measured at five levels:

(5) Not at all: Distractions have no or very little impact on social cohesion.
(4) A little: Distractions have a little impact on social cohesion.
(3) Moderate: Distractions have a moderate impact on social cohesion.
(2) Significant: Distractions have a significant impact on social cohesion.
(1) Very Significant: Distractions have a very significant impact on social cohesion.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble.

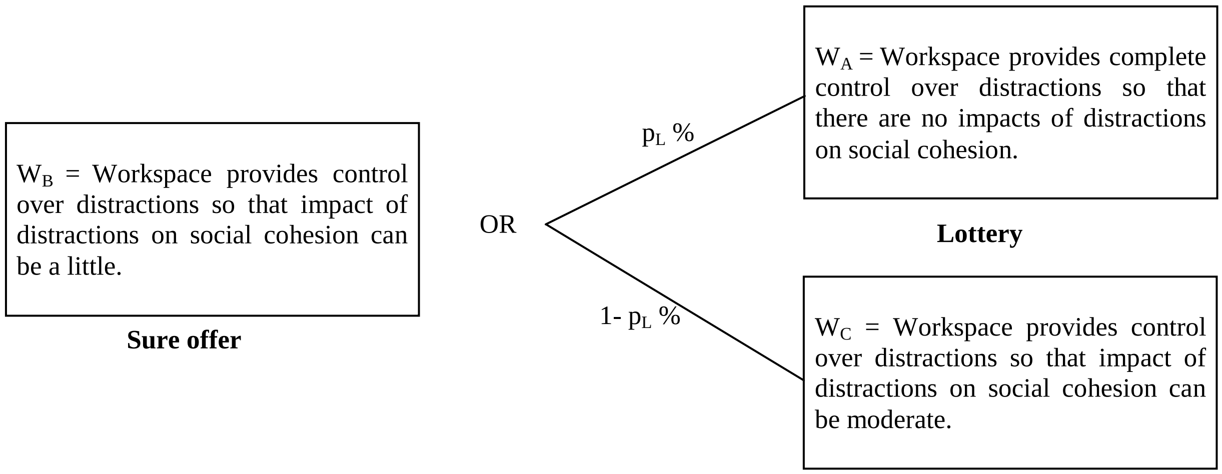
Attribute A7: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A7.

Question	Answer
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

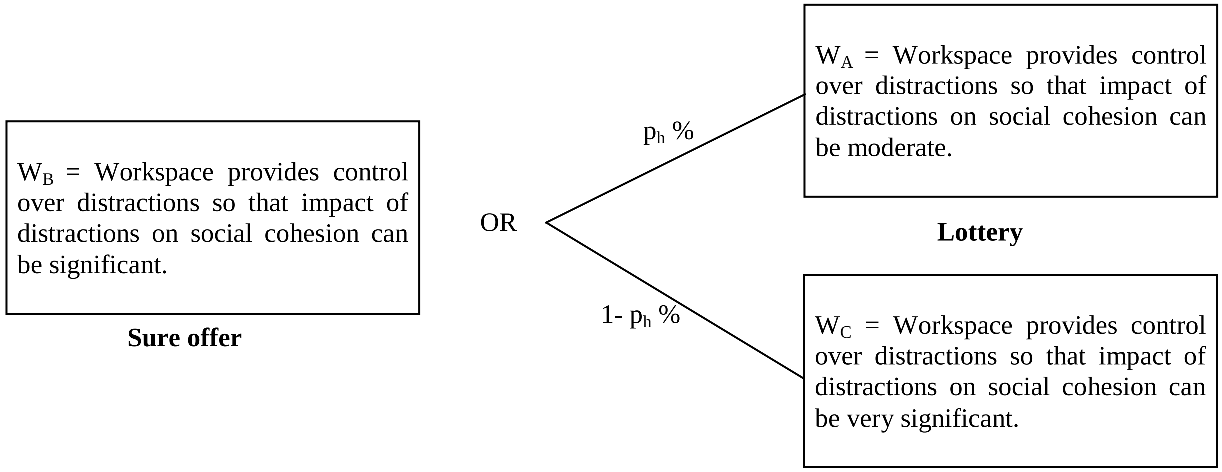
Attribute A7: GAMBLE 2



Please answer the following questions regarding Gamble 2 for attribute A7.

Question	Answer
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A7: GAMBLE 3



Please answer the following questions regarding Gamble 3 for attribute A7.

Question	Answer
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A8

Workspace's support for individual concentrated work, where a workspace is defined as supporting individual concentrated work if and only if it supports following items without having to move to another space:

Privacy from being overheard,

Privacy from overhearing,

Privacy from auditory distractions including sound and speech,

On demand privacy,

Concentration without drive-by interruptions and involuntary auditory distractions,

Individual's subjective response to noise.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Very Significant: Workspace provides very significant support for individual concentrated work.

(4) Significant: Workspace provides significant support for individual concentrated work.

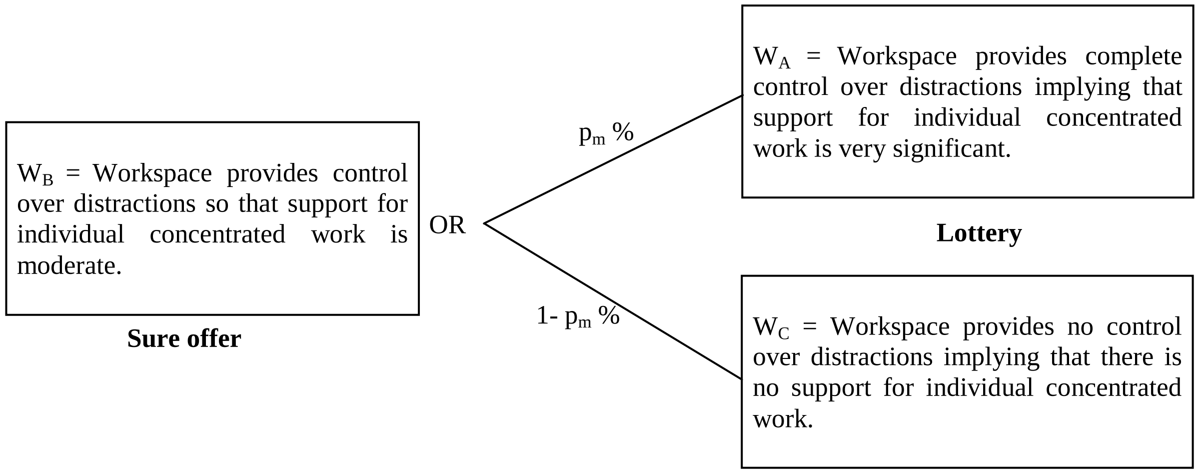
(3) Moderate: Workspace provides moderate support for individual concentrated work.

(2) A little: Workspace provides a little support for individual concentrated work.

(1) Not at all or very little: Workspace provides no or very little support for individual concentrated work.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble.

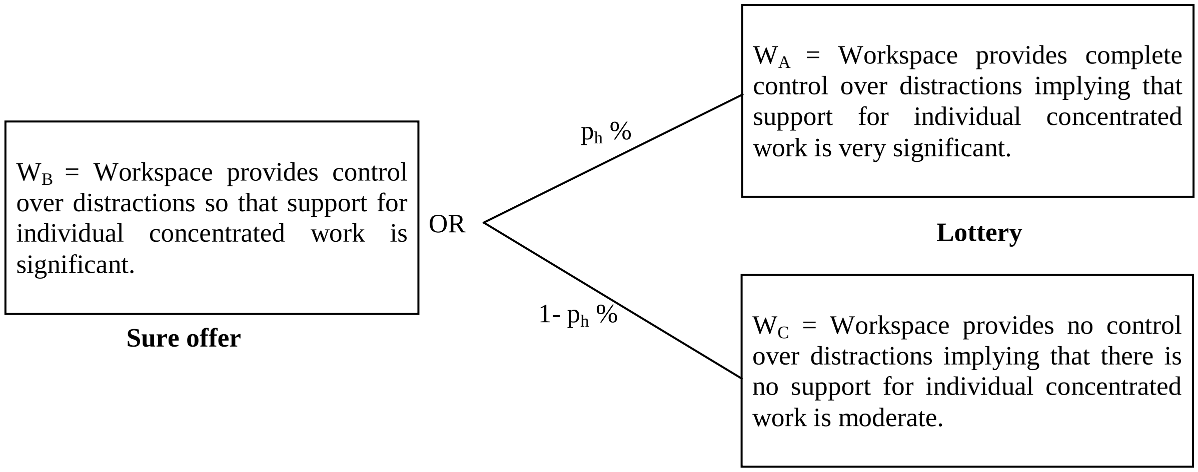
Attribute A8: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A8.

Question	**Answer**
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A8: GAMBLE 2



Please answer the following questions regarding Gamble 2 for attribute A8.

Question	Answer
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A8: GAMBLE 3

W_B = Workspace provides control over distractions so that support for individual concentrated work is a little.

Sure offer

OR

p_L %

W_A = Workspace provides control over distractions so that support for individual concentrated work is moderate.

Lottery

1- p_L %

W_C = Workspace provides no control over distractions implying that there is no support for individual concentrated work.

Please answer the following questions regarding Gamble 3 for attribute A8.

Question	Answer
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A9

Workspace's support for collaborative group work, where a workspace is defined as supporting collaborative group work if and only if it supports following items without having to move to another space and without disturbing surroundings:

Serendipitous interactions,

Privacy of telephonic meetings,

Short consultation between colleagues,

Brief social interactions,

Drive-by interruptions.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Very Significant: Workspace provides very significant support for collaborative group work.

(4) Significant: Workspace provides significant support for collaborative group work.

(3) Moderate: Workspace provides moderate support for collaborative group work.

(2) A little: Workspace provides a little support for collaborative group work.

(1) Not at all or very little: Workspace provides no or very little support for collaborative group work.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble.

Attribute A9: GAMBLE 1

W_B = Workspace provides control over distractions so that support for collaborative group work is moderate.

Sure offer

OR

p_m %

W_A = Workspace provides complete control over distractions implying that support for collaborative group work is very significant.

Lottery

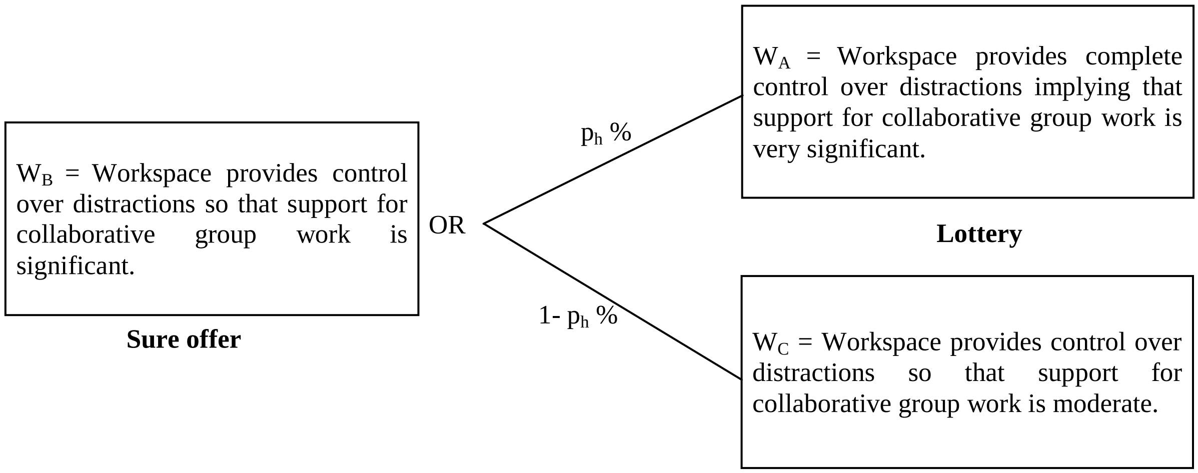
1- p_m %

W_C = Workspace provides no control over distractions implying that there is no support for collaborative group work.

Please answer the following questions regarding Gamble 1 for attribute A9.

Question	**Answer**
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A9: GAMBLE 2



Please answer the following questions regarding Gamble 2 for attribute A9.

Question	**Answer**
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A9: GAMBLE 3

W_B = Workspace provides control over distractions so that support for collaborative group work is a little.

Sure offer

OR

p_L %

W_A = Workspace provides control over distractions so that support for collaborative group work is moderate.

Lottery

1- p_L %

W_C = Workspace provides no control over distractions implying that there is no support for individual concentrated work.

Please answer the following questions regarding Gamble 3 for attribute A9.

Question	**Answer**
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A10

Direct cost of workspace, where direct cost of workspace is defined in terms of costs of acquiring and installing a workspace.

Measurement levels of attribute

The attribute is measured at five levels:

(5) Very little: Direct costs of workspace are very little, i.e. $100 -$500.

(4) A little: Direct costs of workspace are a little, i.e. $501 - $1000.

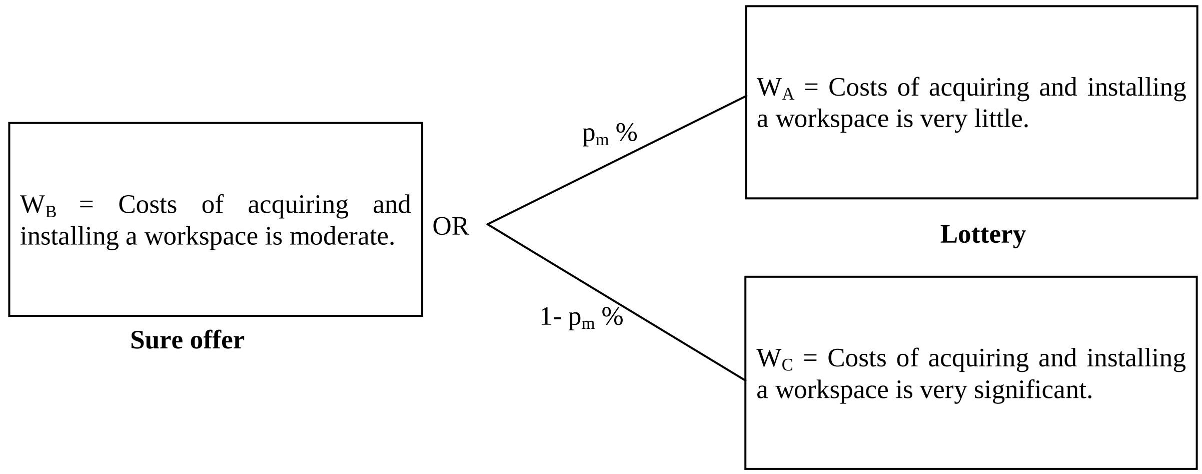
(3) Moderate: Direct costs of workspace are moderate, i.e. $1001 - $2000.

(2) Significant: Direct costs of workspace are significant, i.e. $2001-$5000.

(1) Very Significant: Direct costs of workspace are very significant, i.e. $5100-$10,000.

You are invited to participate in the gambles shown in the figures below. Please answer the questions related to each gamble.

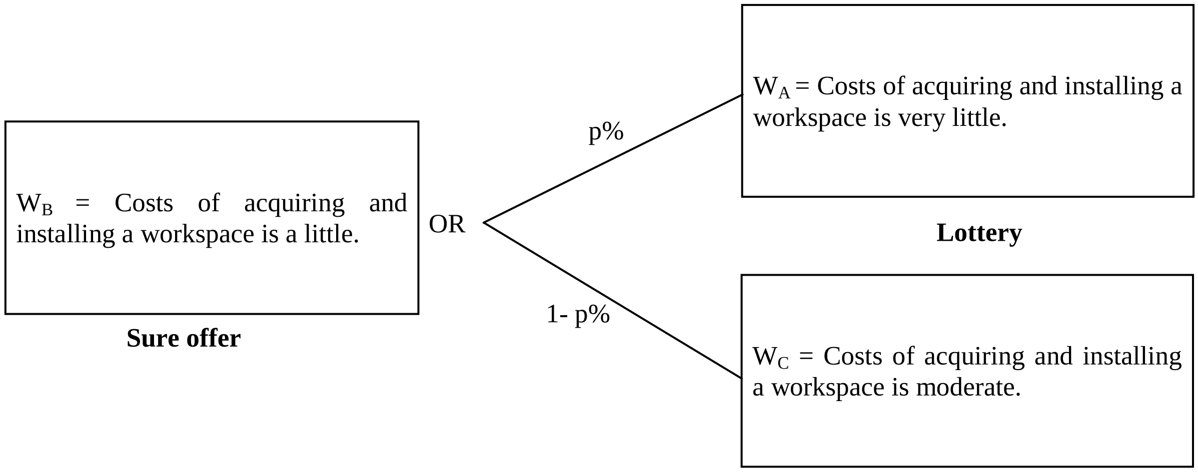
Attribute A10: GAMBLE 1



Please answer the following questions regarding Gamble 1 for attribute A10.

Question	Answer
What is the smallest value of p_m (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_m (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_m in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_m, where p_m is in percentage?	
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_m (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

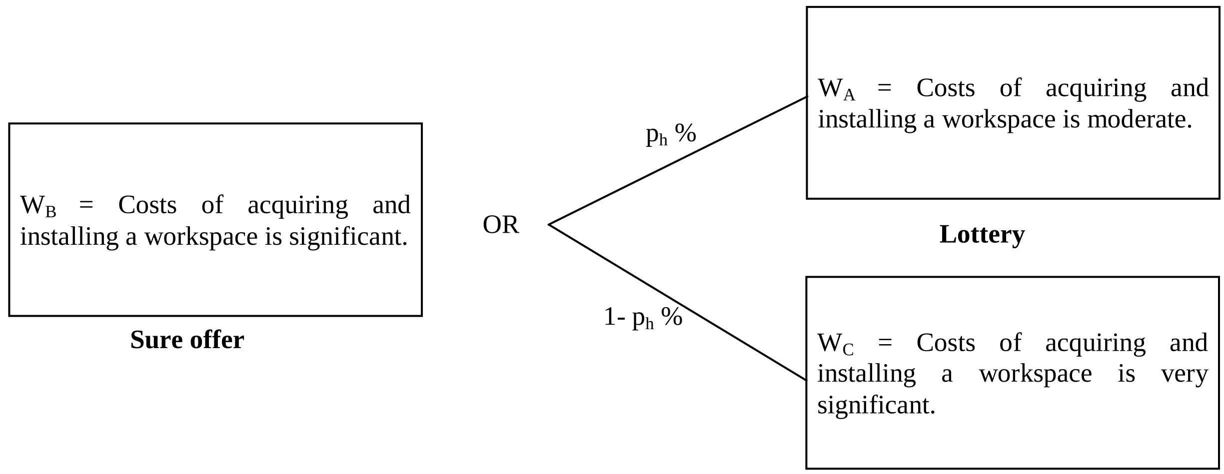
Attribute A10: GAM



Please answer the following questions regarding Gamble 2 for attribute A10.

Question	Answer
What is the smallest value of p_L (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_L (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_L in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_L, where p_L is in percentage?	
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_L (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

Attribute A10: GAMBLE 3



Please answer the following questions regarding Gamble 3 for attribute A10.

Question	Answer
What is the smallest value of p_h (say p1) for which you will definitely prefer lottery to the sure offer (i.e. W_B)? p1 is in percentage. (i.e. if the chance of winning the best workspace (i.e. W_A) in the lottery is at least p1%, then you will definitely go for the lottery).	
What is the largest value of p_h (say p2) for which you will definitely prefer the sure offer (i.e. W_B) to the lottery? p2 is in percentage. (i.e., if the chance of getting the best workspace (i.e. W_A) in the lottery is only p2% or lower, then you will prefer to accept the sure offer)	
In the above two questions, your preference changed from accepting the lottery to accepting the sure offer. Therefore, there shall be a p_h in between p1 and p2 for which you will be indifferent between the lottery and the sure offer, i.e. you will accept either of the two, the lottery or the sure offer. What is this value of p_h, where p_h is in percentage?	
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their best level? Please circle your choice.	Yes No
Do you think your value of p_h (indifference point between the lottery and sure offer) will change if all other nine attributes are fixed at their worst level? Please circle your choice.	Yes No

ATTRIBUTES FOR EVALUATING WORKSPACES

Table 1. . Summary of validated attributes for evaluating workspaces (copied from page 4)

Notation	Attribute	Items of attribute	Measurement of attribute	Measurement levels of attribute: Worst	Measurement levels of attribute: Best
A1	Impact of distractions on work efficiency, i.e. distractions impact	Time to accomplish task	Strength of perception about impact of distractions on work efficiency	Very Significant	Not at all or very little
		Ability to concentrate			
		Speed to finish task			
		Efforts to finish task			
A2	Impact of distractions on work effectiveness, i.e. distractions impact	Desirability to generate new ideas, methods, concepts etc.	Strength of perception about impact of distractions on work effectiveness	Very Significant	Not at all or very little
		Desirability to explore alternatives rather than adopting routine			
		Desirability to create value for customers, organization etc.			
		Desirability to be creative and innovative.			
A3	Impact of distractions on psychological health, i.e. distractions make you feel	Sad or depressed	Strength of perception about impact of distractions on psychological health	Very Significant	Not at all or very little
		Worried			
		In low spirits			
		Nervous			
		Lonely			
		Feel like crying			
		Anxious			
		Angry			
		Irritated			
		Aggravated			
		Frustrated			
A4	Impact of distractions on physical health, i.e. you feel distractions increases frequency or severity of	Headache	Strength of perception about impact of distractions on physical health	Very Significant	Not at all or very little
		Backache			
		Other musculoskeletal problems			
		Easily tired			
		Unusual fatigue			
		Physical irritation			
		Gastrointestinal disturbance			
		Low in energy			
		Unusual stress			

<table>
<tr><th rowspan="2">Notation</th><th rowspan="2">Attribute</th><th rowspan="2">Items of attribute</th><th rowspan="2">Measurement of attribute</th><th colspan="2">Measurement levels of attribute</th></tr>
<tr><th>Worst</th><th>Best</th></tr>
<tr><td rowspan="4">A5</td><td rowspan="4">Impact of distractions on workspace satisfaction, i.e. you do not feel satisfied with</td><td>Speech privacy</td><td rowspan="4">Strength of perception about impact of distractions on satisfaction with workspace</td><td rowspan="4">Very Significant</td><td rowspan="4">Not at all or very little</td></tr>
<tr><td>Privacy from auditory distractions coming from the surroundings</td></tr>
<tr><td>Working in the workspace</td></tr>
<tr><td>Design of workspace and micro-environment</td></tr>
<tr><td rowspan="4">A6</td><td rowspan="4">Impact of distractions on social responsiveness, i.e. distractions impact</td><td>Willingness to help colleague</td><td rowspan="4">Strength of perception about impact of distractions on social responsiveness</td><td rowspan="4">Very Significant</td><td rowspan="4">Not at all or very little</td></tr>
<tr><td>Willingness to cooperate</td></tr>
<tr><td>Attitude towards co-worker</td></tr>
<tr><td>Behavior towards co-worker</td></tr>
<tr><td rowspan="5">A7</td><td rowspan="5">Impact of distractions on social cohesion, i.e. distractions impact</td><td>Free communication between colleagues</td><td rowspan="5">Strength of perception about impact of distractions on social cohesion</td><td rowspan="5">Very Significant</td><td rowspan="5">Not at all or very little</td></tr>
<tr><td>Preference to work as a team rather than alone</td></tr>
<tr><td>Preference to spend time outside workplace and work hours</td></tr>
<tr><td>Preference to stick together after the project is over</td></tr>
<tr><td>Preference to socialize often</td></tr>
<tr><td rowspan="2">A8</td><td rowspan="2">Workspace’s support for individual work , i.e., workspace supports the following items without having to find another private enclosure</td><td>On demand opaqueness from environmental distractions</td><td rowspan="2">Strength of perception about workspace’s support for individual work</td><td rowspan="2">Not at all or very little</td><td rowspan="2">Very Significant</td></tr>
<tr><td>On demand concentration without drive-by interruptions</td></tr>
<tr><td rowspan="4">A9</td><td rowspan="4">Workspace’s support for collaborative work , i.e., workspace supports the following items without having to find another collaboration space and without disturbing surroundings</td><td>Serendipitous interactions</td><td rowspan="4">Strength of perception about workspace’s support for collaborative group work</td><td rowspan="4">Not at all or very little</td><td rowspan="4">Very Significant</td></tr>
<tr><td>Short consultations between colleagues</td></tr>
<tr><td>Brief social interactions</td></tr>
<tr><td>Drive-by interruptions</td></tr>
<tr><td>A10</td><td colspan="2">Direct costs of workspace</td><td>Cost of acquiring and installing a workspace</td><td>Very Significant i.e. $51,00 - $10,000</td><td>Very Little, i.e. $100 - $500</td></tr>
</table>

RANKING OF ATTRIBUTES

The attributes validated for evaluating workspace alternatives are shown in table 1. The best and worst measurement levels are also shown.

