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The Effects of Cross Cultural Interface Design Orientation on World Wide Web User Performance

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Abstract:
The electronic environment of the World Wide Web evolves daily, increasing the likelihood of international participants and transactions. With this in mind, we investigated several key issues and questions related to the cultural context of Web interface design. We conducted three major studies to get at the issues of the relationship of culture to design on the Web.

In the first study we asked the general question, are there design elements that repeat themselves in different cultures and different genres that we can use to design genre-specific and culture-specific Web sites? To answer this question, we conducted a foraging study in which we inspected dozens of Web sites from various countries. We found that indeed there are a few design elements, we called cultural markers that are both culture specific and genre specific.

In the second study, we designed and conducted a controlled experiment in which we designed culture-specific Web sites using a few of the cultural markers identified in the foraging study, and compared their effects on native users performance and preferences. The results were mixed. We found that for Italian participants, the Italian designs were preferable for navigation markers but not for color. We were not able to show significant differences as a result of varying the markers' cultural values for American participants.

In the third study, we defined culture with a small c referring to an audience with a set of habits and practices based on experience. We used people experienced in two different genres, e-shopping and news sites, on the World Wide Web to investigate preferences and performance as a function of Web cultural experience. We found significant effects for both preference and performance.

The Foraging Study

Introduction:
The evolution of the World Wide Web as a medium for international communication, participation, and transaction serves as both reminder and stimulant when considering interface design for a multi-cultured environment. Although this relatively new medium is touted as "World Wide" and "Global," it remains localized due to design and cultural constraints, which can and will be overcome. Basic tenets of usability including learnability, efficiency, and satisfaction combined with a basic component of HCI, detailed audience analysis, take on a larger meaning when designing for an international market. What becomes clear is that one medium does not equate with one interface. Instead, the interface designs, interactivity, and content reflect a cultural sensitivity and understanding of the targeted audience; indeed, the Global Interface is culturally dimensional and capable of rapid change.

Part I of our research, discussed here, encompasses a large population of sites, categorized by country of origin, language, and genre and generates a list of cultural markers, which may prove to distinguish cultural/genre specific design elements. Creating or retrofitting software for other countries requires attention to technical detail that goes beyond mere translation. For example, how pictorial information is presented and organized for scanning on a display can be related to the script direction of the user's first language. The basic premise behind the research outlined here is simple: No longer can issues of culture and usability remain separate in design for the World Wide Web. Cultural preferences and biases (i.e., colors, text vs. graphics, spatial orientation, among many others) impact what is deemed "user friendly;" thus, usability issues must take on a cultural context. Indeed, the software industry is beginning to recognize the need to design for the international interface (Kano, N. 1995; Nielsen, J. 1996). A clarification of terms contained in here and how we use them to discuss both our goals and our findings is listed below.

Culture: The term "culture" is a complex and problematic one defined differently by various disciplines. We use the word "culture" - somewhat loosely- as a means of distinguishing among the different countries and their respective web-sites. Our use of the term is not intended to be indicative of all the nuances and properties frequently implied by the term, but rather to permit discourse about the features that distinguish one country or region of the world from another in the electronic medium of the Web.

Cultural Marker: Cultural markers are interface design elements and features that are prevalent, and possibly preferred, within a particular cultural group. Such markers signify a cultural affiliation. A cultural marker, such as a national symbol, color, or spatial organization, for example, denotes a conventionalized use of the feature in the web-site, not an anomalous feature that occurs infrequently.

Genre/Knowledge Domain: A knowledge domain refers to the type of information being presented on the Web and describes large categories of sites. News and Media, for example, is a knowledge domain that presents similar types of information, but may vary stylistically, such as a magazine, newspaper, or broadcast.

Culturally Deep vs. Shallow Sites: We define a culturally deep web-site as one that occurs in the native language of its country of origin and links to other native-language sites. A culturally shallow site is one that occurs in a secondary language and links to other secondary language sites.

Project Description:
Cultural usability is a term we use to emphasize the importance of the relationship between culture and usability in WWW design, but it can be expanded to apply to any software designed for international use. When one visits a foreign country, it is rarely enough to have a pocket translation dictionary and the proper currency. Although the dictionary and currency may help in performing simple tasks, purchasing a cheeseburger for example, one is still inundated with cues that mark her location as distinctly different from her native home. This may interfere with performing more complex tasks, asking a police officer for directions to the nearest hospital, for example. Sounds, smells, architecture, geography, flags, mode of dress, signs, customs, language, currency, and many other features contribute to the traveler's awareness of being in an unfamiliar place, which can be exciting when one wants to explore, and frustrating when one needs to accomplish a complex task easily and efficiently. Apply the traveler's analogy to the WWW, and the similarities are striking. Just as physical cities and countries differ and reflect their inhabitants, so do Web sites. Colors, spatial organization, fonts, shapes, icons and metaphors, geography, language, flags, sounds, and motion contribute to the design and content of a Web page, which directly effects the way that a user interacts with the site. Can she find the information she seeks? Can she submit a form or make a request?