In this section, you are requested to rank and rate the attributes. In reference, eleven hypothetical consequences are prepared as shown in table 2. Each row in the table represents a consequence in which one of the 10 attributes is swung to its best level while all other attributes are fixed at their worst level. For instance in the row 2, the attribute “impact on work efficiency” is swung to its best level, which is “no impact or very little impact” and in the row 3, attribute “impact on work effectiveness” is swung to its best level, which is “no impact or very little impact” whereas all other attributes are fixed at their worst level.

You are requested to rank and rate the consequences in rows 2 to 11. For instance, if you prefer the consequence, “no or very little impact on physical health (attribute A4)” as the most important or valuable consequence then, rank this consequence “1”. Similarly repeat he process for rest of the attributes ranking each consequence from 2 to 10. Row 1 represents a benchmark consequence where all the attributes are at their worst level; so obviously this is the worst possible consequence with rank 11.

After completing the ranking of the consequences, you are requested to rate the consequences between 0 and 100. According to the methodology, the rating for the benchmark consequence (row 1 in the table 2) is default to 0 and the rating for the highest ranked (rank = 1) consequence is default to 100. The ratings for other 9 consequences must fall between 0 and 100 and should follow the rankings, i.e. higher ranking (where, 1 is the best rank and 11 is the worst rank) must yield higher rating (where, 100 is the best rating and 0 is the worst rating) and lower ranking must yield lower rating. The rating of x% for a consequence actually means that you think improving the respective attribute from worst to best is worth x% of the value you get by improving the best consequence (with rank 1) from worst to best. For instance, if consequence 4 is ranked 2 and consequence 10 is ranked 1, then a rating of 100 will be assigned to consequence 10 and a rating of 80 for consequence 4 will mean that you think by improving the attribute A3 “Impact on psychological health” from its worst level to its best level you will get 80% of the value that you would have achieved by improving the highest ranked consequence, i.e. consequence 10 from its worst to its best level.

Table 2. Hypothetical Consequences for rank assessment.

Consequence No.	Attribute swung from worst to best	Consequence	Rank	Rating
1	(Benchmark)	A1 - A10 are at worst level.	11	0
2	A1 - Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level		
3	A2 - Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level		
4	A3 - Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst		
5	A4 - Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst		
6	A5 - Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst		
7	A6 - Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst		
8	A7 - Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst		
9	A8 – Workspace’s support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst		
10	A9 – Workspace’s support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level		
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level		

WORKSPACE ALTERNATIVES

Please rank the alternatives for workspace in the table 3 from 1 through 5.

Assumption: Assume that a workspace that provides moderate control over distractions is the one that contributes moderately to all the attributes, A1 through A10, i.e., .the impacts of distractions on work efficiency, work effectiveness, etc. will be moderate and it will provide moderate support for individual or collaborative work.

Table 3. Alternative workspace choices.

	Description	**Rank**
W1	Open workspace, that provides no control over distractions*	
W2	Adaptable workspace that provides a little control over distractions*; for instance you are provided with noise cancellation headphones.	
W3	Adaptable workspace provides moderate control over distractions*; for instance you work in an environment with personal acoustical masking.	
W4	Adaptable workspace provides a significant control over distractions*, for instance you work in an environment where you can operate personal acoustical shadow technology.	
W5	Adaptable workspace provides very significant or complete control over distractions*, for instance IBM’s BLUSESPACE and Queen’s Attentive office cubicle.	

PROBABILITY ASSIGNMENT

In table 5, each alternative choice (C1 through C5) is displayed with its total consequence space in terms of all ten attributes (A1 through A10) and the five levels of measurement (not at all through very significant). You are requested to assign probabilities to each consequence for each alternative. Please note that the sum total of probabilities for consequence space (not at all or very little through very significant) of each attribute associated with each alternative choice shall add to 1.0 as shown at the end of columns in table 5. For instance, in case of alternative C1, the consequence space for attribute A1 is: not at all or very little, a little, moderate, significant, very significant. Similar is the consequence space for other nine attributes for alternative C1. To assign probabilities, you shall be asking questions like "In open workspace (alternative C1), what is the likelihood of getting none or very little impact of distractions on work efficiency (attribute A1) of knowledge workers?"

For ease of understanding, please read the following illustration.

Alternative choice: Academic job

Measurement levels:

Not at all

A little

Moderate

Significant

Very Significant

Attribute: Job satisfaction

Consequence space: (No job satisfaction, a little job satisfaction, Moderate job satisfaction, significant job satisfaction, very significant job satisfaction)

Assignment of Probabilities

Measurement levels	**Illustration of questions to assign probabilities to each consequence**	**Probability**
Not at all	What is the likelihood that I won't get any job satisfaction with academic job?	0.15
A little	What is the likelihood that I will get a little job satisfaction with academic job?	0.10
Moderate	What is the likelihood that I will get moderate job satisfaction with academic job?	0.15
Significant	What is the likelihood that I will get a significant job satisfaction with academic job?	0.40
Very Significant	What is the likelihood that I will get a very significant job satisfaction with academic job?	0.20

Sum Total	1.0

Please fill in the table below. Please use pencil so that you can erase and re-fill, as I assume that because of the subjective nature of the task you will adjust and re-adjust probability assignments as you proceed.

Table 4. Total consequence space.

Alternative Choice	**Measurement Levels**	**Attributes****									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1- Open workspace, that provides no control over distractions	Not at all or very little										
	A little										
	Moderate										
	Significant										
	Very Significant										
	Sum total	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
W2 – Adaptable workspace, that provides a little control over distractions	Not at all										
	A little										
	Moderate										
	Significant										
	Very Significant										
	Sum total	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
W3 - Adaptable workspace, that provides a moderate control over distractions	Not at all										
	A little										
	Moderate										
	Significant										
	Very Significant										
	Sum total	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
W4 - Adaptable workspace, that provides a significant control over distractions	Not at all										
	A little										
	Moderate										
	Significant										
	Very Significant										
	Sum total	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
W5 - Adaptable workspace, that provides a very significant or complete control over distractions	Not at all										
	A little										
	Moderate										
	Significant										
	Very Significant										
	Sum total	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Please accept our heartiest thanks for completing the questionnaire. Your participation was very valuable to make this study a success.

Parminder Juneja

Professor Kathy O. Roper

APPENDIX G

ATTRIBUTE WEIGHTS DATA SET

This Appendix presents the ranks and ratings assigned by all 20 subjects to the 10 attributes of the decision problem. The weight column is derived by normalizing the rating values, which means divide the rating assigned to an attribute by sum of ratings for all the attributes. Tables G.1 to G.10 show the data for knowledge workers and Tables G.11 to G.20 show the data for decision-makers.

Table G.1 – Attribute Weights for kw1

No.	**Attribute swung from worst to best**	**Consequences**	**Rank (R)**	**Rating (r)**	**Weight (r/∑r)**
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	2	90	0.153
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	3	85	0.144
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	9	20	0.034
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	1	100	0.169
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	4	70	0.119
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	6	65	0.110
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	5	60	0.102
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	7	40	0.085
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	8	40	0.068
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	10	0.017
	Total			580	1.00

Table G.2 – Attribute Weights for kw2

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	5	60	0.110
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	6	50	0.092
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	1	100	0.183
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	2	90	0.165
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	3	80	0.147
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	20	0.037
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	7	40	0.073
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	4	70	0.128
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	8	30	0.055
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	5	0.009
	Total			545	1.00

Table G.3 – Attribute Weights for kw3

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	4	70	0.127
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	5	60	0.109
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	1	100	0.182
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	8	30	0.055
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	9	20	0.036
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	2	90	0.164
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	3	80	0.145

9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	6	50	0.091
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	7	40	0.073
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	10	0.018
	Total			550	1.00

Table G.4 – Attribute Weights for kw4

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	4	80	0.112
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	1	100	0.14
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	3	90	0.126
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	2	95	0.133
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	6	70	0.098
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	10	40	0.056
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	9	50	0.07
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	5	75	0.105
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	7	60	0.084
11	A10– Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	8	55	0.077
	Total			715	1.00

Table G.5 – Attribute Weights for kw5

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	4	70	0.115
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	5	65	0.107

4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	2	80	0.131
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	1	100	0.164
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	3	75	0.123
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	35	0.057
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	8	50	0.082
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	6	60	0.098
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	7	55	0.09
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	20	0.033
	Total			610	1.00

Table G.6 – Attribute Weights for kw6

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	4	70	0.115
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	5	65	0.107
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	2	80	0.131
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	1	100	0.164
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	3	75	0.123
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	35	0.057
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	8	50	0.082
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	6	60	0.098
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	7	55	0.09
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	20	0.033
	Total			665	1.00

Table G.7 – Attribute Weights for kw7

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	5	70	0.118
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	3	85	0.143
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	2	95	0.16
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	1	100	0.168
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	8	30	0.05
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	6	60	0.101
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	7	50	0.084
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	4	80	0.134
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	9	20	0.034
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	5	0.008
	Total			595	1.00

Table G.8 – Attribute Weights for kw8

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	100	0.182
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	2	90	0.164
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	5	60	0.109
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	4	70	0.127
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	3	80	0.145
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	6	50	0.091
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	9	20	0.036
9	A8 – Workspace's support	A8 is at best level;	7	40	0.073

	for individual work	A1 – A7, A9, A10 are at worst level			
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	8	30	0.055
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	10	0.018
	Total			550	1.00

Table G.9 – Attribute Weights for kw9

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	100	0.136
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	4	80	0.109
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	7	70	0.095
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	2	95	0.129
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	10	50	0.068
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	5	75	0.102
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	6	65	0.088
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	3	85	0.116
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	9	55	0.075
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	8	60	0.082
	Total			735	1.00

Table G.10 – Attribute Weights for kw10

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	4	85	0.128
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	5	80	0.120

4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	1	100	0.150
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	2	95	0.143
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	7	55	0.083
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	8	50	0.075
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	6	60	0.090
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	3	90	0.135
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	9	40	0.060
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	10	0.015
	Total			655	1.00

Table G.11 – Attribute Weights for dm1

No.	**Attribute swung from worst to best**	**Consequences**	**Rank (R)**	**Rating (r)**	**Weight (r/∑r)**
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	100	0.182
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	2	90	0.164
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	3	80	0.145
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	4	70	0.127
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	10	10	0.018
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	5	60	0.109
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	6	50	0.091
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	7	40	0.073
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	8	30	0.055
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	9	20	0.036
	Total			550	1.00

Table G.12 – Attribute Weights for dm2

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	100	0.148
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	5	68	0.100
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	4	76	0.112
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	6	61	0.090
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	3	88	0.130
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	10	40	0.059
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	7	54	0.080
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	2	95	0.140
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	9	45	0.066
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	8	50	0.074
	Total			677	1.00

Table G.13 – Attribute Weights for dm3

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	100	0.183
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	2	90	0.165
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	4	70	0.128
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	7	40	0.073
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	8	30	0.055
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	20	0.037
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	10	5	0.009

9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	3	80	0.147
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	5	50	0.092
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	6	60	0.110
	Total			545	1.00

Table G.14 – Attribute Weights for dm4

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	6	50	0.091
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	10	10	0.018
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	5	60	0.109
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	7	40	0.073
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	3	80	0.145
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	4	70	0.127
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	8	30	0.055
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	1	100	0.182
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	2	90	0.164
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	9	20	0.036
	Total			550	1.00

Table G.15 – Attribute Weights for dm5

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	4	80	0.120
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	9	40	0.06

4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	5	70	0.105
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	3	92	0.138
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	10	30	0.045
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	6	65	0.097
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	2	93	0.139
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	8	45	0.067
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	1	99	0.148
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	7	55	0.082
	Total			669	1.00

Table G.16 – Attribute Weights for dm6

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	100	0.123
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	5	87	0.107
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	2	99	0.122
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	8	75	0.092
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	4	90	0.111
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	7	80	0.099
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	6	85	0.105
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	3	95	0.117
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	9	70	0.086
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	30	0.037
	Total			811	1.00

Table G.17 – Attribute Weights for dm7

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rati ng (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	3	50	0.125
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	4	45	0.113
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	10	5	0.013
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	9	10	0.025
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	6	30	0.075
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	7	25	0.063
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	8	15	0.038
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	5	35	0.088
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	2	85	0.213
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	1	100	0.250
	Total			400	1.00

Table G.18 – Attribute Weights for dm8

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rati ng (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	1	100	0.180
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	2	85	0.150
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	5	55	0.100
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	4	60	0.120
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	6	45	0.085
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	30	0.054
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	7	40	0.075

9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	3	75	0.140
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	8	35	0.060
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	25	0.045
	Total			550	1.00

Table G.19 – Attribute Weights for dm9

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	5	50	0.094
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	4	65	0.123
4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	1	100	0.189
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	2	85	0.160
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	3	70	0.132
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	25	0.047
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	8	30	0.057
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	7	40	0.075
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	6	45	0.085
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	10	20	0.038
	Total			530	1.00

Table G.20 – Attribute Weights for dm10

No.	Attribute swung from worst to best	Consequences	Rank (R)	Rating (r)	Weight (r/∑r)
1	(Benchmark)	A1 – A10 are at worst level.	11	0	0
2	A1 – Impact of distractions on work efficiency	A1 is at best level; A2 – A10 are at worst level	4	60	0.129
3	A2 – Impact of distractions on work effectiveness	A2 is at best level; A1, A3 – A10 are at worst level	3	70	0.151

4	A3 – Impact of distractions on psychological health	A3 is at best level; A1, A2, A4 – A10 are at worst level	1	100	0.215
5	A4 – Impact of distractions on physical health	A4 is at best level; A1 – A3, A5 – A10 are at worst level	2	80	0.172
6	A5 – Impact of distractions on workspace satisfaction	A5 is at best level; A1 – A4, A6 – A10 are at worst level	5	50	0.108
7	A6 – Impact of distractions on social responsiveness	A6 is at best level; A1 – A5, A7 – A10 are at worst level	9	10	0.022
8	A7 – Impact of distractions on social cohesion	A7 is at best level; A1 – A6, A8 – A10 are at worst level	10	05	0.011
9	A8 – Workspace's support for individual work	A8 is at best level; A1 – A7, A9, A10 are at worst level	7	30	0.065
10	A9 – Workspace's support for collaborative work	A9 is at best level; A1 – A8, A10 are at worst level	8	20	0.043
11	A10 – Direct cost of workspace	A10 is at best level; A1 – A9 are at worst level	6	40	0.086
	Total			465	1.00

APPENDIX H

PROBABILITY ASSIGNMENT DATA SET

Tables H.1 to H.16 in this Appendix presents the probabilities assigned by 16 subjects to various consequences designed for each workspace alternative.

Table H.1 - Probability Assignments by Subject kw1

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.05	0.10	0.30	0.05	0.10	0.10	0.10	0.10	0.25	0.40
	Better - A little	0.05	0.15	0.25	0.05	0.10	0.15	0.10	0.15	0.20	0.20
	Neutral - Moderate	0.15	0.15	0.20	0.10	0.20	0.15	0.15	0.20	0.20	0.15
	Bad - Significant	0.25	0.20	0.15	0.30	0.20	0.25	0.20	0.25	0.25	0.15
	Worst - Very Significant	0.50	0.40	0.10	0.50	0.40	0.35	0.45	0.30	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.05	0.10	0.35	0.10	0.10	0.10	0.10	0.15	0.30	0.10
	Better - A little	0.10	0.10	0.20	0.10	0.20	0.15	0.15	0.15	0.20	0.10
	Neutral - Moderate	0.20	0.20	0.15	0.15	0.20	0.15	0.15	0.20	0.15	0.20
	Bad - Significant	0.30	0.30	0.10	0.30	0.20	0.25	0.30	0.20	0.20	0.30
	Worst - Very Significant	0.35	0.30	0.20	0.40	0.30	0.35	0.30	0.30	0.15	0.30
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.15	0.10	0.15	0.15	0.30	0.15	0.10	0.20	0.20	0.15
	Better - A little	0.15	0.15	0.25	0.15	0.25	0.15	0.20	0.20	0.20	0.25
	Neutral - Moderate	0.20	0.20	0.30	0.20	0.15	0.30	0.20	0.25	0.25	0.30
	Bad - Significant	0.20	0.20	0.20	0.20	0.10	0.20	0.25	0.20	0.20	0.20
	Worst - Very Significant	0.30	0.35	0.10	0.30	0.20	0.20	0.25	0.15	0.15	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.20	0.25	0.40	0.15	0.25	0.30	0.25	0.40	0.40	0.05
	Better - A little	0.25	0.25	0.30	0.15	0.25	0.25	0.25	0.30	0.30	0.05
	Neutral - Moderate	0.25	0.25	0.15	0.25	0.20	0.25	0.20	0.10	0.15	0.10
	Bad - Significant	0.20	0.15	0.01	0.25	0.15	0.10	0.15	0.10	0.10	0.30
	Worst - Very Significant	0.10	0.10	0.05	0.20	0.15	0.10	0.15	0.10	0.05	0.50
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.30	0.35	0.45	0.25	0.40	0.30	0.35	0.40	0.45	0.00
	Better - A little	0.25	0.25	0.25	0.25	0.25	0.30	0.25	0.30	0.25	0.05
	Neutral - Moderate	0.25	0.20	0.20	0.20	0.20	0.20	0.25	0.15	0.20	0.15
	Bad - Significant	0.10	0.10	0.05	0.10	0.10	0.10	0.10	0.10	0.05	0.30
	Worst - Very Significant	0.10	0.10	0.05	0.10	0.05	0.10	0.05	0.05	0.05	0.50
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.2 - Probability Assignments by Subject kw3

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Better - A little	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20
	Neutral - Moderate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.50
	Bad - Significant	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.20
	Worst - Very Significant	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.00	0.10	0.00
	Better - A little	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.10	0.30	0.10
	Neutral - Moderate	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.30	0.10	0.20
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.00
	Better - A little	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.10
	Neutral - Moderate	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10
	Bad - Significant	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.50
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.00
	Better - A little	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.00
	Neutral - Moderate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.00
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.30
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.00
	Better - A little	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.00
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.3 - Probability Assignments by Subject kw4

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.50	0.50
	Better - A little	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.20	0.20
	Neutral - Moderate	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Bad - Significant	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.07	0.07
	Worst - Very Significant	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.08	0.08
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.45	0.45
	Better - A little	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.20
	Neutral - Moderate	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Bad - Significant	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.10	0.10
	Worst - Very Significant	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.30	0.30
	Better - A little	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
	Neutral - Moderate	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
	Bad - Significant	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.15
	Worst - Very Significant	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.10	0.15
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.45	0.10
	Better - A little	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.25	0.10
	Neutral - Moderate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.25
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.45
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.00
	Better - A little	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.10
	Neutral - Moderate	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.4 - Probability Assignments by Subject kw6

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.90
	Better - A little	0.01	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.10	0.10
	Neutral - Moderate	0.01	0.01	0.01	0.03	0.04	0.10	0.00	0.00	0.00	0.00
	Bad - Significant	0.90	0.08	0.90	0.85	0.15	0.30	0.20	0.00	0.00	0.00
	Worst - Very Significant	0.08	0.90	0.08	0.10	0.80	0.60	0.80	1.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.80
	Better - A little	0.01	0.00	0.10	0.10	0.01	0.01	0.01	0.00	0.10	0.20
	Neutral - Moderate	0.02	0.00	0.90	0.90	0.04	0.04	0.04	0.00	0.00	0.00
	Bad - Significant	0.90	0.90	0.00	0.00	0.90	0.90	0.90	0.90	0.00	0.00
	Worst - Very Significant	0.05	0.10	0.00	0.00	0.05	0.05	0.05	0.10	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00
	Better - A little	0.90	0.90	0.80	0.80	0.80	0.80	0.80	0.90	0.90	0.20
	Neutral - Moderate	0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.00	0.10	0.80
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
	Better - A little	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
	Better - A little	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.5 - Probability Assignments by Subject kw7

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.00	0.10	0.50	0.50	0.10	0.10	0.05	0.00	0.70	0.00
	Better - A little	0.10	0.15	0.20	0.20	0.10	0.10	0.20	0.00	0.30	0.20
	Neutral - Moderate	0.20	0.40	0.10	0.10	0.20	0.20	0.40	0.00	0.00	0.60
	Bad - Significant	0.50	0.20	0.10	0.10	0.40	0.40	0.30	0.40	0.00	0.20
	Worst - Very Significant	0.20	0.15	0.00	0.00	0.20	0.20	0.05	0.60	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.00	0.20	0.60	0.60	0.00	0.00	0.10	0.00	0.60	0.00
	Better - A little	0.10	0.20	0.20	0.20	0.20	0.20	0.30	0.00	0.40	0.20
	Neutral - Moderate	0.30	0.40	0.10	0.10	0.30	0.30	0.40	0.00	0.00	0.60
	Bad - Significant	0.50	0.10	0.10	0.10	0.40	0.40	0.20	0.40	0.00	0.20
	Worst - Very Significant	0.10	0.10	0.00	0.00	0.10	0.10	0.00	0.60	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.00	0.00	0.60	0.60	0.10	0.10	0.10	0.00	0.50	0.00
	Better - A little	0.00	0.10	0.30	0.30	0.30	0.30	0.50	0.10	0.20	0.20
	Neutral - Moderate	0.30	0.50	0.10	0.10	0.40	0.40	0.30	0.20	0.20	0.60
	Bad - Significant	0.50	0.30	0.00	0.00	0.20	0.20	0.10	0.20	0.10	0.20
	Worst - Very Significant	0.20	0.10	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.50	0.40	0.70	0.70	0.50	0.50	0.50	0.20	0.20	0.00
	Better - A little	0.40	0.50	0.30	0.30	0.30	0.40	0.40	0.40	0.40	0.20
	Neutral - Moderate	0.10	0.10	0.00	0.00	0.20	0.10	0.10	0.20	0.20	0.60
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.70	0.60	0.80	0.80	0.30	0.20	0.20	0.70	0.70	0.00
	Better - A little	0.30	0.40	0.20	0.20	0.60	0.50	0.50	0.30	0.30	0.20
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.10	0.20	0.20	0.00	0.00	0.60
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.00	0.20
	Worst - Very Significant		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.6 - Probability Assignments by Subject kw8