Does she find the site easy to use? Aesthetically pleasing? Consider the various meanings associated with color by different cultures. The Color-Culture Chart below illustrates some of the different meanings (Boor & Russo, 1993). When applied to Web design, color may impact the user's expectations about navigation, links, and content, for example, as well as overall satisfaction. For example, an American bank using a web site to promote services for French investors may want to avoid the use of the color green, which some French may associate with criminality. On the other hand, the American bank may want to use green to attract Egyptian and Middle Eastern investors, as green has a positive connotation for them.

Color-Culture Chart

Color	China	Japan	Egypt	France	United States
Red	Happiness	Anger Danger	Death	Aristocracy	Danger Stop
Blue	Heavens Clouds	Villainy	Virtue Faith Truth	Freedom Peace	Masculine
Green	Ming Dynasty Heavens	Future Youth Energy	Fertility Strength	Criminality	Safety Go
Yellow	Birth Wealth Power	Grace Nobility	Happiness Prosperity	Temporary	Cowardice Temporary
White	Death Purity	Death	Joy	Neutrality	Purity

The long term objective of our current research is twofold: First, the study aims to identify and study design standards and conventions that distinguish cultures as manifested in existing Web pages; and second, to understand how cultural influences lead to variations in peoples' behaviors and practices. Once this is understood, the development of what we term cultural usability guidelines may be implemented when considering design for the Web. Specifically, we focused on identifying cultural design cultural markers present in Web sites that have different languages, originate in different countries, and represent different genres. The intent is to explore three main questions: 1.) Are there design elements that are culturally unique and specific? 2.) Are there design elements that are genre specific? 3.) Are there design dominance relationships between culture and genre?

There are two primary motivating forces behind this work, which include studies of situated learning and data from a Cultural Issues Questionnaire designed by the GVU at Georgia Tech. Briefly, we relate psychological studies of situated learning to our work in that environmental and contextual cues effect learning and memory performance in recall and recognition tests (Reisberg, 1997). Cultural markers are a significant part of our environment and we expect our work to demonstrate that the presence and/or absence of cultural markers in international Web sites can effect learning and performance in an electronic environment, as well.

The other motivating force is based on the information provided by international respondents to a Cultural Issues Questionnaire. An analysis of data collected through the 8th GVU (Graphics, Visualization, and Usability Center) WWW User Survey (Cultural Issues Questionnaire) demonstrates that there are indeed cultural preferences and biases which effect user satisfaction and performance. Simply put, people perceive cultural differences as important. Some Middle Eastern and European respondents to the GVU survey indicate that they believe American images make computers harder to learn, while Asian and American respondents

believe American images have no effect on learning. What is more, according to the survey, Asian and Middle Eastern respondents were most likely to know someone who could not use the Internet due to language barriers. Asian respondents suggest that if the web sites are designed for their language and culture, more people would be willing to use the web. What becomes clear is that a Global Interface Design relies cultural usability, as it is capable of capturing the cultural nuances of a targeted audience to enhance usability; thus, the Global Interface may really mean an American Interface, a French Interface, an Israeli Interface, a Chinese Interface. To illustrate and explore the point more fully, Part I of this research identifies cultural markers that differ across cultures and genres. In an effort to go beyond the GVU survey, our research method includes an inspection of several dozen web sites to identify culture and genre design elements. What follows is a detailed description of our method.

Methodology:

The cultural usability Inspection Method grew from discussions about usability and how such a concept might change given different cultural backgrounds and international users. We have identified numerous cultural markers that are reflected in Web sites around the world with some being far more prevalent in one country or region than in others. Cultural markers, customs, habits, and preferences are embedded in international WWW sites, both deliberately and unintentionally. Similarly, specific genres, such as *Government* (including official government home pages, military, & political web sites) *Travel*, and *News* (in a few instances, the American CNN site for example), exploit cultural icons and cues. One relationship to be examined in more detail concerns the thematic use of flags and the symbols and colors found on a national flag, which are frequently found in WWW sites.