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.10	0.10	0.15	0.20	0.10	0.20	0.30	0.10	0.25	0.10
	Better - A little	0.10	0.20	0.15	0.30	0.30	0.20	0.10	0.20	0.25	0.30
	Neutral - Moderate	0.20	0.20	0.30	0.20	0.20	0.20	0.20	0.30	0.20	0.20
	Bad - Significant	0.20	0.20	0.20	0.15	0.20	0.30	0.20	0.30	0.20	0.20
	Worst - Very Significant	0.40	0.30	0.20	0.15	0.20	0.10	0.20	0.10	0.10	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.10	0.20	0.20	0.25	0.20	0.15	0.10	0.10	0.20	0.20
	Better - A little	0.10	0.20	0.25	0.25	0.20	0.15	0.20	0.20	0.15	0.20
	Neutral - Moderate	0.20	0.20	0.25	0.15	0.20	0.30	0.20	0.20	0.25	0.20
	Bad - Significant	0.20	0.20	0.15	0.15	0.30	0.20	0.20	0.20	0.15	0.20
	Worst - Very Significant	0.30	0.20	0.15	0.20	0.10	0.20	0.30	0.30	0.20	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.15	0.30	0.10	0.15	0.10	0.10	0.20	0.25	0.30	0.20
	Better - A little	0.15	0.30	0.25	0.15	0.10	0.20	0.20	0.25	0.30	0.20
	Neutral - Moderate	0.25	0.20	0.25	0.30	0.20	0.25	0.20	0.20	0.20	0.25
	Bad - Significant	0.25	0.10	0.20	0.20	0.30	0.25	0.30	0.15	0.10	0.25
	Worst - Very Significant	0.20	0.10	0.20	0.20	0.30	0.20	0.10	0.15	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.25	0.30	0.25	0.30	0.25	0.30	0.30	0.20	0.40	0.15
	Better - A little	0.25	0.30	0.25	0.20	0.25	0.20	0.30	0.25	0.20	0.15
	Neutral - Moderate	0.20	0.20	0.20	0.20	0.15	0.20	0.20	0.25	0.20	0.20
	Bad - Significant	0.20	0.10	0.15	0.20	0.15	0.20	0.10	0.15	0.10	0.25
	Worst - Very Significant	0.10	0.10	0.15	0.10	0.20	0.10	0.10	0.15	0.10	0.25
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.30	0.20	0.30	0.20	0.30	0.10	0.10	0.20	0.30	0.10
	Better - A little	0.30	0.20	0.25	0.20	0.10	0.30	0.30	0.40	0.20	0.10
	Neutral - Moderate	0.20	0.20	0.25	0.20	0.20	0.20	0.20	0.20	0.20	0.20
	Bad - Significant	0.10	0.20	0.10	0.30	0.20	0.30	0.20	0.10	0.15	0.30
	Worst - Very Significant	0.10	0.20	0.10	0.10	0.20	0.10	0.20	0.10	0.15	0.30
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.7 - Probability Assignments by Subject kw9

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.05	0.15	0.10	0.20	0.15	0.20	0.40	0.10	0.10	0.15
	Better - A little	0.10	0.15	0.20	0.40	0.15	0.30	0.30	0.20	0.30	0.20
	Neutral - Moderate	0.20	0.20	0.40	0.20	0.20	0.30	0.20	0.30	0.30	0.30
	Bad - Significant	0.50	0.40	0.20	0.10	0.40	0.10	0.05	0.25	0.20	0.20
	Worst - Very Significant	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.15	0.10	0.15
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.15	0.20	0.20	0.20	0.20	0.20	0.30	0.10	0.10	0.10
	Better - A little	0.15	0.20	0.30	0.30	0.20	0.30	0.40	0.20	0.25	0.30
	Neutral - Moderate	0.20	0.30	0.20	0.30	0.20	0.20	0.10	0.30	0.30	0.30
	Bad - Significant	0.40	0.15	0.20	0.10	0.30	0.20	0.10	0.20	0.25	0.20
	Worst - Very Significant	0.10	0.15	0.10	0.10	0.10	0.10	0.10	0.20	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.15	0.25	0.30	0.30	0.20	0.30	0.20	0.15	0.20	0.20
	Better - A little	0.30	0.30	0.30	0.30	0.40	0.40	0.30	0.15	0.30	0.30
	Neutral - Moderate	0.30	0.20	0.20	0.20	0.20	0.10	0.30	0.20	0.30	0.30
	Bad - Significant	0.20	0.15	0.10	0.10	0.10	0.10	0.10	0.30	0.10	0.10
	Worst - Very Significant	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.30	0.40	0.40	0.40	0.20	0.30	0.20	0.20	0.40	0.10
	Better - A little	0.40	0.30	0.30	0.30	0.30	0.30	0.40	0.40	0.30	0.20
	Neutral - Moderate	0.20	0.10	0.10	0.10	0.30	0.20	0.20	0.20	0.10	0.30
	Bad - Significant	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.30
	Worst - Very Significant	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
	Best - Not at all	0.65	0.60	0.60	0.60	0.30	0.50	0.50	0.40	0.40	0.30
	Better - A little	0.20	0.20	0.25	0.25	0.30	0.30	0.30	0.30	0.30	0.30
	Neutral - Moderate	0.05	0.10	0.05	0.05	0.20	0.10	0.10	0.10	0.15	0.30
	Bad - Significant	0.05	0.05	0.05	0.05	0.10	0.05	0.05	0.10	0.10	0.05
	Worst - Very Significant	0.05	0.05	0.05	0.05	0.10	0.05	0.05	0.10	0.05	0.05
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.8 - Probability Assignments by Subject kw10

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.95
	Better - A little	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.05
	Neutral - Moderate	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.05	0.05	0.15	0.15	0.10	0.10	0.05	0.05	0.00	0.00
	Worst - Very Significant	0.95	0.95	0.80	0.80	0.90	0.90	0.95	0.95	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.70
	Better - A little	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.30
	Neutral - Moderate	0.00	0.00	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00
	Bad - Significant	0.30	0.30	0.20	0.20	0.20	0.20	0.30	0.30	0.00	0.00
	Worst - Very Significant	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.70	0.00
	Better - A little	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.30	0.30	0.05
	Neutral - Moderate	0.90	0.90	0.70	0.70	0.70	0.70	0.70	0.00	0.00	0.90
	Bad - Significant	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.05
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.90	0.90	0.80	0.80	0.80	0.80	0.90	0.80	0.80	0.00
	Better - A little	0.10	0.10	0.20	0.20	0.20	0.20	0.10	0.20	0.20	0.00
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.90	0.00
	Better - A little	0.05	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.00
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.9 - Probability Assignments by Subject dm1

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.10	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	Better - A little	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	Neutral - Moderate	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Better - A little	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Neutral - Moderate	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Better - A little	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Neutral - Moderate	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	Bad - Significant	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Better - A little	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Neutral - Moderate	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	Bad - Significant	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	Worst - Very Significant	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Better - A little	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Neutral - Moderate	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Bad - Significant	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
	Worst - Very Significant	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.10 - Probability Assignments by Subject dm2

Consequences		**Attributes**									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.05	0.10	0.05	0.10	0.05	0.10	0.05	0.05	0.60	0.50
	Better - A little	0.05	0.05	0.05	0.10	0.15	0.10	0.05	0.05	0.15	0.25
	Neutral - Moderate	0.10	0.15	0.05	0.10	0.05	0.30	0.05	0.05	0.10	0.15
	Bad - Significant	0.20	0.15	0.15	0.20	0.15	0.20	0.30	0.05	0.10	0.05
	Worst - Very Significant	0.60	0.45	0.70	0.50	0.60	0.30	0.55	0.80	0.05	0.05
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.05	0.05	0.10	0.05	0.05	0.10	0.05	0.05	0.55	0.40
	Better - A little	0.05	0.05	0.10	0.10	0.10	0.20	0.05	0.05	0.10	0.25
	Neutral - Moderate	0.10	0.20	0.10	0.15	0.15	0.20	0.15	0.05	0.15	0.15
	Bad - Significant	0.30	0.30	0.10	0.25	0.20	0.20	0.30	0.15	0.10	0.15
	Worst - Very Significant	0.50	0.40	0.60	0.45	0.50	0.30	0.45	0.50	0.10	0.05
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.10	0.15	0.10	0.10	0.10	0.15	0.10	0.05	0.20	0.10
	Better - A little	0.15	0.15	0.10	0.20	0.10	0.35	0.15	0.05	0.40	0.20
	Neutral - Moderate	0.15	0.20	0.10	0.20	0.20	0.20	0.15	0.30	0.20	0.35
	Bad - Significant	0.20	0.20	0.20	0.15	0.20	0.15	0.25	0.15	0.15	0.25
	Worst - Very Significant	0.40	0.30	0.50	0.35	0.40	0.15	0.35	0.45	0.05	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.30	0.05	0.40	0.30	0.40	0.20	0.10	0.50	0.20	0.10
	Better - A little	0.30	0.60	0.30	0.15	0.20	0.25	0.15	0.20	0.20	0.10
	Neutral - Moderate	0.20	0.15	0.10	0.20	0.20	0.20	0.25	0.20	0.30	0.20
	Bad - Significant	0.10	0.15	0.10	0.15	0.15	0.15	0.25	0.05	0.15	0.30
	Worst - Very Significant	0.10	0.05	0.10	0.20	0.05	0.20	0.25	0.05	0.15	0.30
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.30	0.30	0.30	0.25	0.50	0.30	0.15	0.60	0.15	0.05
	Better - A little	0.20	0.20	0.25	0.25	0.35	0.30	0.40	0.20	0.15	0.10
	Neutral - Moderate	0.20	0.20	0.15	0.20	0.05	0.15	0.10	0.10	0.50	0.25
	Bad - Significant	0.20	0.20	0.15	0.10	0.05	0.15	0.20	0.05	0.10	0.25
	Worst - Very Significant	0.10	0.20	0.15	0.10	0.05	0.10	0.15	0.05	0.10	0.35
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.11 - Probability Assignments by Subject dm3

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
	Better - A little	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.33	0.50
	Neutral - Moderate	0.00	0.00	0.10	0.40	0.00	0.33	0.33	0.00	0.34	0.00
	Bad - Significant	0.20	0.20	0.30	0.40	0.20	0.33	0.33	0.20	0.33	0.00
	Worst - Very Significant	0.80	0.80	0.60	0.20	0.80	0.33	0.33	0.80	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Better - A little	0.00	0.00	0.33	0.33	0.00	0.33	0.33	0.00	0.33	0.33
	Neutral - Moderate	0.50	0.50	0.34	0.34	0.50	0.34	0.34	0.50	0.34	0.34
	Bad - Significant	0.50	0.50	0.33	0.33	0.50	0.33	0.33	0.50	0.33	0.33
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Better - A little	0.33	0.33	0.50	0.50	0.33	0.50	0.50	0.33	0.00	0.33
	Neutral - Moderate	0.34	0.34	0.50	0.50	0.34	0.50	0.50	0.34	0.50	0.34
	Bad - Significant	0.33	0.33	0.00	0.00	0.33	0.00	0.00	0.33	0.50	0.33
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Better - A little	0.50	0.50	0.75	0.75	0.50	0.33	0.33	0.50	0.75	0.00
	Neutral - Moderate	0.50	0.50	0.25	0.25	0.50	0.34	0.34	0.50	0.25	0.33
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.34
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.80	0.80	0.60	0.60	0.80	0.60	0.60	0.80	0.80	0.00
	Better - A little	0.20	0.20	0.30	0.30	0.20	0.40	0.40	0.20	0.20	0.00
	Neutral - Moderate	0.00	0.00	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.12 - Probability Assignments by Subject dm6

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.80	0.20
	Better - A little	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.20	0.80
	Neutral - Moderate	0.00	0.00	0.00	0.10	0.00	0.20	0.00	0.00	0.00	0.00
	Bad - Significant	0.30	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.00	0.00
	Worst - Very Significant	0.70	0.70	0.70	0.60	0.70	0.40	0.80	0.80	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
	Better - A little	0.00	0.70	0.70	0.70	0.30	0.30	0.20	0.70	0.50	0.30
	Neutral - Moderate	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.00	0.10	0.00
	Bad - Significant	0.70	0.00	0.00	0.00	0.50	0.50	0.20	0.70	0.20	0.00
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.30	0.20	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.10	0.00
	Better - A little	0.20	0.20	0.20	0.00	0.20	0.20	0.20	0.20	0.20	0.00
	Neutral - Moderate	0.60	0.60	0.60	1.00	0.20	0.40	0.60	0.60	0.50	0.70
	Bad - Significant	0.20	0.20	0.20	0.00	0.20	0.40	0.20	0.20	0.20	0.30
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.80	0.80	0.80	1.00	0.80	0.00	0.00	0.80	0.80	0.00
	Better - A little	0.20	0.20	0.20	0.00	0.20	0.00	0.00	0.20	0.20	0.00
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.80	0.80	0.00	0.00	0.80
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
	Better - A little	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Neutral - Moderate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bad - Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.13 - Probability Assignments by Subject dm7

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.30	0.30	0.84	0.90	0.50	0.50	0.60	0.05	0.45	0.50
	Better - A little	0.25	0.25	0.10	0.10	0.20	0.20	0.25	0.10	0.25	0.23
	Neutral - Moderate	0.20	0.20	0.40	0.00	0.15	0.15	0.10	0.15	0.15	0.15
	Bad - Significant	0.15	0.15	0.20	0.00	0.10	0.10	0.05	0.25	0.10	0.10
	Worst - Very Significant	0.10	0.10	0.00	0.00	0.05	0.05	0.00	0.45	0.05	0.02
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.42	0.45	0.88	0.92	0.64	0.52	0.58	0.00	0.63	0.00
	Better - A little	0.25	0.24	0.07	0.08	0.15	0.23	0.26	0.23	0.23	0.60
	Neutral - Moderate	0.15	0.18	0.05	0.00	0.13	0.14	0.12	0.14	0.14	0.20
	Bad - Significant	0.10	0.10	0.00	0.00	0.06	0.08	0.04	0.63	0.00	0.15
	Worst - Very Significant	0.08	0.30	0.00	0.00	0.02	0.05	0.00	0.00	0.00	0.05
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.48	0.65	0.92	0.94	0.78	0.55	0.55	0.00	0.72	0.00
	Better - A little	0.27	0.17	0.06	0.06	0.10	0.25	0.28	0.72	0.20	0.00
	Neutral - Moderate	0.12	0.12	0.02	0.00	0.08	0.13	0.15	0.20	0.08	0.70
	Bad - Significant	0.08	0.05	0.00	0.00	0.04	0.06	0.02	0.08	0.00	0.18
	Worst - Very Significant	0.05	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.50	0.76	0.96	0.96	0.92	0.58	0.52	0.88	0.88	0.00
	Better - A little	0.32	0.13	0.04	0.04	0.05	0.28	0.29	0.07	0.07	0.00
	Neutral - Moderate	0.10	0.08	0.00	0.00	0.03	0.11	0.18	0.04	0.04	0.00
	Bad - Significant	0.06	0.03	0.00	0.00	0.00	0.03	0.01	0.01	0.01	0.15
	Worst - Very Significant	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.53	0.85	1.00	1.00	1.00	0.60	0.50	1.00	1.00	0.00
	Better - A little	0.35	0.10	0.00	0.00	0.00	0.30	0.30	0.00	0.00	0.00
	Neutral - Moderate	0.08	0.05	0.00	0.00	0.00	0.10	0.20	0.00	0.00	0.00
	Bad - Significant	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Worst - Very Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.14 - Probability Assignments by Subject dm8

Consequences		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
		Attributes									
W1	Best - Not at all	0.05	0.10	0.10	0.10	0.10	0.15	0.10	0.10	0.40	0.20
	Better - A little	0.10	0.15	0.15	0.15	0.15	0.20	0.15	0.15	0.20	0.35
	Neutral - Moderate	0.15	0.15	0.20	0.20	0.15	0.25	0.15	0.15	0.15	0.30
	Bad - Significant	0.35	0.20	0.35	0.35	0.20	0.20	0.20	0.20	0.15	0.20
	Worst - Very Significant	0.35	0.40	0.20	0.20	0.40	0.20	0.40	0.40	0.10	0.05
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.10	0.05	0.10	0.05	0.10	0.15	0.10	0.05	0.25	0.10
	Better - A little	0.25	0.25	0.20	0.25	0.20	0.20	0.15	0.20	0.30	0.35
	Neutral - Moderate	0.35	0.35	0.35	0.35	0.35	0.35	0.20	0.25	0.20	0.20
	Bad - Significant	0.25	0.25	0.20	0.25	0.20	0.20	0.35	0.30	0.15	0.20
	Worst - Very Significant	0.05	0.10	0.15	0.10	0.15	0.10	0.20	0.20	0.10	0.15
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.20	0.20	0.20	0.20	0.20	0.10	0.10	0.25	0.20	0.10
	Better - A little	0.30	0.30	0.30	0.25	0.25	0.25	0.20	0.30	0.25	0.25
	Neutral - Moderate	0.20	0.20	0.20	0.25	0.20	0.25	0.25	0.25	0.20	0.25
	Bad - Significant	0.20	0.20	0.20	0.20	0.20	0.25	0.25	0.10	0.20	0.20
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.15	0.15	0.20	0.10	0.15	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.10	0.20	0.10
	Better - A little	0.60	0.60	0.60	0.60	0.40	0.40	0.40	0.40	0.20	0.10
	Neutral - Moderate	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20	0.40	0.20
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.10	0.40
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.60	0.60	0.50	0.50	0.60	0.50	0.50	0.50	0.50	0.10
	Better - A little	0.10	0.10	0.20	0.20	0.10	0.20	0.20	0.20	0.20	0.10
	Neutral - Moderate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.60
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.15 - Probability Assignments by Subject dm9

Consequences		Attributes									
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
W1	Best - Not at all	0.10	0.05	0.30	0.30	0.10	0.05	0.05	0.10	0.30	0.10
	Better - A little	0.15	0.10	0.25	0.25	0.15	0.10	0.10	0.15	0.25	0.25
	Neutral - Moderate	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.20	0.20	0.35
	Bad - Significant	0.20	0.30	0.15	0.15	0.25	0.30	0.30	0.25	0.15	0.20
	Worst - Very Significant	0.30	0.35	0.10	0.10	0.30	0.40	0.40	0.30	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.45	0.45	0.30	0.30	0.30	0.10	0.15	0.15	0.15	0.15
	Better - A little	0.25	0.25	0.25	0.25	0.25	0.20	0.25	0.25	0.25	0.25
	Neutral - Moderate	0.15	0.15	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.25
	Bad - Significant	0.10	0.10	0.15	0.15	0.15	0.20	0.20	0.20	0.20	0.15
	Worst - Very Significant	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.10
	Better - A little	0.20	0.20	0.20	0.20	0.25	0.25	0.25	0.25	0.25	0.25
	Neutral - Moderate	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.30
	Bad - Significant	0.20	0.20	0.20	0.20	0.25	0.25	0.25	0.25	0.25	0.25
	Worst - Very Significant	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.10	0.10	0.10	0.10	0.10	0.30	0.30	0.30	0.10	0.15
	Better - A little	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.15
	Neutral - Moderate	0.30	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.30	0.20
	Bad - Significant	0.25	0.25	0.25	0.25	0.25	0.15	0.15	0.15	0.25	0.30
	Worst - Very Significant	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.10	0.15
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
5	Best - Not at all	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.10
	Better - A little	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.10
	Neutral - Moderate	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.15
	Bad - Significant	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Worst - Very Significant	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.35
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

Table H.16 - Probability Assignments by Subject dm10

Consequences		Attributes									
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
W1	Best - Not at all	0.05	0.10	0.05	0.05	0.10	0.10	0.05	0.10	0.25	0.25
	Better - A little	0.10	0.10	0.15	0.15	0.15	0.15	0.10	0.15	0.40	0.40
	Neutral - Moderate	0.20	0.15	0.20	0.20	0.15	0.10	0.20	0.10	0.20	0.10
	Bad - Significant	0.45	0.55	0.45	0.45	0.40	0.40	0.40	0.40	0.10	0.15
	Worst - Very Significant	0.20	0.10	0.15	0.15	0.20	0.25	0.25	0.25	0.05	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W2	Best - Not at all	0.05	0.10	0.10	0.10	0.10	0.15	0.15	0.05	0.30	0.25
	Better - A little	0.10	0.15	0.10	0.20	0.15	0.20	0.15	0.10	0.35	0.40
	Neutral - Moderate	0.25	0.15	0.25	0.20	0.20	0.25	0.30	0.20	0.20	0.10
	Bad - Significant	0.40	0.40	0.30	0.30	0.40	0.20	0.25	0.40	0.10	0.15
	Worst - Very Significant	0.20	0.20	0.25	0.20	0.15	0.20	0.15	0.25	0.05	0.10
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W3	Best - Not at all	0.20	0.20	0.15	0.15	0.20	0.25	0.15	0.10	0.10	0.15
	Better - A little	0.25	0.40	0.45	0.40	0.25	0.40	0.25	0.20	0.45	0.15
	Neutral - Moderate	0.25	0.10	0.20	0.25	0.25	0.10	0.30	0.30	0.25	0.25
	Bad - Significant	0.20	0.15	0.15	0.15	0.20	0.15	0.15	0.30	0.10	0.25
	Worst - Very Significant	0.10	0.10	0.05	0.05	0.10	0.10	0.15	0.10	0.10	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W4	Best - Not at all	0.20	0.25	0.20	0.25	0.20	0.10	0.20	0.20	0.20	0.05
	Better - A little	0.40	0.35	0.25	0.35	0.30	0.45	0.30	0.30	0.40	0.15
	Neutral - Moderate	0.15	0.15	0.25	0.15	0.20	0.25	0.20	0.20	0.15	0.20
	Bad - Significant	0.10	0.15	0.20	0.15	0.20	0.10	0.20	0.20	0.15	0.40
	Worst - Very Significant	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***
W5	Best - Not at all	0.45	0.15	0.45	0.20	0.25	0.20	0.15	0.25	0.20	0.05
	Better - A little	0.25	0.40	0.25	0.40	0.35	0.30	0.25	0.40	0.40	0.10
	Neutral - Moderate	0.15	0.25	0.10	0.15	0.25	0.25	0.30	0.10	0.15	0.15
	Bad - Significant	0.10	0.10	0.10	0.10	0.10	0.15	0.15	0.15	0.15	0.25
	Worst - Very Significant	0.05	0.10	0.10	0.15	0.10	0.10	0.15	0.10	0.10	0.45
	Sum total	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***	***1.0***

APPENDIX I (A)

SINGLE ATTRIBUTE UTLITIES AND UTILITY FUNCTIONS

Appendix I is divided into two parts. Part A presents the single attribute marginal utility values as derived for each subject of Phase III of the study. These are shown in the Tables I.1 – I20.

Table I.1 - Single Attribute Marginal Utilities for subject kw1

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = w(x) * $u_i(x_i)$
Work Efficiency	5 (Best)	0.18		1.000	0.153
	4		0.45	0.725	0.111
	3		0.50	0.500	0.076
	2		0.35	0.175	0.027
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.15		1.000	0.144
	4		0.30	0.580	0.084
	3		0.40	0.400	0.058
	2		0.20	0.080	0.012
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.1		1.000	0.034
	4		0.30	0.615	0.021
	3		0.45	0.450	0.015
	2		0.25	0.113	0.004
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.12		1.000	0.169
	4		0.55	0.730	0.124
	3		0.40	0.400	0.068
	2		0.25	0.100	0.017
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.085		1.000	0.119
	4		0.50	0.750	0.089
	3		0.50	0.500	0.059
	2		0.30	0.150	0.018
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.054		1.000	0.110
	4		0.60	0.800	0.088
	3		0.50	0.500	0.055
	2		0.35	0.175	0.019
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.075		1.000	0.102
	4		0.55	0.708	0.072
	3		0.35	0.350	0.036
	2		0.50	0.175	0.018
	1 (Worst)			0.000	0.000

Attribute Name	**Attribute levels (x-axis)**	**Attribute weight w(x)**	**Indifference value**	**Marginal utility $u_i(x_i)$ (y- axis)**	**Utility $u(x) = w(x) * u_i(x_i)$**
Support for Individual work	5 (Best)	0.14		1.000	0.085
	4		0.50	0.750	0.064
	3		0.50	0.500	0.042
	2		0.30	0.150	0.013
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.06		1.000	0.068
	4		0.55	0.753	0.051
	3		0.45	0.450	0.031
	2		0.35	0.158	0.011
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.045		1.000	0.017
	4		0.60	0.760	0.013
	3		0.40	0.400	0.007
	2		0.40	0.160	0.003
	1 (Worst)			0.000	0.000

Table I.2 - Single Attribute Marginal Utilities for subject kw2

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.110		1.000	0.110
	4		1.00	1.000	0.110
	3		1.00	1.000	0.110
	2		1.00	1.000	0.110
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.092		1.000	0.092
	4		1.00	1.000	0.092
	3		1.00	1.000	0.092
	2		1.00	1.000	0.092
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.183		1.000	0.183
	4		1.00	1.000	0.183
	3		1.00	1.000	0.183
	2		1.00	1.000	0.183
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.165		1.000	0.165
	4		1.00	1.000	0.165
	3		1.00	1.000	0.165
	2		1.00	1.000	0.165
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.147		1.000	0.147
	4		1.00	1.000	0.147
	3		1.00	1.000	0.147
	2		1.00	1.000	0.147
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.037		1.000	0.037
	4		1.00	1.000	0.037
	3		1.00	1.000	0.037
	2		1.00	1.000	0.037
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.073		1.000	0.073
	4		1.00	1.000	0.073
	3		1.00	1.000	0.073
	2		1.00	1.000	0.073
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.128		1.000	0.128
	4		1.00	1.000	0.128
	3		1.00	1.000	0.128
	2		1.00	1.000	0.128
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.055		1.000	0.055
	4		1.00	1.000	0.055
	3		1.00	1.000	0.055
	2		1.00	1.000	0.055
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.009		1.000	0.009
	4		1.00	1.000	0.009
	3		1.00	1.000	0.009
	2		1.00	1.000	0.009
	1 (Worst)			0.000	0.000

Table I.3 - Single Attribute Marginal Utilities for subject kw3

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.127		1.000	0.127
	4		0.70	0.850	0.108
	3		0.50	0.500	0.064
	2		0.40	0.200	0.025
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.109		1.000	0.109
	4		0.50	0.925	0.101
	3		0.85	0.850	0.093
	2		0.50	0.425	0.046
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.182		1.000	0.182
	4		0.60	0.880	0.160
	3		0.70	0.700	0.127
	2		0.55	0.385	0.070
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.055		1.000	0.055
	4		0.65	0.913	0.050
	3		0.75	0.750	0.041
	2		0.55	0.413	0.023
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.036		1.000	0.036
	4		0.30	0.510	0.019
	3		0.30	0.300	0.011
	2		0.30	0.090	0.003
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.164		1.000	0.164
	4		0.60	0.880	0.144
	3		0.70	0.700	0.115
	2		0.70	0.490	0.080
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.145		1.000	0.145
	4		0.50	0.850	0.124
	3		0.70	0.700	0.102
	2		0.55	0.385	0.056
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.091		1.000	0.091
	4		0.50	0.875	0.080
	3		0.75	0.750	0.068
	2		0.75	0.563	0.051
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.073		1.000	0.073
	4		0.40	0.760	0.055
	3		0.60	0.600	0.044
	2		0.75	0.450	0.033
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.018		1.000	0.018
	4		0.50	0.850	0.015
	3		0.70	0.700	0.013
	2		0.75	0.525	0.010
	1 (Worst)			0.000	0.000

Table I.4 - Single Attribute Marginal Utilities for subject kw4

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = w(x) * $u_i(x_i)$
Work Efficiency	5 (Best)	0.112		1.000	0.112
	4		0.75	0.945	0.106
	3		0.78	0.780	0.087
	2		0.90	0.702	0.079
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.140		1.000	0.140
	4		0.78	0.952	0.133
	3		0.78	0.780	0.109
	2		0.85	0.663	0.093
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.126		1.000	0.126
	4		0.85	0.975	0.123
	3		0.83	0.830	0.104
	2		0.80	0.664	0.084
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.133		1.000	0.133
	4		0.80	0.960	0.128
	3		0.80	0.800	0.106
	2		0.90	0.720	0.096
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.098		1.000	0.098
	4		0.80	0.960	0.094
	3		0.80	0.800	0.078
	2		0.85	0.680	0.067
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.056		1.000	0.056
	4		0.65	0.825	0.046
	3		0.50	0.500	0.028
	2		0.65	0.325	0.018
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.070		1.000	0.070
	4		0.65	0.878	0.061
	3		0.65	0.650	0.045
	2		0.60	0.390	0.027
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.105		1.000	0.105
	4		0.85	0.985	0.103
	3		0.90	0.900	0.094
	2		0.90	0.810	0.085
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.084		1.000	0.084
	4		0.65	0.878	0.074
	3		0.65	0.650	0.055
	2		0.60	0.390	0.033
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.077		1.000	0.077
	4		0.55	0.798	0.061
	3		0.55	0.550	0.042
	2		0.50	0.275	0.021
	1 (Worst)			0.000	0.000

Table I.5 - Single Attribute Marginal Utilities for subject kw5

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = w(x) * $u_i(x_i)$
Work Efficiency	5 (Best)	0.115		1.000	0.115
	4		0.50	0.925	0.106
	3		0.85	0.850	0.098
	2		0.55	0.468	0.054
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.107		1.000	0.107
	4		0.35	0.708	0.075
	3		0.55	0.550	0.059
	2		0.45	0.248	0.026
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.131		1.000	0.131
	4		0.45	0.835	0.110
	3		0.70	0.700	0.092
	2		0.10	0.070	0.009
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.164		1.000	0.164
	4		0.80	0.890	0.146
	3		0.45	0.450	0.074
	2		0.55	0.248	0.041
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.123		1.000	0.123
	4		0.90	0.965	0.119
	3		0.65	0.650	0.080
	2		0.40	0.260	0.032
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.057		1.000	0.057
	4		0.90	0.930	0.053
	3		0.30	0.300	0.017
	2		0.40	0.120	0.007
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.082		1.000	0.082
	4		0.35	0.870	0.071
	3		0.80	0.800	0.066
	2		0.55	0.440	0.036
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.098		1.000	0.098
	4		0.80	0.910	0.090
	3		0.55	0.550	0.054
	2		0.20	0.110	0.011
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.090		1.000	0.090
	4		0.90	0.950	0.086
	3		0.50	0.500	0.045
	2		0.35	0.175	0.016
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.033		1.000	0.033
	4		0.08	0.816	0.027
	3		0.80	0.800	0.026
	2		0.35	0.280	0.009
	1 (Worst)			0.000	0.000

Table I.6 - Single Attribute Marginal Utilities for subject kw6

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.128		1.000	0.128
	4		0.35	0.838	0.107
	3		0.75	0.750	0.096
	2		0.65	0.488	0.062
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.120		1.000	0.120
	4		0.45	0.835	0.100
	3		0.70	0.700	0.084
	2		0.50	0.350	0.042
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.150		1.000	0.150
	4		0.85	0.978	0.147
	3		0.85	0.850	0.128
	2		0.65	0.553	0.083
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.143		1.000	0.143
	4		0.90	0.985	0.141
	3		0.85	0.850	0.121
	2		0.83	0.706	0.101
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.083		1.000	0.083
	4		0.45	0.698	0.058
	3		0.45	0.450	0.037
	2		0.55	0.248	0.020
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.075		1.000	0.075
	4		0.55	0.910	0.068
	3		0.80	0.800	0.060
	2		0.45	0.360	0.027
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.090		1.000	0.090
	4		0.45	0.808	0.073
	3		0.65	0.650	0.059
	2		0.70	0.455	0.041
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.135		1.000	0.135
	4		0.85	0.970	0.131
	3		0.80	0.800	0.108
	2		0.73	0.584	0.079
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.060		1.000	0.060
	4		0.63	0.908	0.055
	3		0.75	0.750	0.045
	2		0.60	0.450	0.027
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.015		1.000	0.015
	4		0.25	0.438	0.007
	3		0.25	0.250	0.004
	2		0.07	0.018	0.000
	1 (Worst)			0.000	0.000

Table I.7 - Single Attribute Marginal Utilities for subject kw7

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.118		1.000	0.118
	4		0.30	0.825	0.097
	3		0.75	0.750	0.088
	2		0.25	0.188	0.022
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.143		1.000	0.143
	4		0.70	0.820	0.117
	3		0.40	0.400	0.057
	2		0.50	0.200	0.029
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.160		1.000	0.160
	4		0.50	0.850	0.136
	3		0.70	0.700	0.112
	2		0.50	0.350	0.056
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.168		1.000	0.168
	4		0.50	0.850	0.143
	3		0.70	0.700	0.118
	2		0.60	0.420	0.071
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.050		1.000	0.050
	4		0.40	0.700	0.035
	3		0.50	0.500	0.025
	2		0.50	0.250	0.013
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.101		1.000	0.101
	4		0.50	0.850	0.086
	3		0.70	0.700	0.071
	2		0.60	0.420	0.042
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.084		1.000	0.084
	4		0.30	0.580	0.049
	3		0.40	0.400	0.034
	2		0.50	0.200	0.017
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.134		1.000	0.134
	4		0.80	0.960	0.129
	3		0.80	0.800	0.108
	2		0.50	0.400	0.054
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.034		1.000	0.034
	4		0.40	0.880	0.030
	3		0.80	0.800	0.027
	2		0.40	0.320	0.011
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.008		1.000	0.008
	4		0.90	0.980	0.008
	3		0.80	0.800	0.007
	2		0.90	0.720	0.006
	1 (Worst)			0.000	0.000

Table I.8 - Single Attribute Marginal Utilities for subject kw8

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = w(x) * $u_i(x_i)$
Work Efficiency	5 (Best)	0.182		1.000	0.182
	4		0.40	0.700	0.127
	3		0.50	0.500	0.091
	2		0.40	0.200	0.036
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.164		1.000	0.164
	4		0.50	0.625	0.102
	3		0.25	0.250	0.041
	2		0.40	0.100	0.016
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.109		1.000	0.109
	4		0.50	0.700	0.076
	3		0.40	0.400	0.044
	2		0.50	0.200	0.022
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.127		1.000	0.127
	4		0.50	0.750	0.095
	3		0.50	0.500	0.064
	2		0.40	0.200	0.025
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.145		1.000	0.145
	4		0.50	0.700	0.102
	3		0.40	0.400	0.058
	2		0.50	0.200	0.029
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.091		1.000	0.091
	4		0.40	0.640	0.058
	3		0.40	0.400	0.036
	2		0.30	0.120	0.011
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.036		1.000	0.036
	4		0.50	0.700	0.025
	3		0.40	0.400	0.015
	2		0.50	0.200	0.007
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.073		1.000	0.073
	4		0.40	0.700	0.051
	3		0.50	0.500	0.036
	2		0.50	0.250	0.018
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.055		1.000	0.055
	4		0.50	0.700	0.038
	3		0.40	0.400	0.022
	2		0.40	0.160	0.009
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.018		1.000	0.018
	4		0.50	0.750	0.014
	3		0.50	0.500	0.009
	2		0.50	0.250	0.005
	1 (Worst)			0.000	0.000

Table I.9 - Single Attribute Marginal Utilities for subject kw9

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = w(x) * $u_i(x_i)$
Work Efficiency	5 (Best)	0.136		1.000	0.136
	4		0.65	0.913	0.124
	3		0.75	0.750	0.102
	2		0.65	0.488	0.066
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.109		1.000	0.109
	4		0.55	0.798	0.087
	3		0.55	0.550	0.060
	2		0.50	0.275	0.030
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.095		1.000	0.095
	4		0.50	0.775	0.074
	3		0.55	0.550	0.052
	2		0.65	0.358	0.034
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.129		1.000	0.129
	4		0.65	0.913	0.118
	3		0.75	0.750	0.097
	2		0.65	0.488	0.063
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.068		1.000	0.068
	4		0.60	0.840	0.057
	3		0.60	0.600	0.041
	2		0.65	0.390	0.027
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.102		1.000	0.102
	4		0.60	0.840	0.086
	3		0.60	0.600	0.061
	2		0.65	0.390	0.040
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.088		1.000	0.088
	4		0.60	0.840	0.074
	3		0.60	0.600	0.053
	2		0.60	0.360	0.032
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.116		1.000	0.116
	4		0.60	0.840	0.097
	3		0.60	0.600	0.069
	2		0.65	0.390	0.045
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.075		1.000	0.075
	4		0.65	0.895	0.067
	3		0.70	0.700	0.052
	2		0.55	0.385	0.029
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.082		1.000	0.082
	4		0.60	0.880	0.072
	3		0.70	0.700	0.057
	2		0.70	0.490	0.040
	1 (Worst)			0.000	0.000

Table I.10 - Single Attribute Marginal Utilities for subject kw10

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.128		1.000	0.128
	4		0.78	0.934	0.119
	3		0.70	0.700	0.089
	2		0.18	0.126	0.016
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.120		1.000	0.120
	4		0.75	0.900	0.108
	3		0.60	0.600	0.072
	2		0.15	0.090	0.011
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.150		1.000	0.150
	4		0.80	0.940	0.141
	3		0.70	0.700	0.105
	2		0.15	0.105	0.016
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.143		1.000	0.143
	4		0.80	0.940	0.134
	3		0.70	0.700	0.100
	2		0.15	0.105	0.015
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.083		1.000	0.083
	4		0.80	0.920	0.076
	3		0.60	0.600	0.050
	2		0.15	0.090	0.007
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.075		1.000	0.075
	4		0.80	0.920	0.069
	3		0.60	0.600	0.045
	2		0.20	0.120	0.009
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.090		1.000	0.090
	4		0.80	0.920	0.083
	3		0.60	0.600	0.054
	2		0.15	0.090	0.008
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.135		1.000	0.135
	4		0.80	0.950	0.129
	3		0.75	0.750	0.102
	2		0.16	0.120	0.016
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.060		1.000	0.060
	4		0.80	0.940	0.057
	3		0.70	0.700	0.042
	2		0.16	0.112	0.007
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.015		1.000	0.015
	4		0.92	0.944	0.014
	3		0.30	0.300	0.005
	2		0.16	0.048	0.001
	1 (Worst)			0.000	0.000

Table I.11 - Single Attribute Marginal Utilities for subject dm1

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.182		1.000	0.182
	4		0.30	0.510	0.093
	3		0.30	0.300	0.055
	2		0.35	0.105	0.019
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.164		1.000	0.164
	4		0.25	0.475	0.078
	3		0.30	0.300	0.049
	2		0.25	0.075	0.012
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.145		1.000	0.145
	4		0.25	0.588	0.085
	3		0.45	0.450	0.065
	2		0.25	0.113	0.016
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.127		1.000	0.127
	4		0.25	0.588	0.075
	3		0.45	0.450	0.057
	2		0.30	0.135	0.017
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.018		1.000	0.018
	4		0.20	0.440	0.008
	3		0.30	0.300	0.005
	2		0.25	0.075	0.001
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.109		1.000	0.109
	4		0.30	0.510	0.056
	3		0.30	0.300	0.033
	2		0.30	0.090	0.010
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.091		1.000	0.091
	4		0.25	0.513	0.047
	3		0.35	0.350	0.032
	2		0.20	0.070	0.006
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.073		1.000	0.073
	4		0.35	0.578	0.042
	3		0.35	0.350	0.025
	2		0.25	0.088	0.006
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.055		1.000	0.055
	4		0.35	0.545	0.030
	3		0.30	0.300	0.016
	2		0.30	0.090	0.005
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.036		1.000	0.036
	4		0.35	0.675	0.025
	3		0.50	0.500	0.018
	2		0.35	0.175	0.006
	1 (Worst)			0.000	0.000

Table I.12 - Single Attribute Marginal Utilities for subject dm2

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.148		1.000	0.148
	4		0.55	0.820	0.121
	3		0.60	0.600	0.089
	2		0.53	0.318	0.047
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.100		1.000	0.100
	4		0.55	0.753	0.076
	3		0.45	0.450	0.045
	2		0.35	0.158	0.016
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.112		1.000	0.112
	4		0.40	0.580	0.065
	3		0.30	0.300	0.034
	2		0.18	0.054	0.006
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.090		1.000	0.090
	4		0.38	0.560	0.050
	3		0.29	0.290	0.026
	2		0.25	0.073	0.007
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.130		1.000	0.130
	4		0.83	0.966	0.126
	3		0.80	0.800	0.104
	2		0.80	0.640	0.083
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.059		1.000	0.059
	4		0.31	0.414	0.024
	3		0.15	0.150	0.009
	2		0.14	0.021	0.001
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.080		1.000	0.080
	4		0.46	0.622	0.050
	3		0.30	0.300	0.024
	2		0.26	0.078	0.006
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.140		1.000	0.140
	4		0.93	0.994	0.139
	3		0.91	0.910	0.128
	2		0.88	0.801	0.112
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.066		1.000	0.066
	4		0.75	0.923	0.061
	3		0.69	0.690	0.046
	2		0.66	0.455	0.030
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.074		1.000	0.074
	4		0.38	0.585	0.043
	3		0.33	0.330	0.024
	2		0.27	0.089	0.007
	1 (Worst)			0.000	0.000

Table I.13 - Single Attribute Marginal Utilities for subject dm3

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.183		1.000	0.183
	4		0.45	0.615	0.113
	3		0.30	0.300	0.055
	2		0.65	0.195	0.036
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.165		1.000	0.165
	4		0.35	0.513	0.085
	3		0.25	0.250	0.041
	2		0.30	0.075	0.012
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.128		1.000	0.128
	4		0.20	0.480	0.062
	3		0.35	0.350	0.045
	2		0.20	0.070	0.009
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.073		1.000	0.073
	4		0.10	0.415	0.030
	3		0.35	0.350	0.026
	2		0.20	0.070	0.005
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.055		1.000	0.055
	4		0.50	0.650	0.036
	3		0.30	0.300	0.017
	2		0.20	0.060	0.003
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.037		1.000	0.037
	4		0.40	0.640	0.023
	3		0.40	0.400	0.015
	2		0.30	0.120	0.004
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.009		1.000	0.009
	4		0.25	0.513	0.005
	3		0.35	0.350	0.003
	2		0.15	0.053	0.000482
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.147		1.000	0.147
	4		0.40	0.472	0.069
	3		0.12	0.120	0.018
	2		0.40	0.048	0.007
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.092		1.000	0.092
	4		0.25	0.513	0.047
	3		0.35	0.350	0.032
	2		0.20	0.070	0.006
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.110		1.000	0.110
	4		0.20	0.440	0.048
	3		0.30	0.300	0.033
	2		0.50	0.150	0.017
	1 (Worst)			0.000	0.000

Table I.14 - Single Attribute Marginal Utilities for subject dm4

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.091		1.000	0.091
	4		0.45	0.588	0.053
	3		0.25	0.250	0.023
	2		0.35	0.088	0.008
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.018		1.000	0.018
	4		0.4	0.550	0.010
	3		0.25	0.250	0.005
	2		0.5	0.125	0.002
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.109		1.000	0.109
	4		0.33	0.531	0.058
	3		0.3	0.300	0.033
	2		0.4	0.120	0.013
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.073		1.000	0.073
	4		0.33	0.498	0.036
	3		0.25	0.250	0.018
	2		0.25	0.063	0.005
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.145		1.000	0.145
	4		0.66	0.772	0.112
	3		0.33	0.330	0.048
	2		0.5	0.165	0.024
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.127		1.000	0.127
	4		0.66	0.772	0.098
	3		0.33	0.330	0.042
	2		0.5	0.165	0.021
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.055		1.000	0.055
	4		0.33	0.498	0.027
	3		0.25	0.250	0.014
	2		0.66	0.165	0.009
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.182		1.000	0.182
	4		0.42	0.565	0.103
	3		0.25	0.250	0.045
	2		0.5	0.125	0.023
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.164		1.000	0.164
	4		0.66	0.803	0.131
	3		0.42	0.420	0.069
	2		0.5	0.210	0.034
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.036		1.000	0.036
	4		0.42	0.936	0.034
	3		0.89	0.890	0.032
	2		0.5	0.445	0.016
	1 (Worst)			0.000	0.000

Table I.15 - Single Attribute Marginal Utilities for subject dm5

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = $w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.120		1.000	0.120
	4		0.75	0.883	0.106
	3		0.53	0.530	0.063
	2		0.40	0.212	0.025
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.060		1.000	0.060
	4		0.80	0.936	0.056
	3		0.68	0.680	0.041
	2		0.47	0.320	0.019
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.105		1.000	0.105
	4		0.48	0.688	0.072
	3		0.40	0.400	0.042
	2		0.18	0.072	0.008
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.138		1.000	0.138
	4		0.48	0.688	0.095
	3		0.40	0.400	0.055
	2		0.18	0.072	0.010
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.045		1.000	0.045
	4		0.77	0.924	0.041
	3		0.67	0.670	0.030
	2		0.43	0.288	0.013
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.097		1.000	0.097
	4		0.83	0.915	0.089
	3		0.50	0.500	0.049
	2		0.27	0.135	0.013
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.139		1.000	0.139
	4		0.80	0.870	0.121
	3		0.35	0.350	0.049
	2		0.18	0.063	0.009
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.067		1.000	0.067
	4		0.72	0.882	0.059
	3		0.58	0.580	0.039
	2		0.27	0.157	0.011
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.148		1.000	0.148
	4		0.80	0.890	0.132
	3		0.45	0.450	0.067
	2		0.33	0.149	0.022
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.082		1.000	0.082
	4		0.70	0.859	0.071
	3		0.53	0.530	0.044
	2		0.25	0.133	0.011
	1 (Worst)			0.000	0.000