Stage 1 Foraging: The foraging stage involves categorizing hundreds of Web sites by country, genre, and language to create a large base of Web sites to be further examined. During the initial foraging stage, sites representing many countries were collected regardless of language, for example Chinese sites in English were included in the data. In order to narrow the scope of our research, we are currently examining sites that are created in their country's native language, although the site may offer other language options. In a future iteration of the project, all sites will be examined so that comparisons can be made between native and non-native language sites. Table I below shows the countries, genres, and languages examined thus far, and to be included here, each site must be in its country's native language. We hypothesize that sites in the country of origin's native language will depict cultural cultural markers more specific to that particular culture, whereas a site in a non-native language will be more influenced by outside cultural markers.

Table I - Foraging Results

Countries	Languages	Genres

Australia Andorra Austria Italy France China Japan Iran Israel Lebanon Saudi Arabia South Africa Canada United States Mexico Brazil Colombia Venezuela	English Catalan German Italian French Chinese Japanese Afrikaans Persian Arabic Hebrew Spanish Portuguese	Government News & Media Business Education Travel Society & Culture Health Science Art & Humanities
Total: 18	**Total:** 13	**Total:** 9

Table I represents 168 native-language sites, reiterating the diversity of cultures to be found on the WWW. Although more usability and web design guidelines are being established in the relevant literature, such guidelines still remain separate from issues of cultural context. In other words, design elements that are appropriate for one culture may not be appropriate for another.

Stage 2 Cultural marker Identification: During cultural marker identification, a detailed inspection of each site occurs. Cultural markers are cross listed by country and genre. Cultural markers are design elements found in web pages, and such elements become cultural markers when they prove to be highly prevalent within a particular cultural group and less prevalent or absent in other groups. Table II shows a list of cultural markers identified for this project.

Table II - Cultural markers

HTML Specific	Icons/Metaphors	Colors	Specific Colors	Grouping

# of lines # of centers # of images # of links # of internal links # of external links link color visited link color horizontal bars tables bold italics underlines frames audio video background image background color text color	international local clocks newspapers books pages homes stamps envelopes musical notes paperclips thumbtacks other	red blue green purple pink black yellow gold teal white multiple	flag graphics pictures borders background	symmetrical asymmetrical proximity alignment boundary enclosure connection
Flag	Language	Geography	Orientation	Sound
native foreign multiple	native foreign multiple	maps outline globe	centered left-right right-left	music voice
Font	Links	Regional	Shapes	Architecture
cursive italics bold size shading	color embedded stand alone internal external	foliage animals landscape water desert	squares circles triangles rectangles lines arrows	state building house church office cityscape

The lists of cultural markers in Table II are not intended to be exhaustive lists. The list must be somewhat flexible to account for changes in web sites and technology.

Stage 3 Pattern Identification: Cultural markers are checked for emergent patterns within countries and genres and across regions, which can then be analyzed for depth and WWW design implications. A "culturally deep" site is one that is in the native language and links to other native language sites. A "culturally shallow" site is one that is in a non-native language and/or primarily links to other non-native language sites. To aid in the identification of patterns and cultural marker aggregate analysis an engine has been implemented, which checks for cultural markers that can be specified in HTML files; all sites, however, are also inspected by hand. Patterns are emerging which suggest that there are definitely design cultural markers that are culturally determined and genre specific. Tables III - V illustrate samples of high frequency occurrences of cultural markers organized by genre and country. Each table represents

only a sample of specific data collected during the foraging and cultural marker identification stages. Tables VI - VII show how this data can be taken and generalized into cultural markers that have a high frequency rating for a given culture and/or genre.

Table III - Specified Sample of High Frequency of Flag Cultural Marker by Genre

Country	Flags	Genre	URL
Andorra	Andorra, Spain, France, Germany, United Kingdom	Government	http://www.andorra.ad/consell/index.html
Lebanon	Lebanon	Government	htttp://www.lp.gov.lb/index.html
Brazil	Brazil	Government	http://www.mare.gov.br
Mexico	Mexico, Trinidad, Canada Nicaragua,	Government	http://www.presidencia.gob.mx

Table IV - Specified Sample of High Frequency of Right -to - Left Orientation by Cultural Marker

Country	Cultural Marker	Genre	URL
Egypt	Right-Left	News & Media	http://www.elshaab.com
Israel	Right-Left	Government	http://192.115.74.50/shilton/heb/open.htm
Israel	Right-Left	News & Media	http://www6.snunit.k12.il/news
Lebanon	Right-Left	News & Media	http://www.arabia.com/Addustour