Table I.16 - Single Attribute Marginal Utilities for subject dm6

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.123		1.000	0.123
	4		0.80	0.930	0.115
	3		0.65	0.650	0.080
	2		0.15	0.098	0.012
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.107		1.000	0.107
	4		0.85	0.955	0.102
	3		0.70	0.700	0.075
	2		0.55	0.385	0.041
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.122		1.000	0.122
	4		0.90	0.985	0.120
	3		0.85	0.850	0.104
	2		0.40	0.340	0.042
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.092		1.000	0.092
	4		0.85	0.955	0.088
	3		0.70	0.700	0.065
	2		0.30	0.210	0.019
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.111		1.000	0.111
	4		0.70	0.850	0.094
	3		0.50	0.500	0.055
	2		0.55	0.275	0.031
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.099		1.000	0.099
	4		0.80	0.930	0.092
	3		0.65	0.650	0.064
	2		0.67	0.436	0.043
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.105		1.000	0.105
	4		0.55	0.910	0.095
	3		0.80	0.800	0.084
	2		0.30	0.240	0.025
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.117		1.000	0.117
	4		0.80	0.930	0.109
	3		0.65	0.650	0.076
	2		0.30	0.195	0.023
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.086		1.000	0.086
	4		0.80	0.940	0.081
	3		0.70	0.700	0.060
	2		0.25	0.175	0.015
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.037		1.000	0.037
	4		0.50	0.875	0.032
	3		0.75	0.750	0.028
	2		0.72	0.540	0.020
	1 (Worst)			0.000	0.000

Table I.17 - Single Attribute Marginal Utilities for subject dm7

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = $w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.125		1.000	0.125
	4		0.85	0.955	0.119
	3		0.70	0.700	0.088
	2		0.45	0.315	0.039
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.113		1.000	0.113
	4		0.70	0.910	0.102
	3		0.70	0.700	0.079
	2		0.30	0.210	0.024
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.013		1.000	0.013
	4		0.70	0.925	0.012
	3		0.75	0.750	0.009
	2		0.85	0.638	0.008
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.025		1.000	0.025
	4		0.40	0.700	0.018
	3		0.50	0.500	0.013
	2		0.55	0.275	0.007
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.075		1.000	0.075
	4		0.65	0.878	0.066
	3		0.65	0.650	0.049
	2		0.75	0.488	0.037
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.063		1.000	0.063
	4		0.65	0.895	0.056
	3		0.70	0.700	0.044
	2		0.75	0.525	0.033
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.038		1.000	0.038
	4		0.75	0.888	0.033
	3		0.55	0.550	0.021
	2		0.70	0.385	0.014
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.088		1.000	0.088
	4		0.55	0.843	0.074
	3		0.65	0.650	0.057
	2		0.63	0.410	0.036
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.213		1.000	0.213
	4		0.75	0.913	0.194
	3		0.65	0.650	0.138
	2		0.57	0.371	0.079
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.250		1.000	0.250
	4		0.55	0.843	0.211
	3		0.65	0.650	0.163
	2		0.75	0.488	0.122
	1 (Worst)			0.000	0.000

Table I.18 - Single Attribute Marginal Utilities for subject dm8

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = w(x) * $u_i(x_i)$
Work Efficiency	5 (Best)	0.180		1.000	0.180
	4		0.4	0.760	0.137
	3		0.6	0.600	0.108
	2		0.45	0.270	0.049
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.150		1.000	0.150
	4		0.55	0.888	0.133
	3		0.75	0.750	0.113
	2		0.35	0.263	0.039
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.100		1.000	0.100
	4		0.25	0.888	0.089
	3		0.85	0.850	0.085
	2		0.7	0.595	0.060
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.120		1.000	0.120
	4		0.55	0.820	0.098
	3		0.6	0.600	0.072
	2		0.4	0.240	0.029
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.085		1.000	0.085
	4		0.2	0.840	0.071
	3		0.8	0.800	0.068
	2		0.15	0.120	0.010
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.054		1.000	0.054
	4		0.2	0.680	0.037
	3		0.6	0.600	0.032
	2		0.25	0.150	0.008
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.075		1.000	0.075
	4		0.5	0.875	0.066
	3		0.75	0.750	0.056
	2		0.5	0.375	0.028
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.140		1.000	0.140
	4		0.2	0.800	0.112
	3		0.75	0.750	0.105
	2		0.5	0.375	0.053
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.06		1.000	0.060
	4		0.2	0.800	0.048
	3		0.75	0.750	0.045
	2		0.15	0.113	0.007
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.045		1.000	0.045
	4		0.3	0.825	0.037
	3		0.75	0.750	0.034
	2		0.2	0.150	0.007
	1 (Worst)			0.000	0.000

Table I.19 - Single Attribute Marginal Utilities for subject dm9

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility u(x) = $w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.094		1.000	0.094
	4		0.80	0.950	0.090
	3		0.75	0.750	0.071
	2		0.45	0.338	0.032
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.123		1.000	0.123
	4		0.40	0.700	0.086
	3		0.50	0.500	0.061
	2		0.65	0.325	0.040
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.189		1.000	0.189
	4		0.03	0.564	0.106
	3		0.55	0.550	0.104
	2		0.45	0.248	0.047
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.160		1.000	0.160
	4		0.60	0.792	0.127
	3		0.48	0.480	0.077
	2		0.15	0.072	0.012
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.132		1.000	0.132
	4		0.25	0.738	0.097
	3		0.65	0.650	0.086
	2		0.75	0.488	0.064
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.047		1.000	0.047
	4		0.15	0.788	0.037
	3		0.75	0.750	0.035
	2		0.15	0.113	0.005
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.057		1.000	0.057
	4		0.25	0.888	0.050
	3		0.85	0.850	0.048
	2		0.60	0.510	0.029
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.075		1.000	0.075
	4		0.65	0.860	0.065
	3		0.60	0.600	0.045
	2		0.77	0.462	0.035
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.085		1.000	0.085
	4		0.60	0.900	0.076
	3		0.75	0.750	0.064
	2		0.50	0.375	0.032
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.038		1.000	0.038
	4		0.78	0.879	0.033
	3		0.45	0.450	0.017
	2		0.75	0.338	0.013
	1 (Worst)			0.000	0.000

Table I.20 - Single Attribute Marginal Utilities for subject dm10

Attribute Name	Attribute levels (x-axis)	Attribute weight w(x)	Indifference value	Marginal utility $u_i(x_i)$ (y- axis)	Utility $u(x) = w(x) * u_i(x_i)$
Work Efficiency	5 (Best)	0.129		1.000	0.129
	4		0.45	0.670	0.086
	3		0.40	0.400	0.052
	2		0.35	0.140	0.018
	1 (Worst)			0.000	0.000
Work Effectiveness	5 (Best)	0.151		1.000	0.151
	4		0.45	0.670	0.101
	3		0.40	0.400	0.060
	2		0.35	0.140	0.021
	1 (Worst)			0.000	0.000
Psychological Health	5 (Best)	0.215		1.000	0.215
	4		0.45	0.670	0.144
	3		0.40	0.400	0.086
	2		0.35	0.140	0.030
	1 (Worst)			0.000	0.000
Physiological Health	5 (Best)	0.172		1.000	0.172
	4		0.45	0.670	0.115
	3		0.40	0.400	0.069
	2		0.35	0.140	0.024
	1 (Worst)			0.000	0.000
Satisfaction	5 (Best)	0.108		1.000	0.108
	4		0.45	0.670	0.072
	3		0.40	0.400	0.043
	2		0.35	0.140	0.015
	1 (Worst)			0.000	0.000
Social Responsiveness	5 (Best)	0.022		1.000	0.022
	4		0.35	0.610	0.013
	3		0.40	0.400	0.009
	2		0.25	0.100	0.002
	1 (Worst)			0.000	0.000
Social Cohesion	5 (Best)	0.011		1.000	0.011
	4		0.35	0.545	0.006
	3		0.30	0.300	0.003
	2		0.25	0.075	0.001
	1 (Worst)			0.000	0.000
Support for Individual work	5 (Best)	0.065		1.000	0.065
	4		0.50	0.725	0.047
	3		0.45	0.450	0.029
	2		0.40	0.180	0.012
	1 (Worst)			0.000	0.000
Support for collaborative work	5 (Best)	0.043		1.000	0.043
	4		0.50	0.725	0.031
	3		0.45	0.450	0.019
	2		0.40	0.180	0.008
	1 (Worst)			0.000	0.000
Direct costs of workspace	5 (Best)	0.086		1.000	0.086
	4		0.45	0.670	0.058
	3		0.40	0.400	0.034
	2		0.45	0.180	0.015
	1 (Worst)			0.000	0.000

APPENDIX I (B)

RISK MODELS

The appendix I(B) presents the Risk models for attributes A1 through A10. Of the 20 subjects participating in Phase III of the study, two knowledge workers and two decision makers were randomly assigned to the test set for cross validation. Thick solid and dotted lines in the Figures I(B).1 to I(B).10 depicts the extremes of risk behavior and risk behavior of two randomly selected knowledge workers. Alike, thin solid and dotted lines show the extremes of risk behavior and risk behavior of two randomly selected decision-makers. Discussion on these models is presented in section 7.3.2.5.

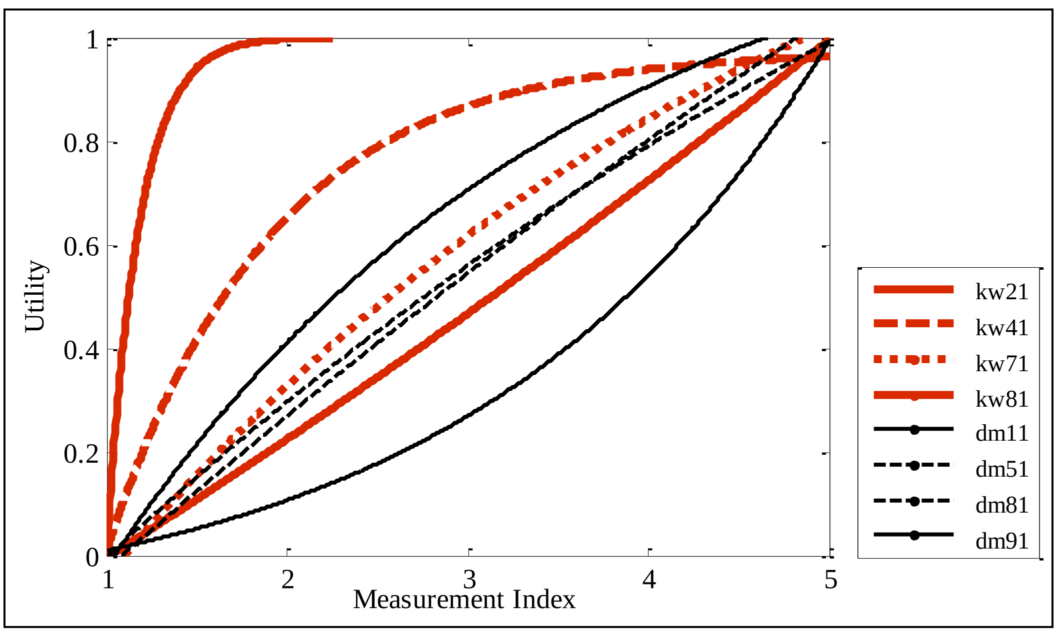


Figure I.1 – Risk Model for Attribute Work Efficiency with Test Subjects

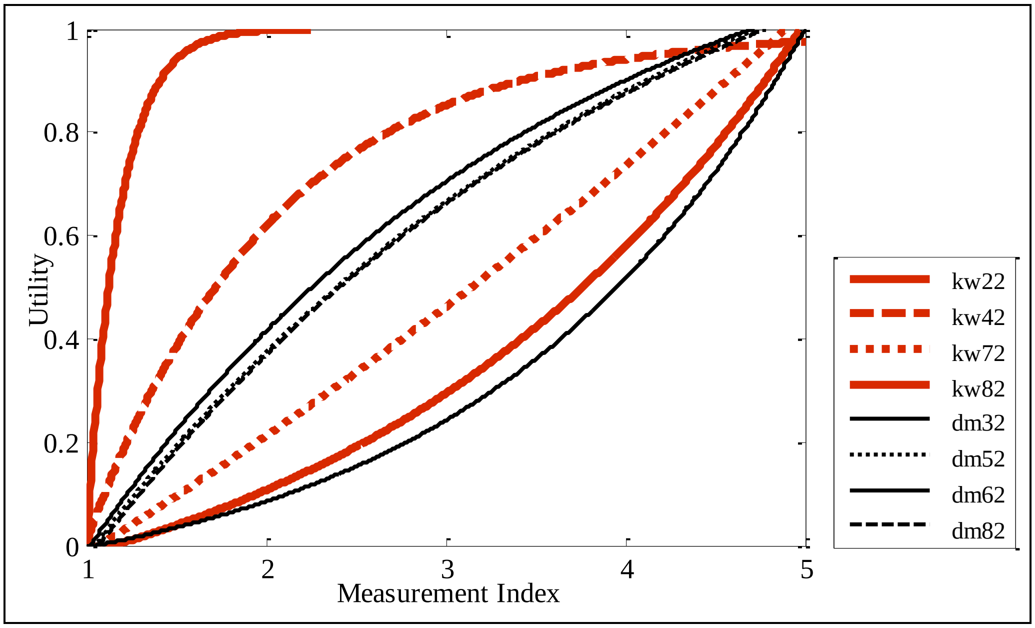


Figure I.2 – Risk Model for Attribute Work Effectiveness with Test Subjects

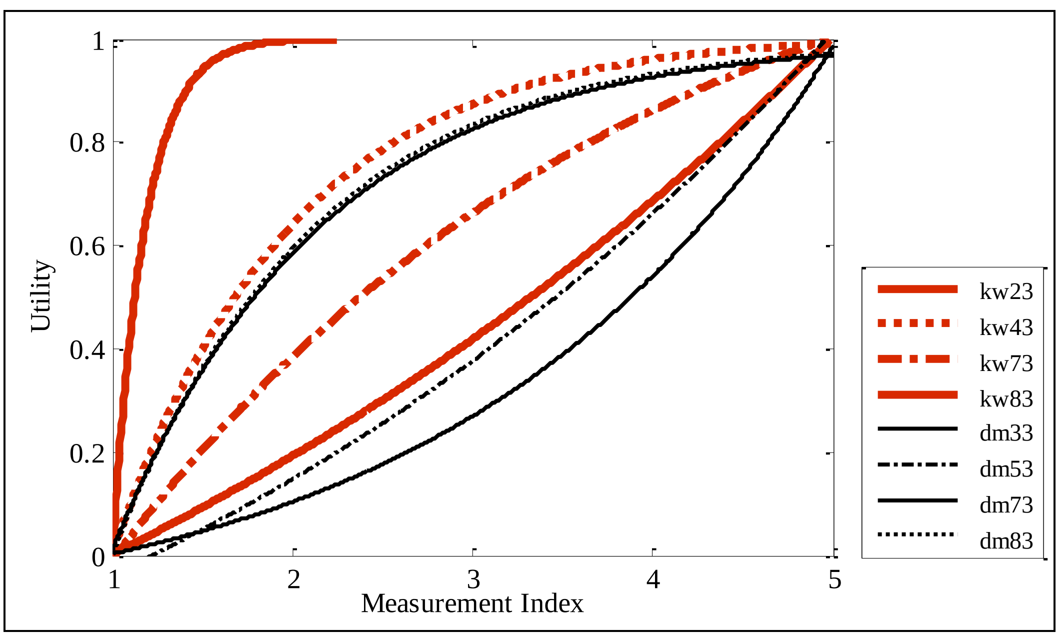


Figure I.3 – Risk Model for Attribute Psychological Health with Test Subjects

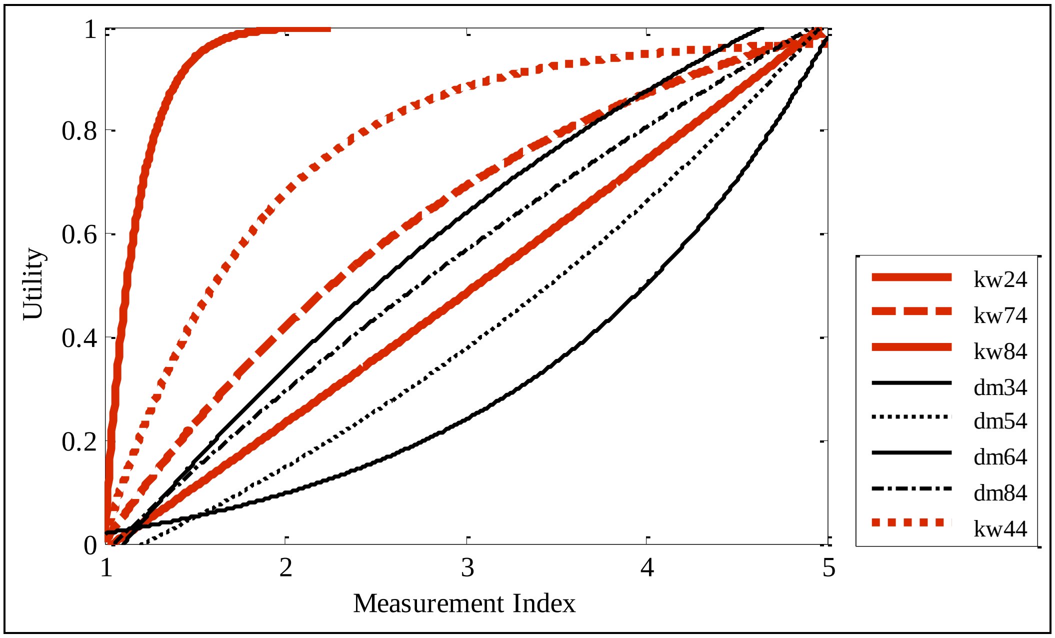


Figure I.4 – Risk Model for Attribute Physiological Health with Test Subjects

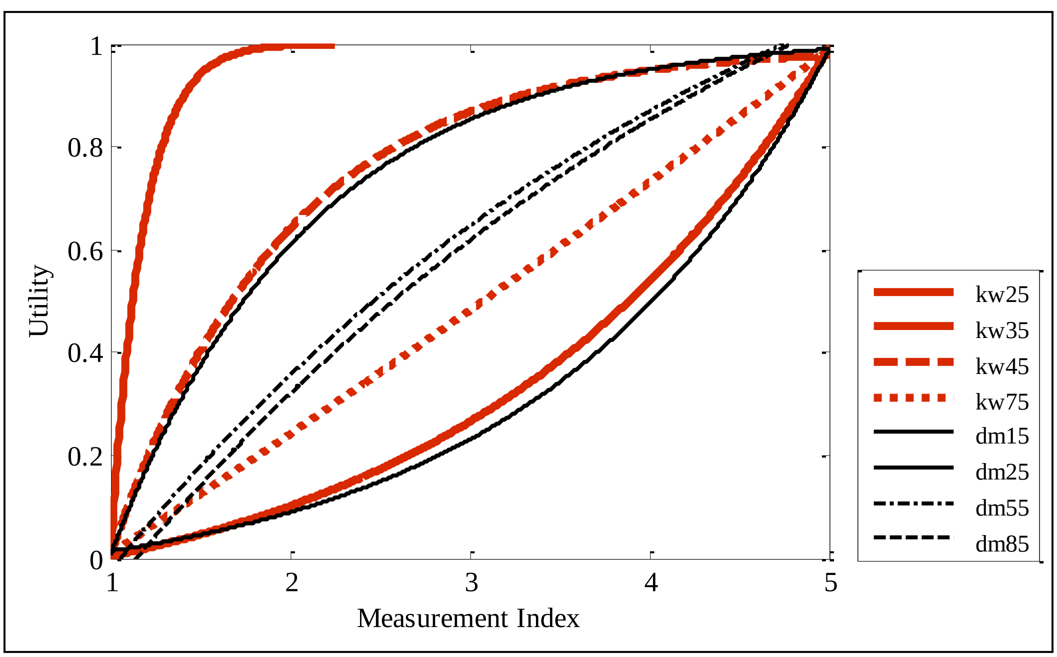


Figure I.5 – Risk Model for Attribute Workspace Satisfaction with Test Subjects

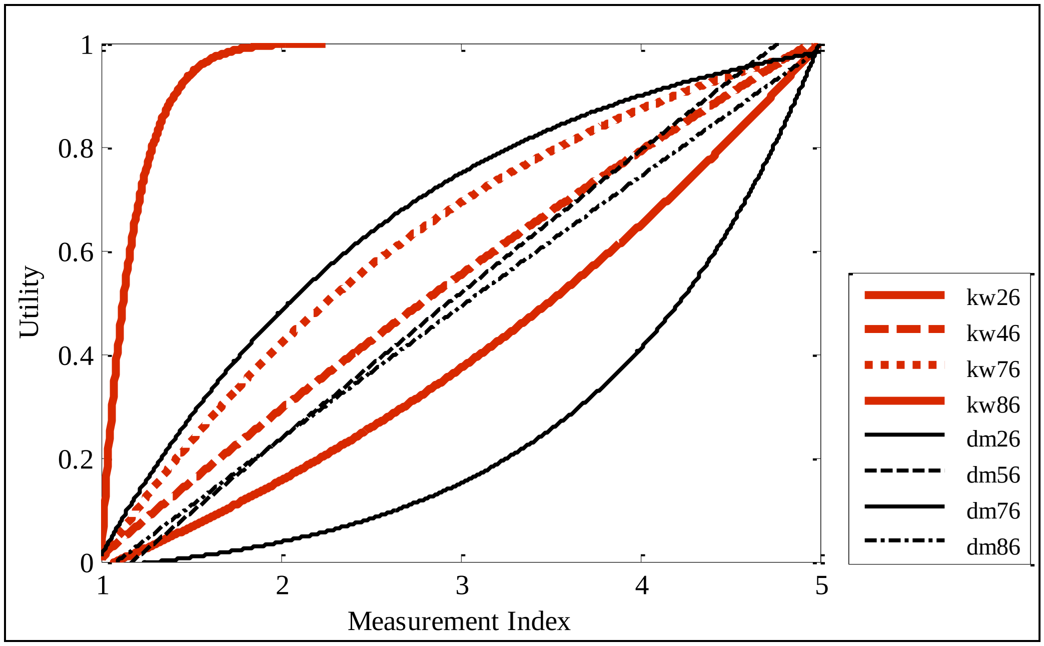


Figure I.6 – Risk Model for Attribute Social Responsiveness with Test Subjects

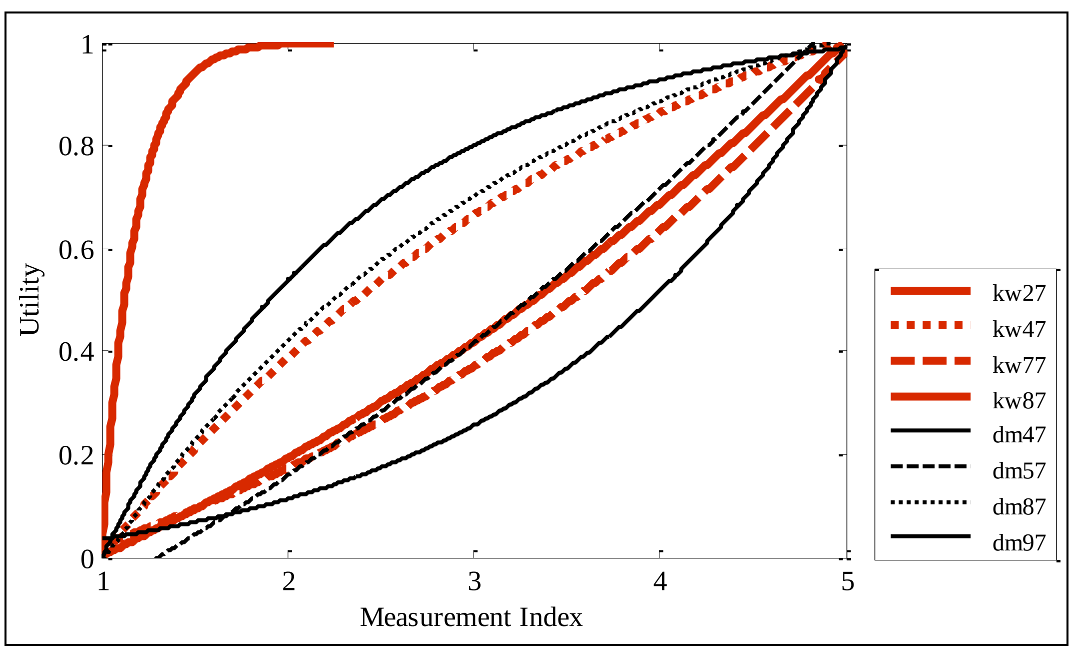


Figure I.7 – Risk Model for Attribute Social Cohesion with Test Subjects

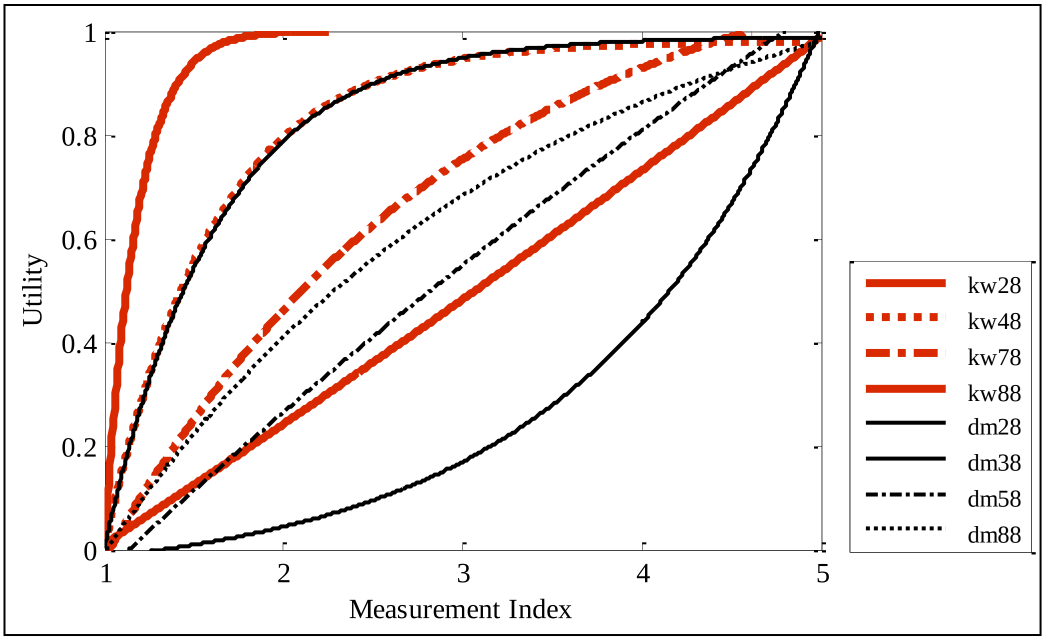


Figure I.8 – Risk Model for Attribute Support for Individual Work with Test Subjects

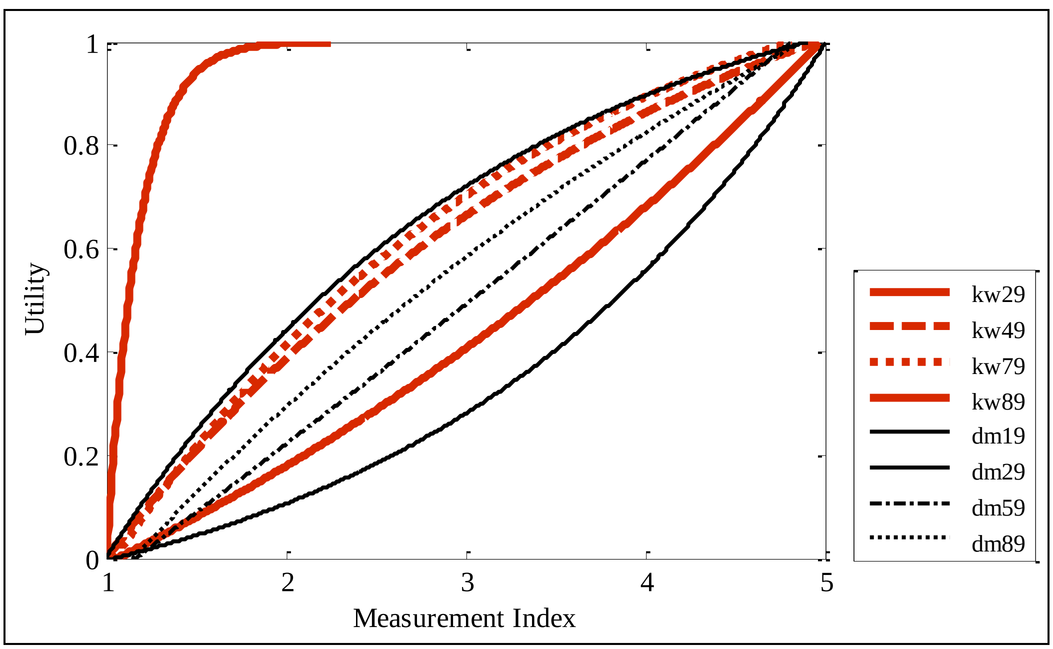


Figure I.9 – Risk Model for Attribute Support for Collaborative Work with Test Subjects

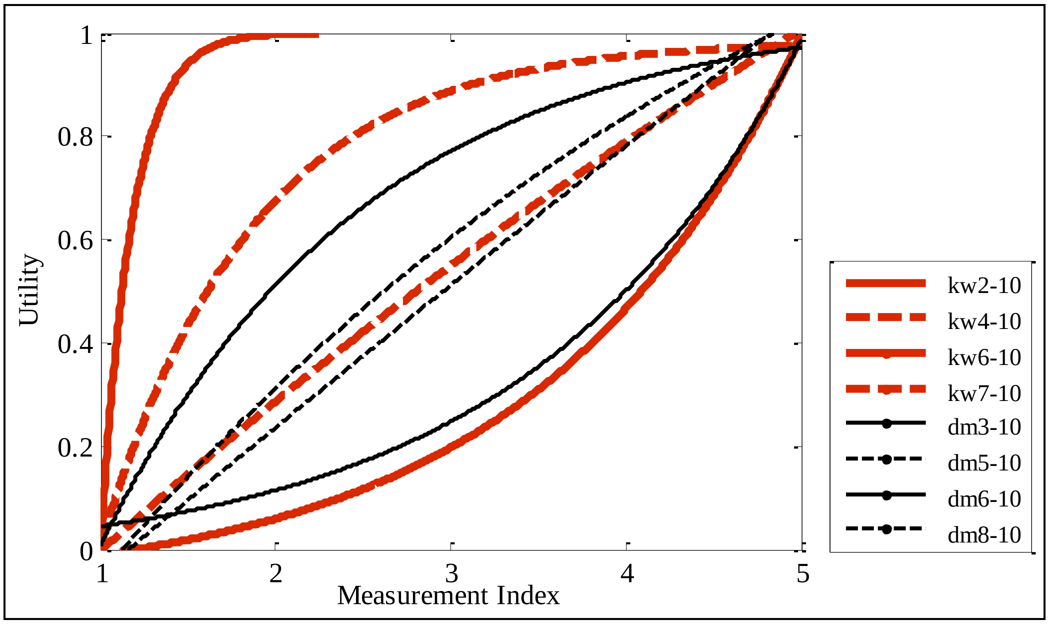


Figure I.10 – Risk Model for Attribute Direct Costs of Workspace with Test Subjects

APPENDIX I (C)

SINGLE ATTRIBUTE UTILITY FUNCTIONS

This part of Appendix I present the single attribute utility functions, their equations, and Goodness of Fit statistics for all 20 subjects of Phase III. Tables I.21 – I.40 shows the single attribute utility equations and vales of R-square and SSE for each best-fit function. Figure I.1 – I.20 presents single attribute utility functions of each subject for all 10 attributes.

Table I.21 - SAUF equation and Goodness of Fit Statistics for kw1

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	11.620	11.920	0.024	0.987	0.010
A2	1.133	2.053	0.580	0.985	0.011
A3	1.291	1.895	0.380	0.999	0.001
A4	1.202	1.928	0.466	0.997	0.002
A5	-0.143	-0.087	-0.513	0.997	0.002
A6	1.128	1.874	0.515	0.997	0.002
A7	1.281	1.872	0.377	0.998	0.001
A8	1.026	2.071	0.712	0.993	0.004
A9	1.328	1.781	0.313	0.978	0.013
A10	1.070	1.884	0.578	0.990	0.006

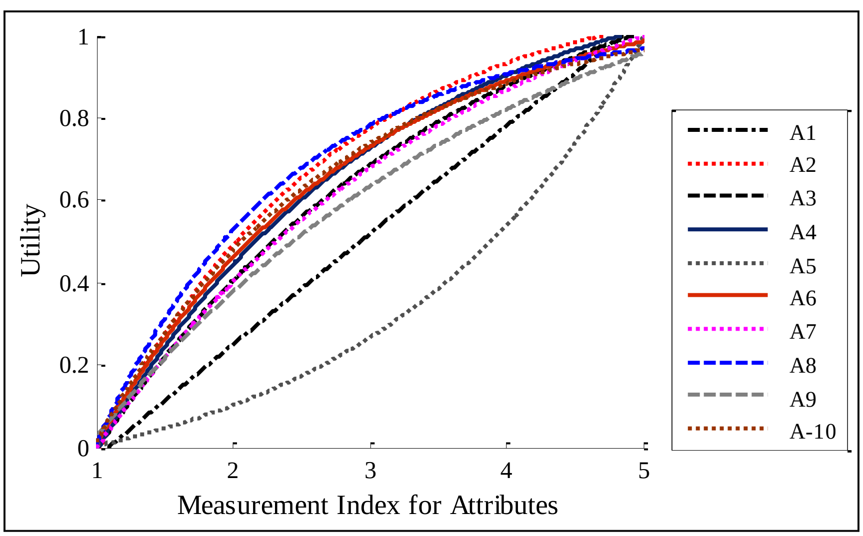


Figure I.11 - Single Attribute Utility Functions for kw1

Table I.22 - SAUF equation and Goodness of Fit Statistics for kw2

Attributes	f(x) = a-b*exp(-c*x)			Goodness of fit	
	Equation Parameters				
	a	b	c	R-Square	SSE
A1	1.001	288.800	5.666	1.000	0.000
A2	1.001	288.800	5.666	1.000	0.000
A3	1.001	288.800	5.666	1.000	0.000
A4	1.001	288.800	5.666	1.000	0.000
A5	1.001	288.800	5.666	1.000	0.000
A6	1.001	288.800	5.666	1.000	0.000
A7	1.001	288.800	5.666	1.000	0.000
A8	1.001	288.800	5.666	1.000	0.000
A9	1.001	288.800	5.666	1.000	0.000
A10	1.001	288.800	5.666	1.000	0.000

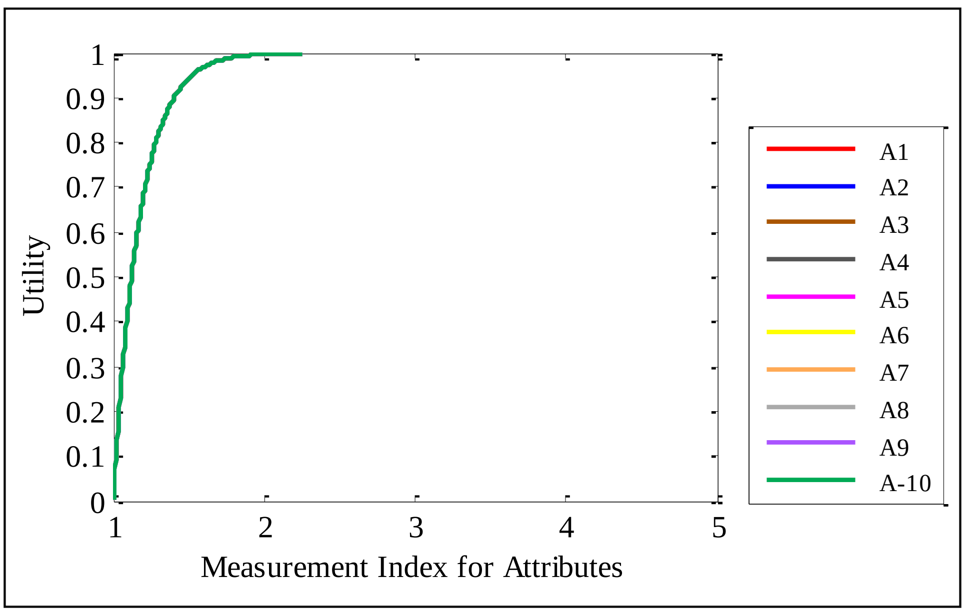


Figure I.12 - Single Attribute Utility Functions for kw2

Table I.23 - SAUF equation and Goodness of Fit Statistics for kw3

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	12.060	12.370	0.023	0.986	0.010
A2	1.134	2.050	0.579	0.985	0.011
A3	1.292	1.894	0.379	0.999	0.001
A4	1.203	1.926	0.465	0.997	0.002
A5	-0.141	-0.087	-0.514	0.997	0.002
A6	1.128	1.871	0.514	0.997	0.002
A7	1.282	1.870	0.376	0.998	0.001
A8	1.026	2.068	0.710	0.993	0.004
A9	1.330	1.781	0.312	0.978	0.013
A10	1.070	1.881	0.577	0.990	0.006

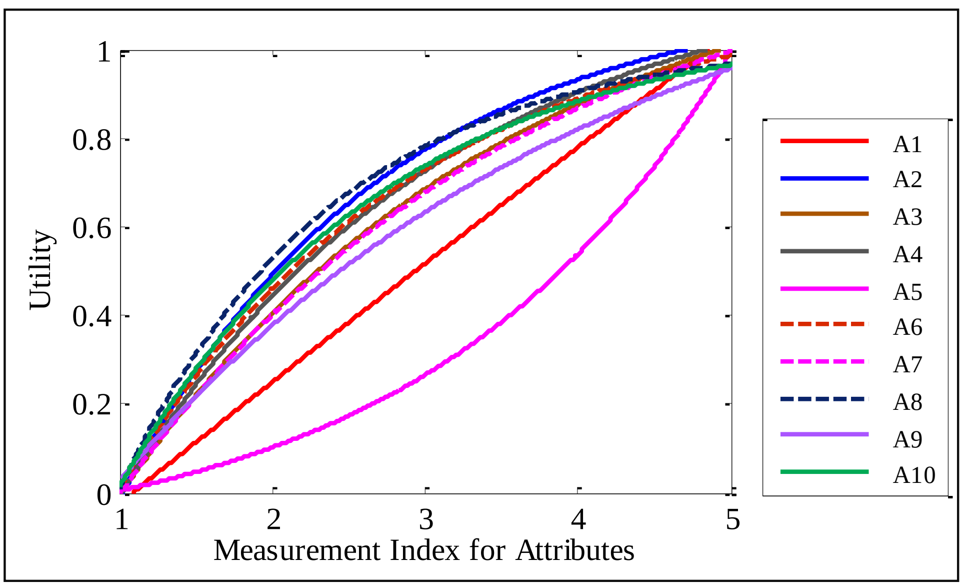


Figure I.13 - Single Attribute Utility Functions for kw3

Table I.24 - SAUF equation and Goodness of Fit Statistics for kw4

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	0.974	2.898	1.098	0.982	0.012
A2	0.997	2.582	0.959	0.988	0.008
A3	1.010	2.732	0.999	0.996	0.003
A4	0.976	3.135	1.173	0.985	0.010
A5	0.994	2.759	1.028	0.990	0.007
A6	3.449	3.750	0.086	0.992	0.005
A7	1.374	1.909	0.330	0.999	0.000
A8	0.981	5.146	1.659	0.996	0.003
A9	1.374	1.909	0.330	0.999	0.000
A10	3.171	3.494	0.096	1.000	0.000

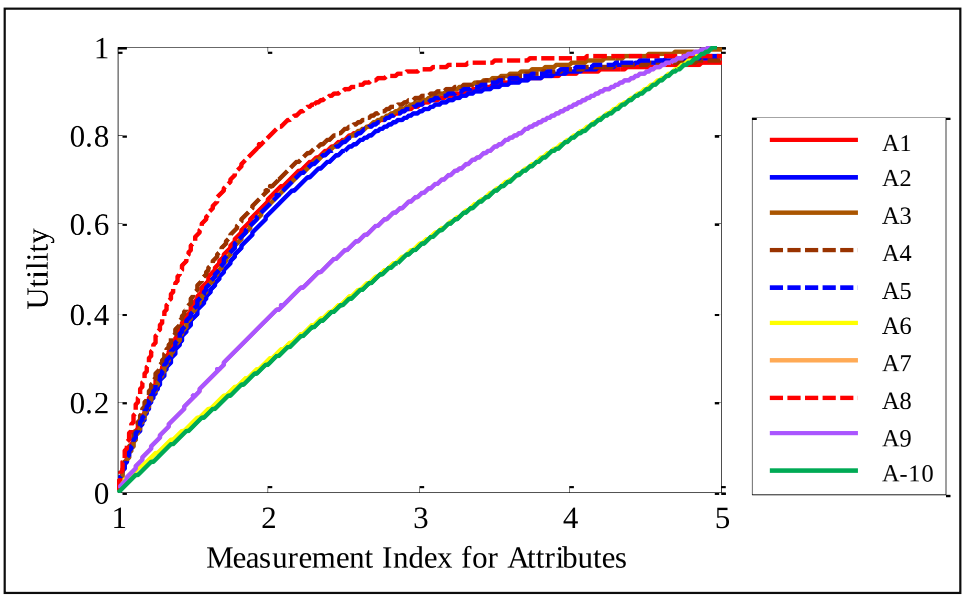


Figure I.14 - Single Attribute Utility Functions for kw4

Table I.25 - SAUF equation and Goodness of Fit Statistics for kw5

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	1.099	2.103	0.640	0.991	0.006
A2	7.926	8.193	0.033	0.994	0.004
A3	2.692	3.139	0.128	0.922	0.065
A4	15.160	15.450	0.018	0.974	0.019
A5	1.752	2.259	0.236	0.974	0.020
A6	-1.543	-1.293	-0.141	0.921	0.068
A7	1.114	1.958	0.558	0.992	0.005
A8	6.219	6.596	0.049	0.955	0.037
A9	5.820	6.181	0.052	0.958	0.034
A10	1.308	1.931	0.369	0.956	0.031

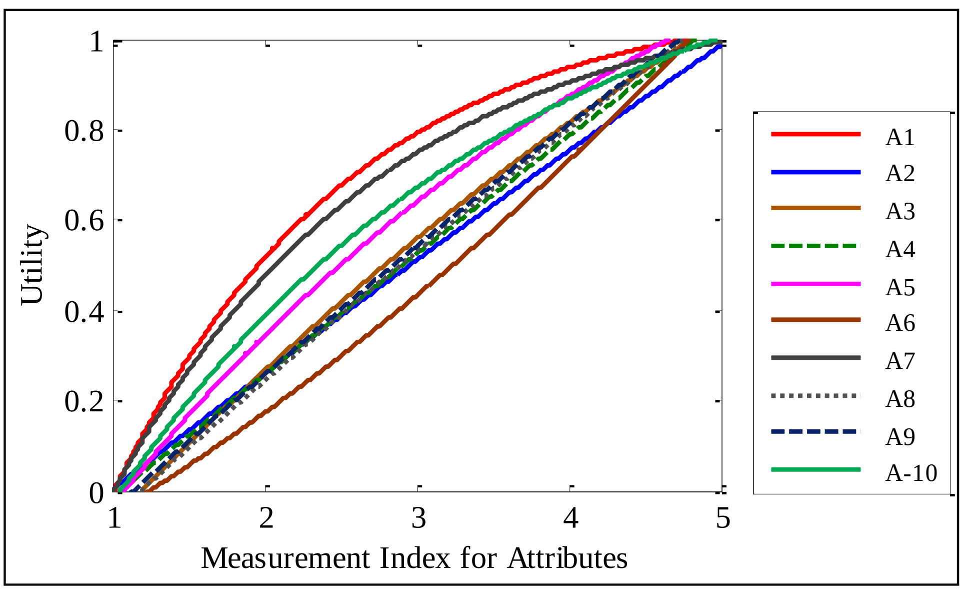


Figure I.15 - Single Attribute Utility Functions for kw5

Table I.26 - SAUF equation and Goodness of Fit Statistics for kw6

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	1.075	1.909	0.579	0.994	0.004
A2	1.350	1.902	0.337	0.995	0.003
A3	1.069	2.303	0.764	0.998	0.001
A4	1.000	3.115	1.139	0.995	0.003
A5	-2.117	-1.936	-0.095	0.998	0.001
A6	1.225	1.964	0.456	0.983	0.012
A7	1.210	1.780	0.399	0.990	0.006
A8	1.051	2.279	0.776	0.998	0.002
A9	1.153	1.932	0.514	1.000	0.000
A10	-0.083	-0.037	-0.675	0.992	0.006