Table V - Specified Sample of High Frequency of Prominent Multiple Colors Organized by Country

Country	Cultural Marker	Genre	URL
Brazil	Multiple Colors	News & Media	http://www.dgabc.com.br
Brazil	Multiple Colors	Travel	http://www.nautaplace.com.br
Brazil	Multiple Colors	Travel	http://www.embratur.gov.br
Brazil	Multiple Colors	Government	http://www.senado.gov.br

Table VI - Generalized Sample of High Frequency Cultural Markers by Country

Israel	Lebanon	Japan	Brazil	France
grouping - alignment	national flag	architecture: cityscapes	national flag	orientation: centered
orientation: right-to-left	icon: cedar tree; found in flag	grouping: enclosure	geographical references	colors: red, blue, white
borders	light graphics; more text	frames	heavy graphics	motion
color: green	color: green			

Table VII - Generalized Sample of High Frequency Cultural Markers by Genre

Government	News & Media	Business	Travel
national flag	Bold font for headlines	orientation: center	heavy graphics
colors of national flag throughout site	English words: news, email, web, info	bullet points	geography: maps, out-line of region

human picture; head of state	icons: sun/clouds for weather	logos	icons: skis; mountains; hiking gear; water

Results and Discussion:

Overall, Tables III-V demonstrate that from the foraging and cultural marker identification stages of this work, patterns have emerged that reflect cultural practices and preferences in Web sites, influenced both by country of origin and genre. Table III shows that a commonly used cultural icon, the flag, is exploited in government sites. The flag serves as a symbol of immediate national, even global, recognition, helping the user to quickly identify the locale and origin of the site, which is particularly helpful when the site is in a language foreign to the user. The flag is also used to denote alternative language choices, which impacts usability in that the user may identify and choose an alternate language much more quickly and efficiently, as opposed to when the choices are textual.

Table IV suggests that some cultural markers may be particular to a given region, especially when the region shares similarities in language. Middle Eastern sites in Arabic and Hebrew have a high frequency of orienting text, links, and graphics from right-to-left, as opposed to centering or left-to-right. The spatial orientation of presented information has immediate implications for usability. While the left side of a web site might be the first focus of attention for an American, the right side would be the initial focus for a Middle Easterner; thus, important information should be displayed accordingly. Manipulate the orientation of the display and the user's comfort zone, the way she is accustomed to viewing information, is also changed.

Table V shows that some cultural markers may be particular to a given country and employed across genres. Brazil's multi-colored government sites differ from the majority of government sites in this study, which usually employ national colors throughout the site. Brazil has many sites that are particularly colorful with no one color being overly dominant. This is indicative of a cultural preference for many colors.

Tables VI and VII demonstrate that cultural markers can be cultural and/or genre specific and can then be used to implement cultural usability guidelines. It is also important to note the interplay between culture and genre. Lebanon, for example, has the cultural markers light graphics and more text based. The travel genre has a high frequency of heavy graphics, but the cultural marker dominates a travel site in Lebanon; thus Lebanese travel sites are still more text oriented rather than graphically oriented.

Cultural usability, the merging of culture and usability, has implications for Web and software design. Usability must be re-defined in terms of a cultural context, as what is "user friendly" for one culture can be vastly different for another culture. The intent is not to develop a generic Global Interface to be accepted by all cultures participating in this medium, but to suggest that cultural markers can be manipulated to facilitate international interactions.

In the final stages of pattern identification in which region, country, genre, and language weigh all cultural markers a set of guidelines can be established. Such guidelines will offer web and software designers specific information about the region and country for which they are developing an interface.

The Effects of Cultural Markers Studies

The Italian Study

Introduction:

In this second study, we designed and conducted controlled experiments in which we compared the effects on native users' performance and preferences of the presence or absence of cultural markers identified in the foraging study. We designed culture-specific Web sites using a few of the cultural markers identified in the foraging study. The setting for the experiment is a hotel Web site where the subjects are asked to perform one of two tasks. One is to reserve a train ticket to the Holy Cross Church, located in the Southern region; the other is to make a reservation for an 8pm dancing show at the Metasol restaurant, which specializes in local cuisine. Each site had three different cultural versions as identified by the foraged markers. The cultural markers we varied were color, page border images, and navigational icons.
We ran the first set of subjects in Bari, Italy. Using WebVip, we captured time and click data. We also ran an on-line rating scale and questionnaire. All the data was captured and transmitted through the Internet. To help run the experiment, a colleague at the University of Bari administered the experiment locally. The data was tabulated and provided in the write-up below.