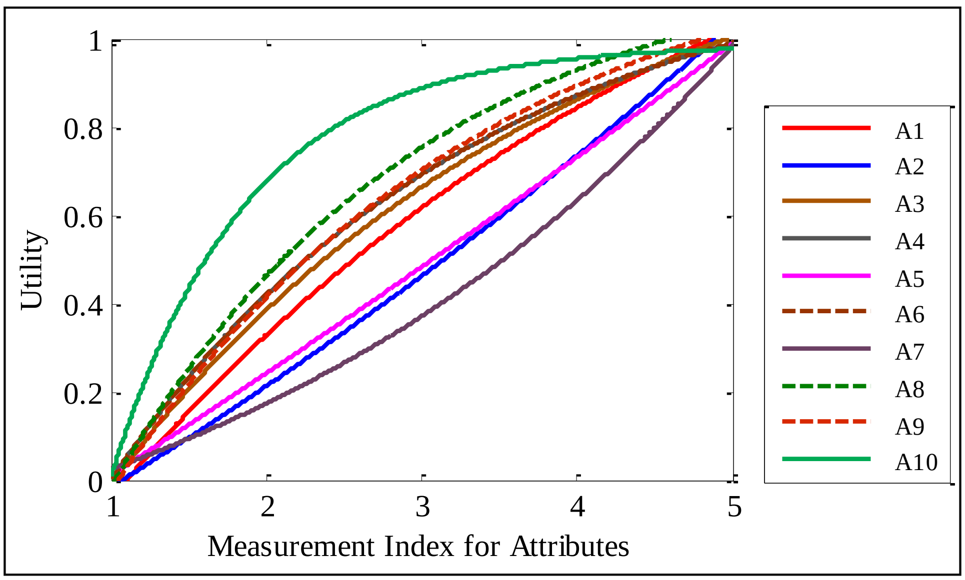


Figure I.16 - Single Attribute Utility Functions for kw6

Table I.27 - SAUF equation and Goodness of Fit Statistics for kw7

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	1.664	2.178	0.244	0.947	0.004
A2	-2.484	-2.258	-0.089	0.982	0.013
A3	1.354	1.913	0.339	0.996	0.003
A4	1.217	1.847	0.418	0.999	0.001
A5	-6.250	-6.035	-0.036	0.997	0.002
A6	1.217	1.847	0.418	0.999	0.001
A7	-0.425	-0.337	-0.286	0.991	0.005
A8	1.201	2.007	0.499	0.988	0.009
A9	1.267	1.952	0.413	0.973	0.019
A10	0.986	3.086	1.147	0.984	0.011

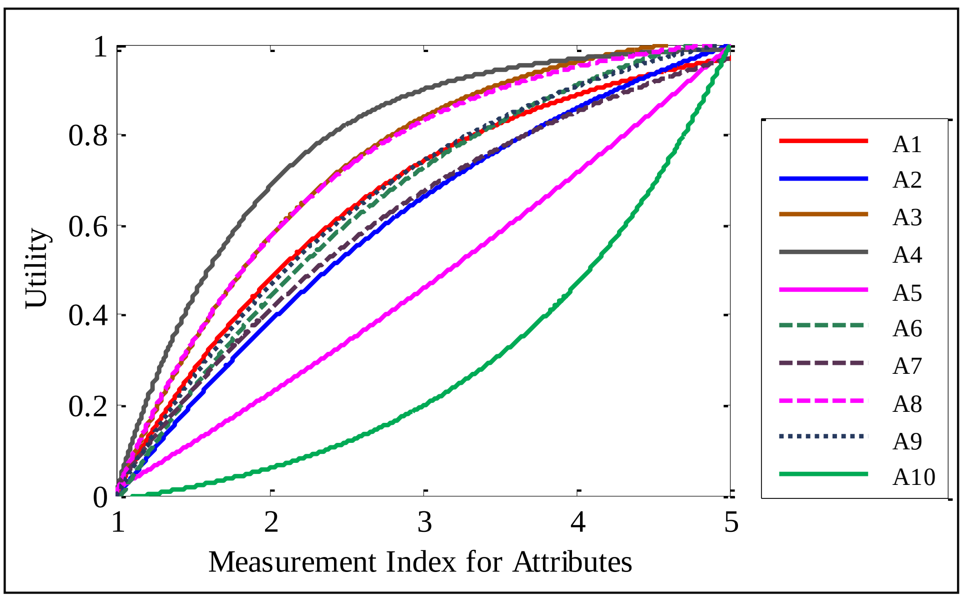


Figure I.17 - Single Attribute Utility Functions for kw7

Table I.28 - SAUF equation and Goodness of Fit Statistics for kw8

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	-3.897	-3.675	-0.057	0.996	0.002
A2	-0.249	-0.153	-0.423	0.993	0.005
A3	-1.021	-0.861	-0.171	0.999	0.001
A4	-8.851	-8.600	-0.027	0.998	0.002
A5	-1.021	-0.861	-0.171	0.999	0.001
A6	-0.621	-0.475	-0.246	0.996	0.002
A7	-1.021	-0.861	-0.171	0.999	0.001
A8	-6.273	-6.058	-0.036	0.997	0.002
A9	-0.947	-0.778	-0.184	0.999	0.001
A10	35.850	36.100	0.007	0.999	0.000

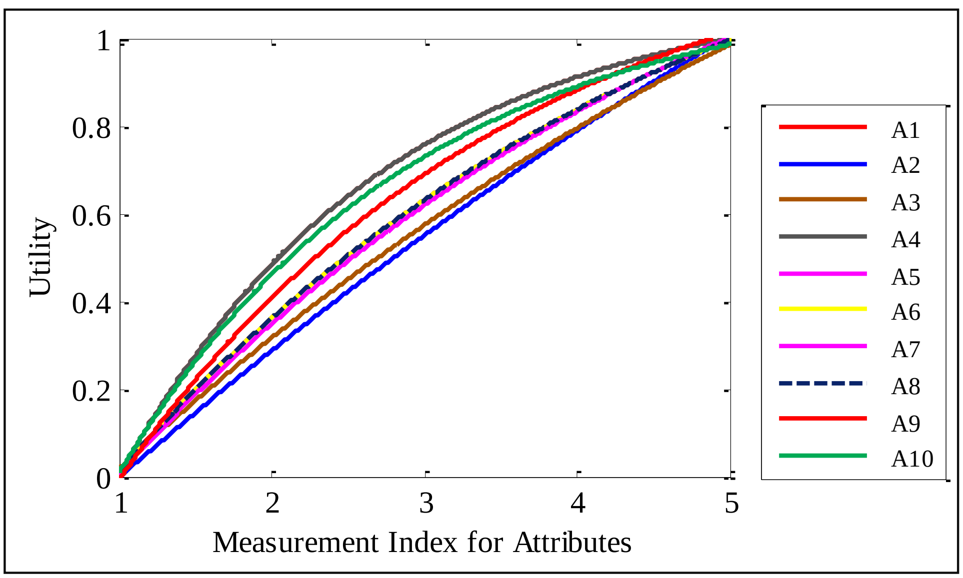


Figure I.18 - Single Attribute Utility Functions for kw8

Table I.29 - SAUF equation and Goodness of Fit Statistics for kw9

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	1.128	1.874	0.515	0.997	0.002
A2	3.171	3.494	0.096	1.000	0.000
A3	2.172	2.502	0.149	0.995	0.003
A4	1.114	1.962	0.567	1.000	0.000
A5	1.522	1.970	0.264	0.997	0.002
A6	1.522	1.970	0.264	0.997	0.002
A7	1.641	2.070	0.235	0.999	0.001
A8	1.522	1.970	0.264	0.997	0.002
A9	1.296	1.907	0.381	0.999	0.001
A10	1.128	1.874	0.515	0.997	0.002

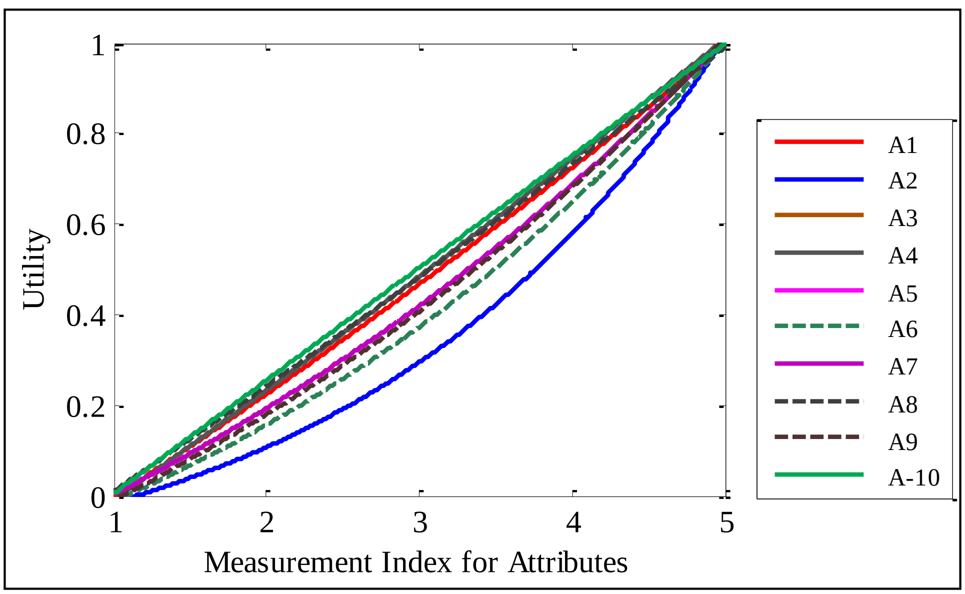


Figure I.19 - Single Attribute Utility Functions for kw9

Table I.30 - SAUF equation and Goodness of Fit Statistics for kw10

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	2.090	2.594	0.186	0.937	0.054
A2	4.175	4.581	0.077	0.946	0.045
A3	2.190	2.693	0.175	0.928	0.063
A4	2.190	2.693	0.175	0.928	0.063
A5	3.918	4.334	0.084	0.943	0.049
A6	3.396	3.812	0.098	0.952	0.040
A7	3.918	4.334	0.084	0.943	0.049
A8	1.857	2.410	0.224	0.921	0.070
A9	2.152	2.657	0.179	0.931	0.060
A10	-1.468	-1.193	-0.152	0.909	0.085

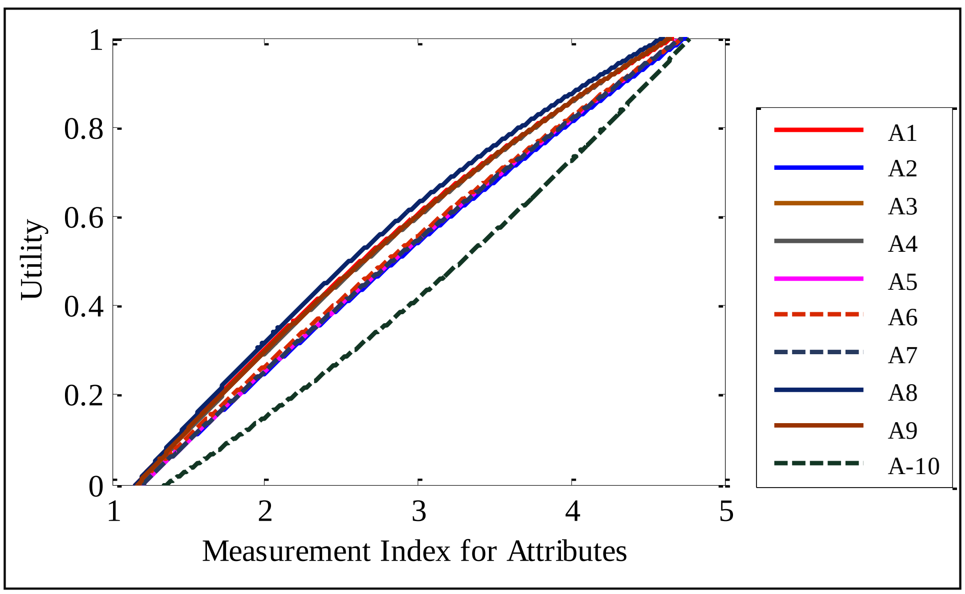


Figure I.20 - Single Attribute Utility Functions for kw10

Table I.31 - SAUF equation and Goodness of Fit Statistics for dm1

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	-0.135	-0.086	-0.514	0.997	0.002
A2	-0.109	-0.065	-0.565	0.992	0.005
A3	-0.633	-0.491	-0.239	0.982	0.012
A4	-0.646	-0.511	-0.232	0.984	0.010
A5	-0.073	-0.046	-0.627	0.987	0.008
A6	-0.143	-0.087	-0.513	0.997	0.002
A7	-0.203	-0.126	-0.449	0.987	0.008
A8	-0.311	-0.207	-0.369	0.996	0.003
A9	-0.189	-0.116	-0.465	0.999	0.001
A10	-2.449	-2.239	-0.086	0.992	0.005

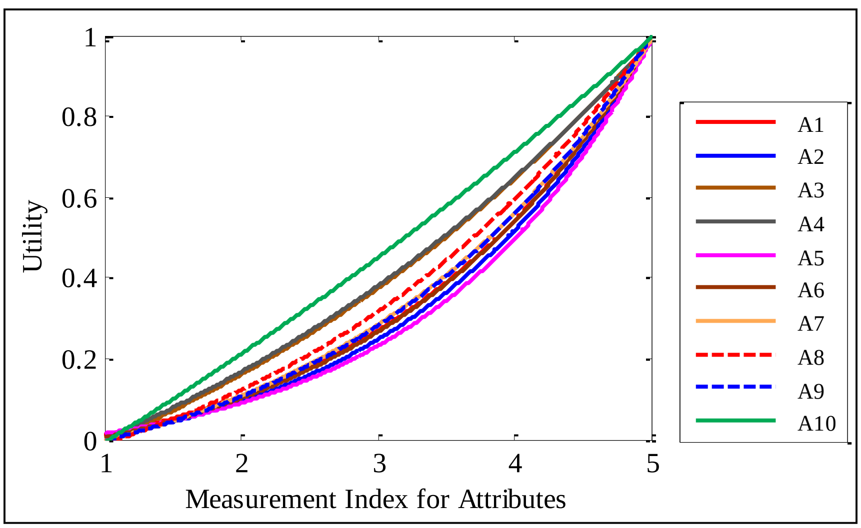


Figure I.21 - Single Attribute Utility Functions for dm1

Table I.32 - SAUF equation and Goodness of Fit Statistics for dm2

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	1.869	2.269	0.192	1.000	0.000
A2	-2.228	-2.003	-0.097	0.994	0.004
A3	-0.257	-0.152	-0.423	0.996	0.003
A4	-0.208	-0.123	-0.457	0.998	0.001
A5	1.017	2.505	0.907	0.994	0.004
A6	-0.050	-0.017	-0.829	0.999	0.000
A7	-0.318	-0.203	-0.376	0.996	0.003
A8	0.989	4.839	1.589	0.997	0.002
A9	1.204	1.892	0.454	0.997	0.002
A10	-0.291	-0.190	-0.383	0.998	0.001

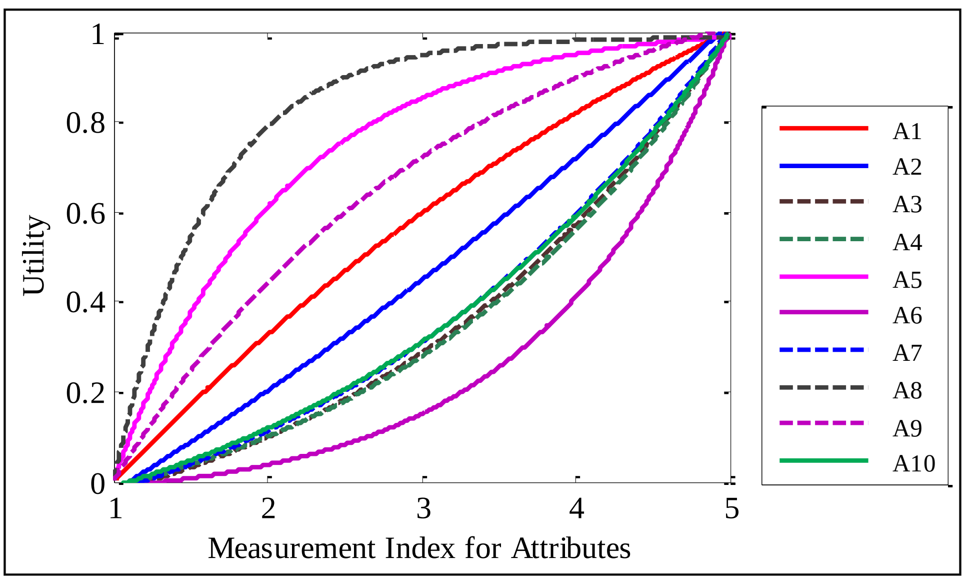


Figure I.22 - Single Attribute Utility Functions for dm2

Table I.33 - SAUF equation and Goodness of Fit Statistics for dm3

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	-0.266	-0.197	-0.372	0.994	0.004
A2	-0.121	-0.066	-0.565	1.000	0.000
A3	-0.155	-0.096	-0.495	0.982	0.012
A4	-0.074	-0.051	-0.608	0.966	0.021
A5	-0.377	-0.242	-0.351	0.991	0.006
A6	-0.621	-0.475	-0.246	0.996	0.002
A7	-0.210	-0.127	-0.450	0.985	0.010
A8	-0.067	-0.024	-0.759	0.994	0.004
A9	-0.203	-0.126	-0.449	0.987	0.008
A10	-0.032	-0.040	-0.648	0.983	0.010

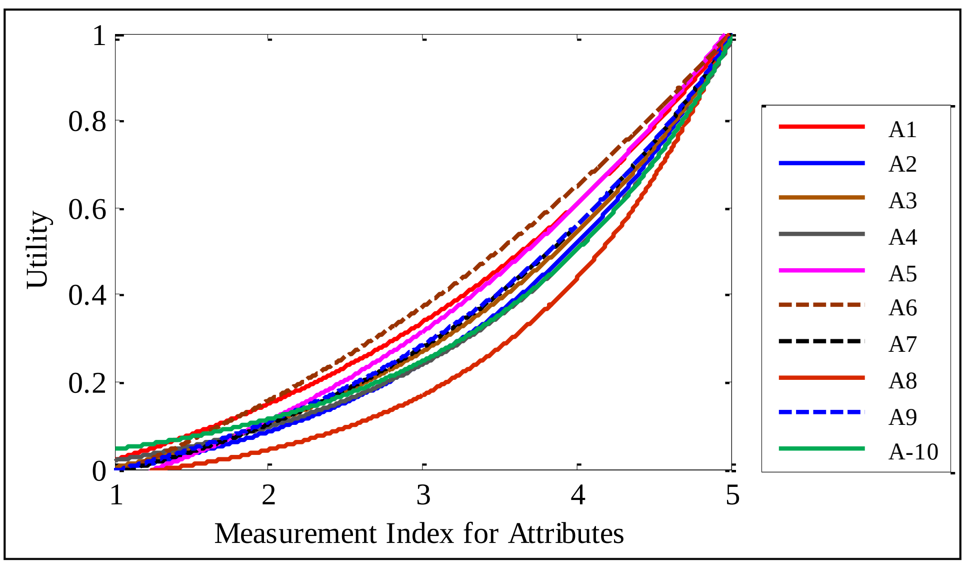


Figure I.23 - Single Attribute Utility Functions for dm3

Table I.34 - SAUF equation and Goodness of Fit Statistics for dm4

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	-0.202	-0.118	-0.466	0.997	0.002
A2	-0.137	-0.086	-0.516	0.999	0.001
A3	-0.156	-0.102	-0.484	0.998	0.001
A4	-0.112	-0.059	-0.586	0.999	0.001
A5	-0.873	-0.699	-0.200	0.980	0.014
A6	-0.873	-0.699	-0.200	0.980	0.014
A7	-0.059	-0.051	-0.605	0.993	0.004
A8	-0.155	-0.097	-0.495	0.998	0.001
A9	-2.987	-2.760	-0.075	0.989	0.008
A10	1.110	2.144	0.644	0.980	0.015

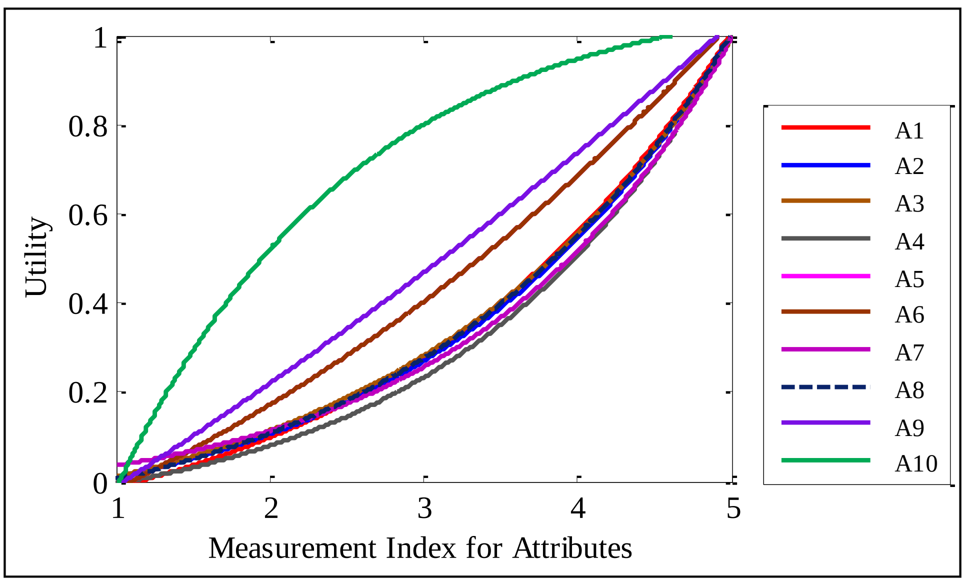


Figure I.24 - Single Attribute Utility Functions for dm4

Table I.35 - SAUF equation and Goodness of Fit Statistics for dm5

Attributes	f(x) = a-b*exp(-c*x)			Goodness of fit	
	Equation Parameters				
	a	b	c	R-Square	SSE
A1	4.237	4.585	0.072	0.983	0.012
A2	1.484	2.038	0.304	0.989	0.008
A3	-0.791	-0.606	-0.219	0.988	0.009
A4	-0.791	-0.606	-0.219	0.988	0.009
A5	1.597	2.118	0.267	0.986	0.010
A6	13.820	14.160	0.021	0.960	0.032
A7	-1.451	-1.194	-0.149	0.946	0.045
A8	3.648	4.032	0.088	0.971	0.022
A9	-9.786	-9.486	-0.027	0.966	0.026
A10	12.520	12.860	0.023	0.972	0.021