Methodology:

The following instructions were given to the local experimenter in Bari:

Please insure that each subject has completed the release form and record their user ID on the volunteer list so that you have a record of which experiments have been completed.

To begin the test, point the browser to http://abadre.cc.gatech.edu and select the appropriate test site.

At this stage, the user will be prompted to input their User ID. Please ensure that the user ID is typed in correctly and then click on "Begin to Instrument the Site.

Present the subject with the TASK LIST for the site, and make sure they understand the goal. When the user is familiar with the task, click on "process now."

The user should now be presented with the web-site. When they are ready to begin, have them click the "START" button at the top of the page. Allow the user to navigate the site and try to reach the goal specified in the task description.

When the user is convinced they have completed the task, have them click the "STOP" button on the last web page they visit. Then have them click the "COMPLETE" button in the extra browser window.

A short survey will be presented to them. Again, please make sure the user enters the correct USER ID when presented with the survey.

At this point, the experimental run is completed and testing can begin for another subject.

Design:

The subjects are all Italian students at the University of Bari in Italy. They are divided into two groups, performing tasks on two different sites. One group is assigned the Italian site while the other was assigned the US site. The major differences between the two sites are the color coordination, the graphics, background image, and navigation icons. For example, the Italian site features more dynamic color and Italian style architectural pictures; the US site contains the national flag and the patriotic color of blue, red, and white. Also, navigation icons have pictures that are culturally meaningful. All other content is exactly the same. The subjects can to take as long as they need to complete one of the two tasks. We collected time, click, and preference data.

Results:

What follows are the results of this first study. The time data was not reliable because of server unpredictability at various times and days of the experiment. On the other hand when comparing the number of clicks used to perform the tasks, the results yield a significant difference in favor of the Italian designed site. In fact, this seems to be reinforced by the subjects' preference for the Italian navigation (icons) over the US site's navigation design as can be seen in table I. While the colors are definitely country colors, as we found in the foraging study, our suspicion is that actual design implementation was not optimal and therefore yielded no significant difference in preference.

Subjects working with the Italian site:

	ID	*Time*	*Finishing Location*	*Number of Clicks*	*IP Address*	*Notes*
	g1001	10:14	a8d.htm	28	193.204.187.253	
	g1003	6:25	a8d.htm	21	193.204.187.253	
	g1005	8:34	a8d.htm	32	193.204.187.253	
	g1006	8:32	a8d.htm	42	193.204.187.253	
Finished	g3001	3:18	d7a.htm	13	193.204.187.253	
	g3002	2:40	d7a.htm	17	193.204.187.253	
	g3003	5:14	d7a.htm	12	193.204.187.253	
	g3004	3:02	d7a.htm	12	193.204.187.253	
	g3005	3:07	d7a.htm	10	193.204.187.253	
	g3006	2:38	d7a.htm	12	193.204.187.253	
Unfinished	g1002	3:10	a8c.htm	14	193.204.187.253	
	g1004	10:00	hotel.htm	30	193.204.187.253	many attempts

Subjects working with the U.S. Site:

	ID	*Time*	*Finishing Location*	*Number of Clicks*	*IP Address*	*Notes*
	g2001	5:31	d7a.htm	21	193.204.187.253	
	g2002	5:25	a8d.htm	22	193.204.187.253	
	g2003	11:43	a8d.htm	38	193.204.187.253	
	g2005	9:15	a8d.htm	36	193.204.187.253	
Finished	g2006	4:00	a8d.htm	20	193.204.187.253	
	g4001	2:26	d7a.htm	9	193.204.187.253	
	g4002	10:58	d7a.htm	30	193.204.187.253	3 separate attempts; eventually did it
	g4004	9:29	d7a.htm	31	193.204.187.253	
	g4005	2:40	d7a.htm	9	193.204.187.253	
	g4006	6:50	d7a.htm	26	193.204.187.253	
Unfinished	g4003	3:00	o1.htm	26	193.204.187.253	Got to d7a.htm; but didn't follow procedures to start & stop
	g2004		hotel.htm	47	193.204.187.253	Got to d7a and a8d; but didn't follow procedures to start & stop

Subjects Surveys

The following are the analysis tables from the surveys taken by each subject in this experiment. They are generally divided and compared between the subjects who worked with the Italian site and those with the U.S. site. There are 12 subjects working with each site; however, one of the people working with the Italian site didn't complete a survey. Therefore, the percentages in the following tables are out of 12 subjects for the U.S. site and out of 11 subjects for the Italian site. They may not add up to be exactly 100%, since the percentages are rounded up to the smallest whole number.