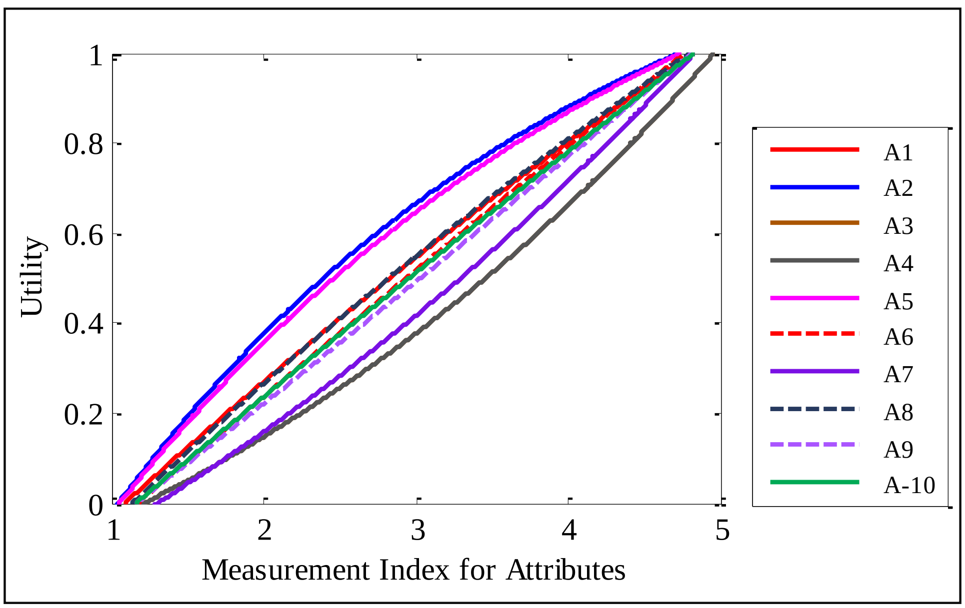


Figure I.25 - Single Attribute Utility Functions for dm5

Table I.36 - SAUF equation and Goodness of Fit Statistics for dm6

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	2.739	3.196	0.130	0.937	0.055
A2	1.317	1.955	0.386	0.993	0.005
A3	1.244	2.062	0.479	0.964	0.028
A4	1.736	2.272	0.243	0.960	0.032
A5	4.488	4.797	0.065	0.991	0.006
A6	1.291	1.894	0.385	0.993	0.005
A7	1.412	2.048	0.343	0.952	0.038
A8	2.060	2.531	0.185	0.966	0.027
A9	1.868	2.386	0.217	0.952	0.039
A10	1.045	2.018	0.665	0.995	0.003

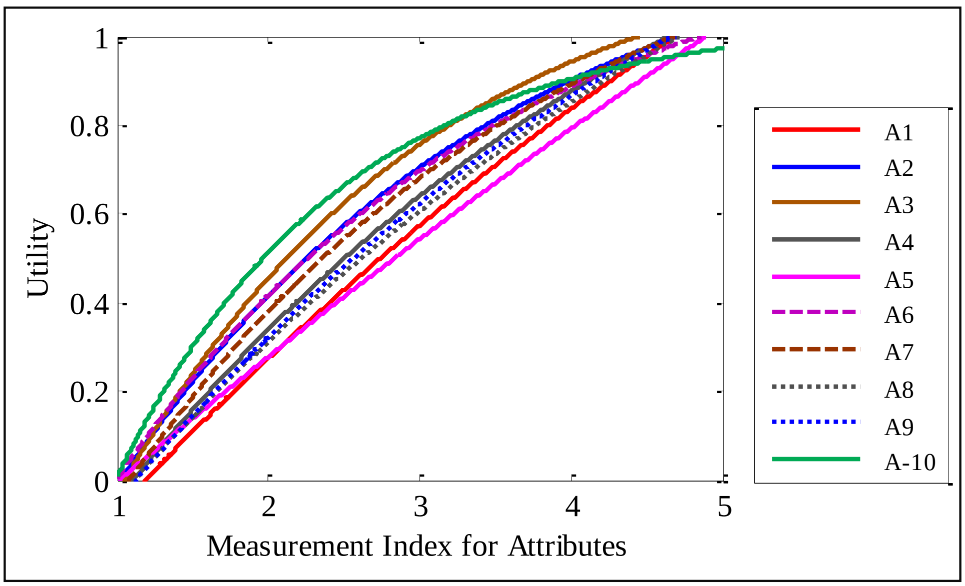


Figure I.26 - Single Attribute Utility Functions for dm6

Table I.37 - SAUF equation and Goodness of Fit Statistics for dm7

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	1.454	2.038	0.321	0.984	0.012
A2	1.751	2.265	0.233	0.966	0.026
A3	0.999	2.356	0.869	0.985	0.010
A4	-14.710	-14.490	-0.016	0.996	0.002
A5	1.179	1.825	0.449	0.990	0.006
A6	1.093	1.915	0.570	0.993	0.005
A7	1.759	2.167	0.214	0.986	0.009
A8	1.320	1.855	0.346	0.999	0.001
A9	1.427	1.965	0.316	0.996	0.003
A10	1.164	1.796	0.448	0.989	0.007

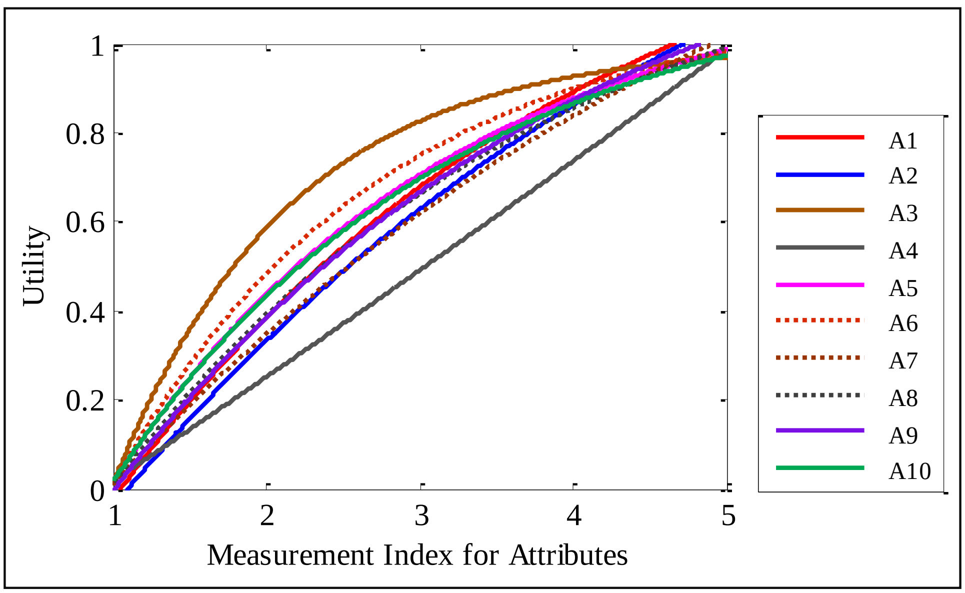


Figure I.27 - Single Attribute Utility Functions for dm7

Table I.38 - SAUF equation and Goodness of Fit Statistics for dm8

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	2.417	2.766	0.133	0.995	0.003
A2	1.453	2.034	0.314	0.971	0.021
A3	0.999	2.455	0.900	0.995	0.003
A4	2.472	2.849	0.134	0.993	0.005
A5	1.701	2.249	0.243	0.907	0.078
A6	15.840	16.130	0.016	0.964	0.024
A7	1.239	1.905	0.422	0.993	0.005
A8	1.208	1.844	0.418	0.984	0.010
A9	1.999	2.477	0.186	0.919	0.065
A10	1.803	2.304	0.217	0.935	0.051

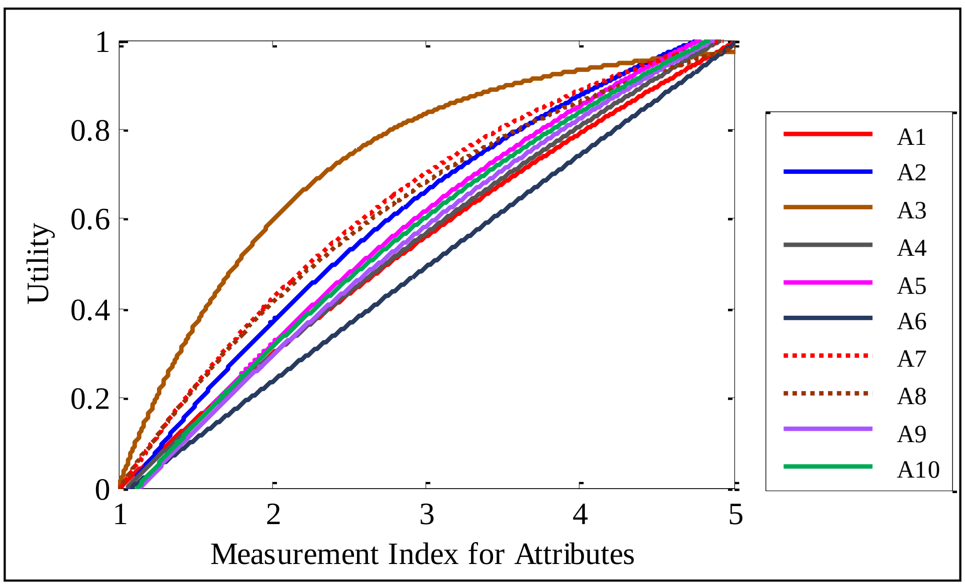


Figure I.28 - Single Attribute Utility Functions for dm8

Table I.39 - SAUF equation and Goodness of Fit Statistics for dm9

Attributes	f(x) = a-b*exp(-c*x)			Goodness of fit	
	Equation Parameters				
	a	b	c	R-Square	SSE
A1	1.328	1.990	0.387	0.984	0.012
A2	14.240	14.460	0.017	0.989	0.006
A3	-2.968	-2.798	-0.067	0.948	0.029
A4	-3.023	-2.746	-0.078	0.971	0.022
A5	1.117	1.709	0.446	0.966	0.019
A6	2.016	2.487	0.183	0.917	0.065
A7	1.049	2.164	0.720	0.992	0.005
A8	1.307	1.825	0.348	0.985	0.009
A9	1.249	1.926	0.423	0.993	0.005
A10	4.553	4.841	0.063	0.970	0.020

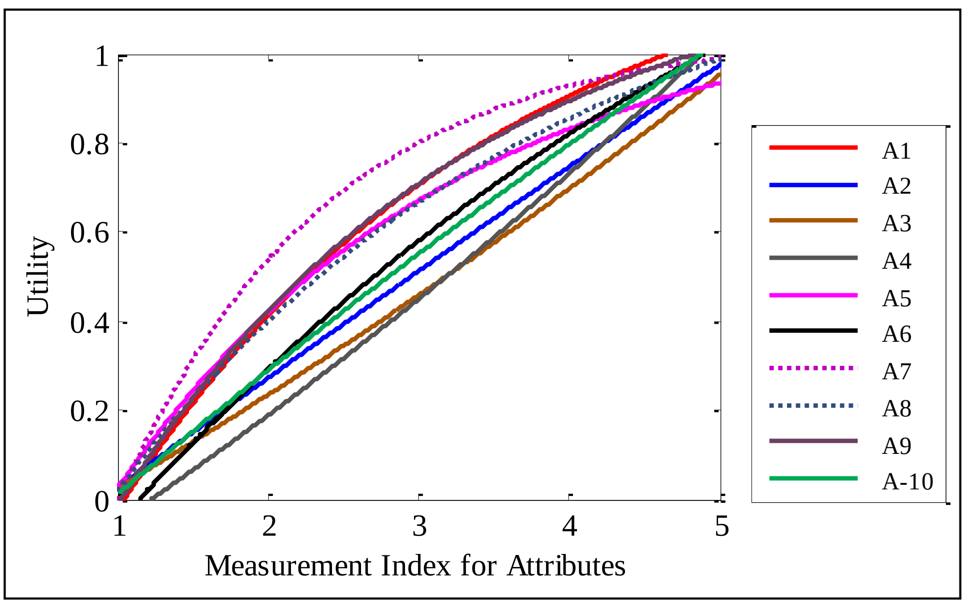


Figure I.29 - Single Attribute Utility Functions for dm9

Table I.40 - SAUF equation and Goodness of Fit Statistics for dm10

Attributes	f(x) = a-b*exp(-c*x) Equation Parameters			Goodness of fit	
	a	b	c	R-Square	SSE
A1	-0.762	-0.605	-0.214	0.998	0.001
A2	-0.762	-0.605	-0.214	0.998	0.001
A3	-0.762	-0.605	-0.214	0.998	0.001
A4	-0.762	-0.605	-0.214	0.998	0.001
A5	-0.762	-0.605	-0.214	0.998	0.001
A6	-0.512	-0.376	-0.278	0.993	0.005
A7	-0.196	-0.117	-0.464	0.998	0.001
A8	-1.960	-1.753	-0.105	0.998	0.001
A9	-1.960	-1.753	-0.105	0.998	0.001
A10	-0.802	-0.655	-0.202	1.000	0.000

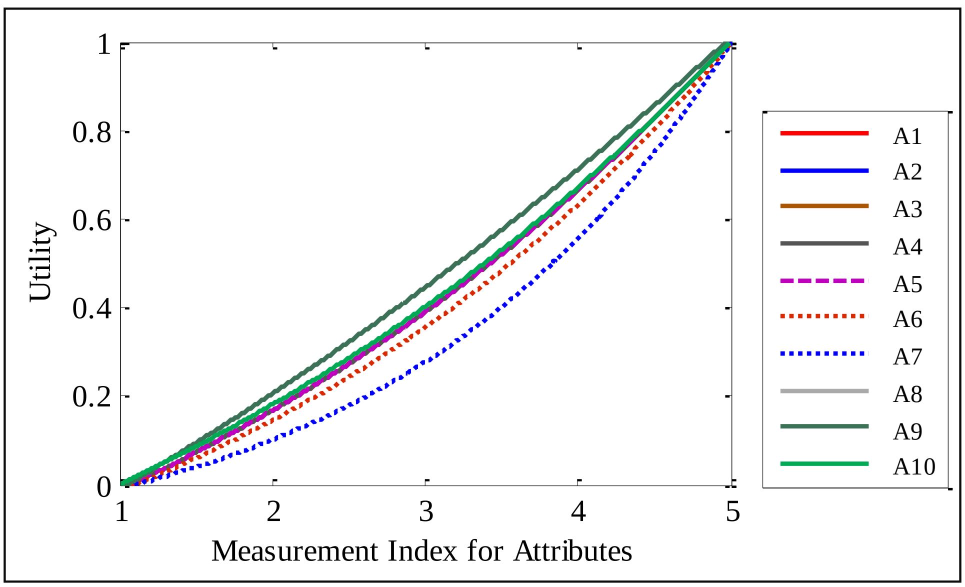


Figure I.30 - Single Attribute Utility Functions for dm10

APPENDIX J

WORKING MEMORY

Working memory is analogous to a cache memory in computers, which provides temporary space for storage, fast access, and manipulation of information necessary for the primary task at hand. In addition, working memory also has access to long-term memory for the stored data (like regular storage for computers, which the microprocessor accesses when it doesn't find required information in the cache), and acts as an interface between perception, action and long-term memory. A simplified model of a working memory system is shown in Figure J.1 (the figure is excerpted from Badde;ley, 2001, p.31); this model was invented by Gallanter Miller and Pribram as a unitary model but was further adopted and advanced by Baddeley and Hitch as a three component system. The model helps explain the irrelevant speech effect by demonstrating that spoken material gains obligatory access to phonological memory storage through the phonological loop; this, in turn, interferes with the task-relevant visual information processed into the phonological store by sub-vocalizing.

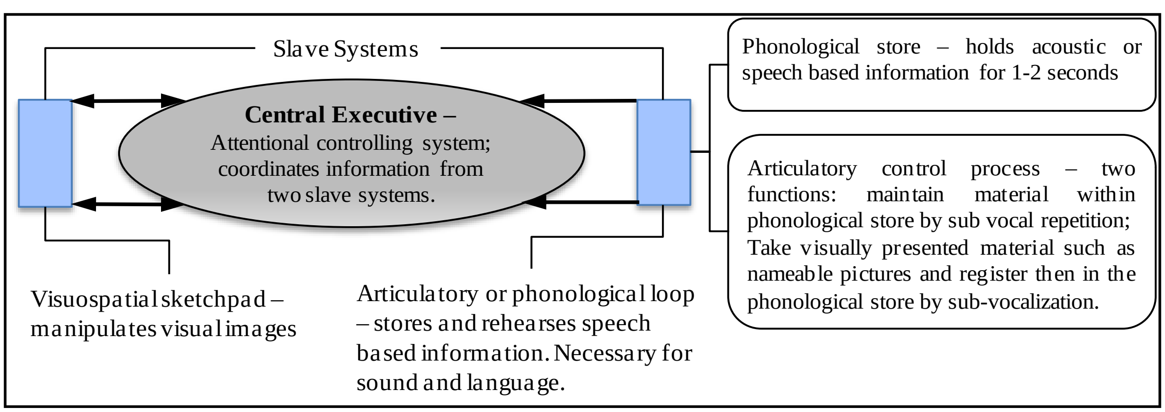


Figure J.1 - Baddeley and Hitch's Working Memory Model (Source: Baddeley, 1992)

APPENDIX K

GROUP ANALYSIS TECHNIQUES

Nominal group technique

The nominal group technique (NGT) is a structured method of collecting and organizing the thoughts of a group. Moore (1987) states that NGT is particularly useful for the following tasks: identify problems, explore solutions, and establish priorities. The process of NGT is such that it prevents domination of the discussion by a single person, encourage all the members of the group to participate, and provides results that represents groups' preferences. NGT is typically a four step process: generate ideas, record ideas, discuss ideas, and vote on ideas. The moderator of the group presents the problem to the group and requests them to write ideas silently and independently. Then the group goes through a feedback session to concisely record each idea, without repeating the ideas, which is then subjected to evaluation for clarity and importance. During this step, group members are able to express their understanding of the logic and the relative importance of each idea. Individuals then vote privately to prioritize the ideas. (Moore, 1987). The ideas that fetch the highest rating by the group are considered the most favored group actions or ideas in response to the problem under scrutiny.

NGT is an appropriate technique to use in the following situations: when the problem is clear, but knowledge about it is dispersed amongst several people; when rapid consensus is required as a team; when group prefers a structured style of working; or when group is not sufficiently comfortable together to be open and creative.

Delphi method

The Delphi method is an iterative process that can be used to collect and analyze expert judgments by using a series of questionnaires interspersed with controlled feedback of information to participants. Communication generally takes place by post or by electronic exchange (Jones et al., 1992b). Subsequent questionnaires are developed based on the results of the previous questionnaire and the process ends when the problem is solved or research question is answered or an acceptable degree of consensus is reached. Definition of consensus is central to the Delphi study and critics of the Delphi state that the issue of consensus is one of the most contentious components of the method (Crisp et al., 1997). Consensus in Delphi is influenced by the sample type also, i.e. if the sample is homogenous, then consensus is easily reached and two to three rounds of questions may fetch consensus (Delbecq et al., 1975) .However, if group consensus is desirable and the sample is heterogeneous, then three or more rounds may be required (Delbecq et al., 1975). The key issue with more number of rounds is that with increase in rounds, the effort required by Delphi participants also increases, so the likelihood of fall in response rate becomes very high (Alexander, 2004, Rosenbaum, 1985, Thomson, 1985).

The Delphi method is the best way to approach experts in the field when there is incomplete knowledge about a phenomenon (Delbecq et al., 1975, Adler and Ziglio, 1995). Therefore, deciding on what constitutes expertise is critical for the validity of the study. Literature suggests that an expert possesses the relevant knowledge and experience; and is respected by fellow workers for his / her opinions and knowledge (Fink et al., 1984, Goodman, 1987, Murry and Hammons, 1995, Clayton, 1997).

A comparison of key features of NGT and Delphi method is presented in Table K.1. This table has been excerpted from Delbecq et. al (1975, p. 32).

Table K.1 - Comparison of NGT and Delphi Methods

Dimension	NGT	Delphi
Overall methodology	Meeting is structured Low variability between decision-making groups	Questionnaires are structured and feedback reports. Low variability between decision panels.
Role orientation of groups	Balanced social-emotional and task-instrumental focus	Task-instrumental focus
Relative quantity of ideas	High; independent thinking	High; isolated thinking
Relative quality and specificity of ideas	High quality; high specificity	High quality; high specificity
Normative behavior	Tolerance for non-conformity	Freedom not to conform
Equality of participation	Member equality	Respondent equality in pooling of independent judgments
Methods of conflict resolution	Problem-centered Confrontation and problem solving	Problem-centered Majority rule of pooled independent judgments
Closure to decision process	High closure High felt accomplishment	High closure Medium felt accomplishment
Task motivation	High	Medium

APPENDIX L

GLOSSARY OF TERMS

Adaptable Workspace

An adaptable workspace (AW), as defined in this study, is a workspace that allows (and assists) its user to exercise control over distractions coming from the surrounding work environment. It supports the conflicting requirements of collaboration and concentration and also informs the surroundings of individuals' social readiness. It allows the environment to adapt to the needs of the user, or it allows the user to adjust the micro-environment to suit to one's needs, such as functional, psychological, and physiological, among other needs. The appropriate illustrations are: IBM's BlueSpace; and Queens University's Attentive Office Cubicle; and Clemson's Animated Work Environment.

Attribute

The degree of achievement of an objective is measured through its attribute. Ideally, all the lowest-level objectives are measurable either objectively or subjectively. Other terms used for an attribute are: measure of effectiveness; performance measure; metric; and evaluation measure.

Externally Generated Involuntary Auditory Distractions (EGIAD)

Externally generated involuntary auditory distractions (EGIAD) are the extraneous speech and sound in ones surrounding work environment. The main characteristics of these distractions are: they originate in ones surroundings; occurrence is random, i.e. they can occur anytime; distractions are discrete, i.e. they have a start time and an end time; knowledge workers have no control over them; and typically their impact is attentional overload.

Fundamental Objective

Fundamental objective is the explicit value that one desires to achieve. It is any criterion that is “significant enough” to be taken into account while evaluating alternatives. It is important to an individual or organization simply because it is important.

Fundamental Objective Hierarchy

Fundamental objective hierarchy is the hierarchy that arranges objectives from broad, overarching concept at the top to lower-level, specific accomplishments or actions. Objectives at the upper levels of the hierarchy reflect broad or inclusive values and progress towards these objectives is achieved by meeting lower-level sub-objectives.

Knowledge Work

Peter Druker in 1959 first introduced the term knowledge work to describe the use of information as the raw material of work. Analysis, creativity, problem-solving, and collaboration are some aspects of what is involved when conducting knowledge work. This requires both highly concentrated individual work and work in teams. Memory and seriation are the key properties of this type of work, involving tasks such as reading comprehension, for example.

Knowledge Worker

All the individuals who are involved with the production and processing of knowledge work are called knowledge workers. They constitute the intellectual capital of knowledge-based organization.

Knowledge-based Enterprise/Organization

According to (Hejduk, 2005) a "knowledge-based enterprise is an organization whose structure is subordinate and guided by developing positive business values, supported by an effective use of knowledge" (p. 8). The main characteristics of these organizations are the following:

- They either provide knowledge-based services or manufacture products whose key components are knowledge-based, e.g. the Tata Consulting Services vs. Mc. Donald fast food restaurants.
- Knowledge workers provide the most essential output among all employed.
- Knowledge-based enterprises place their market value on their intellectual capital.
- They derive their knowledge from various sources that include customer knowledge, competitor knowledge, product knowledge, process knowledge, financial knowledge, and people knowledge (Davies, 2005).

Workspace

Workspace refers to a work-station assigned to a specific individual to work while he or she is in the office. It includes a chair, a table, equipment, supplies, among other items required to complete office tasks by an individual.

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