Table 1 Shows the opinion of the subjects on whether the site is easy to navigate, whether the color of the site is appealing, and whether the site design is appealing.

Table 1

	Site Easy To Navigate		Color Appealing		Site Design Appealing	
	Italian Site	U.S. Site	Italian Site	U.S. Site	Italian Site	U.S. Site
Strongly Agree					9%	8%
Agree	82%	58%	54%	33%	27%	25%
Neither	9%	8%	27%	58%	36%	42%
Disagree	9%	33%	9%	8%	27%	25%
Strongly Disagree			9%			

Table 2 Shows whether the subjects felt comfortable with Task 1 or Task 2, depending on which they performed. The percentage for all Italian site subjects (with Task 1 and Task 2) should add up to be 100%, and likewise for all the U.S. subjects.

Table 2

	Feel Comfortable with Task 1		Feel Comfortable with Task 2	
	Italian Site	U.S. Site	Italian Site	U.S. Site
Strongly Agree				8%
Agree	36%	8%	36%	33%
Neither		8%	18%	8%
Disagree		17%		8%
Strongly Disagree	9%			8%

Table 3 Shows where the subjects think the hotel is located, and which page design do they prefer.

Table 3

Perceived Hotel Location		Page Preference			
Italian Site Users	U.S. Site Users	Italian Site Users		U.S. Site Users	
Spain		Italian Design	U.S. Design	Italian Design	U.S. Design
100%	100%	91%	9%	75%	25%

Table 4 Shows the gender and age of the subjects of these two sites

Table 4

	Gender		Age		
	Male	Female	21-25	26-30	>30
Italian Site	73%	27%	27%	64%	9%
U.S Site	75%	25%	58%	42%	

Table 5 shows the subjects' colorblindness.

Table 5

Colorblindness		
Italian Site	U.S Site	
No	No	Yes
100%	92%	8%

Table 6 Shows whether the subjects are left-handed or right-handed.

Table 6

Handedness		
Italian Site	U.S Site	
Right	Right	Left
100%	92%	8%

Table 7 shows the native language of the subjects.

Table 7

Native Language		
	Italian Site	U.S Site
Italian	100%	100%

Table 8 shows the subjects' English speaking and reading ability on a scale of 1 to 5.

Table 8

	English Speaking		English Reading	
	Italian Site	U.S. Site	Italian Site	U.S. Site
1	18%	9%		
2	27%	50%	36%	
3	27%	25%	9%	42%
4	27%	17%	45%	50%
5			9%	8%

Table 9 shows the number of years the subjects had exposure to English on a regular basis.

Table 9

	Year of English	
	Italian Site	U.S Site
<1 year	9%	
2-4	9%	8%
4-6	45%	50%
6-10	36%	25%
>10 years		17%

Table 10 shows the length of time the subjects have been using a PC.

Table 10

Time Using PC		
	Italian Site	U.S Site
1-2 Years	9%	
> 2 Years	91%	100%

Table 11 shows the frequency of mouse usage among the subjects.

Table 11

Mouse Usage	
Italian Site	U.S Site
Very Frequently	
100%	100%

Table 12 shows the frequency of WWW usage among the subjects.

Table 12

	WWW Usage	
	Italian Site	U.S. Site
Very Frequently	55%	35%
Frequently	36%	50%
Seldom	9%	17%

Table 13 shows the undergraduate major of all the subjects.

Table 13

Undergrad Major		
	Italian Site	U.S Site
Science	18%	8%
Computing	82%	92%

The US study of Comparing Italian, Greek, and US designs:

Introduction

This experiment is designed to evaluate how Web interfaces with different cultural markers affect the navigation and usability of a web site by a sample of US subjects. The setting of the experiment is as in the Italian experiment, a mock-up of a hotel site where the subjects are asked to perform one of two tasks. The first task is to reserve a train ticket to the "Holy Cross Church," located in the Southern region; the other is to make a reservation for an 8pm dancing show at the Metasol restaurant, which specializes in local cuisine. Please see *Appendix A* for the specific instructions on how to set up and run the experiment properly.

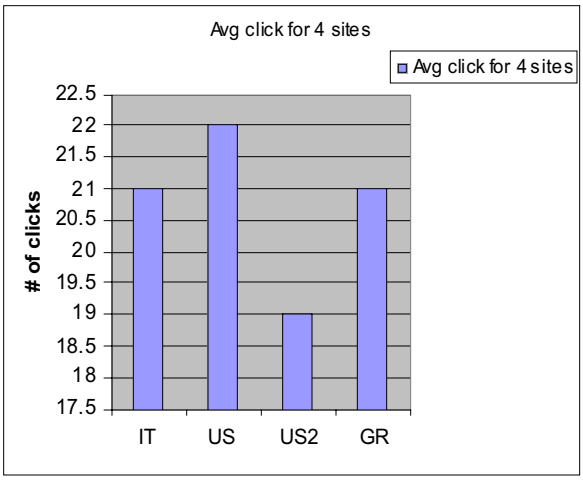
The subjects are divided into four groups, performing tasks on four different sites. The first group was assigned the Italian site; the second was assigned with the US1 site; the third group was assigned the US2 site; and the last group was assigned the Greek site. The US1 site is the original US site the Italian subjects were experimented on, along with the Italian site. After completing the experiment in Italy, it was brought to the attention of the team that the background of that US site is inconsistent with the Italian and Greek sites, which were both examples of local architecture. Therefore, a different US site was constructed, and tests on both sites are now being used for evaluation purposes. The major differences between the four sites are the color coordination, the graphics, and background images, and the navigation icons. For example, the Italian site features more dynamic color and Italian style architectural pictures; the US2 site contains the American buildings and the patriotic color of blue, red, and white. All other aspects, such as the texts and links, are exactly the same. The subjects are to take as long as they need to complete one of the two tasks. The results are then saved and analyzed. Please refer to *Appendix B* for the result data tabulations.

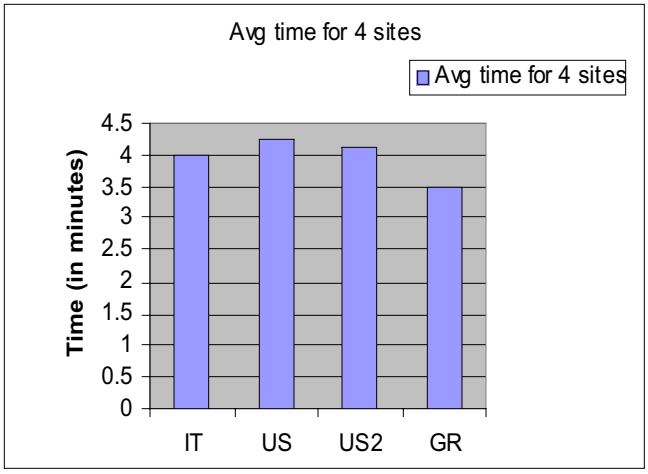
The methodology used is the same as described above for the Italian study.

Analysis:

First, here are some of the averages we obtained from the experiment:

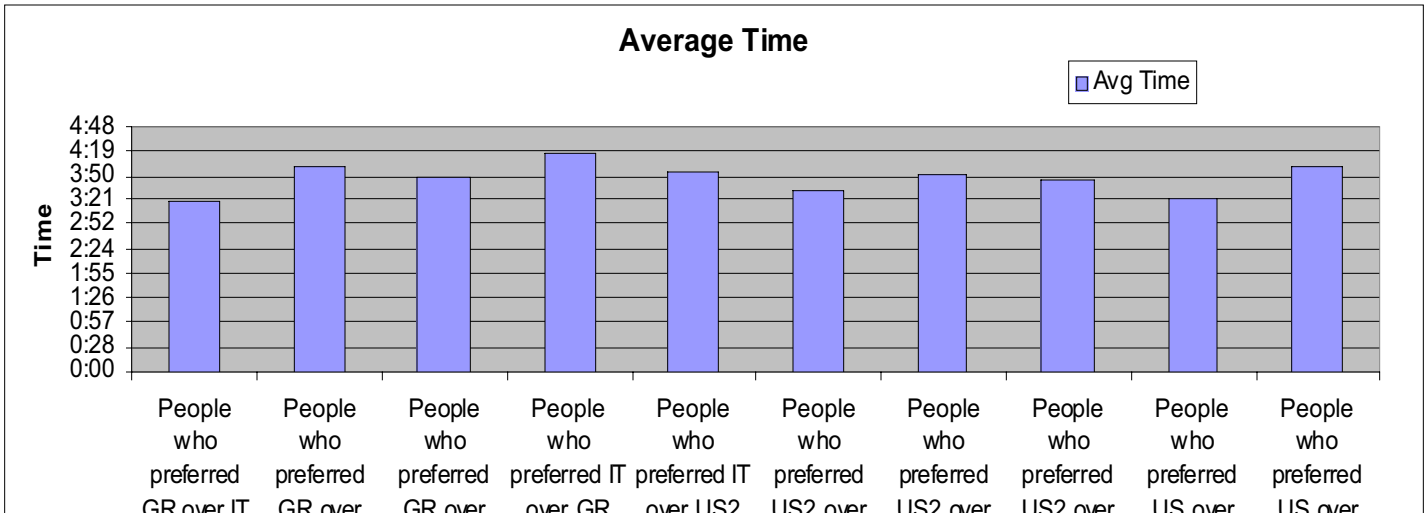
	Avg time for 4 sites		Avg click for 4 sites
IT	4	IT	21
US	4.25	US	22
US2	4.1	US2	19
GR	3.5	GR	21





From a glance, it seems that the users who used the USA2 site had a significantly less number of clicks than the others. However, when examining the raw data, we found out that there are 2 people who had extreme data using the USA2 site. One had 100 clicks, and the other had 4. None of these two people had successfully completed their tasks; therefore, we did not average these data into the calculation. The average time chart seems very reasonable across all the users for the four sites.

Next, we worked on the user surveys, which are shown as *Appendix C*. On the survey, each user filled in their preferences as to which site design they prefer over another one. They did all of the combination of comparisons, except the comparison between users for the Italy site and USA



site.

From this graph in appendix C, it looks as though the people who preferred the USA or USA2 sites performed better than the rest. This result was a little baffling at first, since there are a lot more people preferring the Italian and Greek site design than the two different USA designs. By further analyzing the results in Appendix C, it seems that the subjects might prefer the looks and colors of an exotic cultural design, though they perform better under their own cultural design regardless of what they prefer visually.

What follows is a tabulation of the numbers of clicks by all users for the four sites: This shows that performance on the US sites by US subjects is not significantly different than for Greek or Italian sites.

NUMBER OF CLICKS

ITALY	US 1	US 2	GREECE
20	20	25	14
14	33	60	41
25	18	16	26
16	10	15	16
24	15	22	10
20	26	14	16
12	11	4	15
10	14	100	14
14	18	16	33
17	26	25	11
47	18	13	11
29	25	9	18
17	53	9	13
23	33	9	17
10	10	5	14
35	12	21	13

Then these two tables are obtained:

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
ITALY	16	333	20.8125	96.29583333
US 1	16	342	21.375	127.45
US 2	16	363	22.6875	595.0291667
GREECE	16	282	17.625	72.91666667

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	221.625	3	73.875	0.331392578	0.802660196	2.75807821
Within Groups	13375.375	60	222.9229167			
Total	13597	63				

The variance for this table is rather high, because the largest value is 100 and smallest is 4. That causes these values to deviate from the mean.

Here is the tabulation for all the time spent performing the tasks by all users for the four sites:

TIME TO COMPLETE TASK

ITALY	US 1	US 2	GREECE
2:31	3:30	3:13	2:49
2:30	6:55	8:29	10:03
6:34	2:00	2:25	4:27
3:22	1:35	4:00	2:26
7:28	4:35	4:49	0:53
4:39	5:06	1:46	3:30
1:21	2:13	0:29	4:01
1:55	2:53	19:20	2:50
3:36	4:12	2:00	5:30
3:12	6:15	5:00	4:05
9:07	2:51	2:05	2:25
4:39	3:18	1:21	3:17
1:50	8:26	0:58	2:28
4:09	5:41	2:15	3:28
1:51	1:17	1:35	2:03
5:01	5:50	3:03	2:08

Then these two tables are obtained:

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
ITALY	16	2.656	0.166015625	0.008450712
US 1	16	2.776	0.173480903	0.007441115
US 2	16	2.617	0.163541667	0.035991448
GREECE	16	2.349	0.146831597	0.007356351

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.0060723	3	0.002024104	0.13667231	0.937752127	2.75807821
Within Groups	0.8885944	60	0.014809906			
Total	0.8946667	63				

The variance for this table is very small, due to the fact that all numbers are mostly under the bell curve and therefore close to the mean value.

Appendix A:
Experiment Setup and Usage Instructions

Following are instructions for running the tests:
Please insure that each subject has completed the release form and record their user ID on the volunteer list so that you have a record of which experiments have been completed.

To begin the test, point the browser to http://abadre.cc.gatech.edu and select the appropriate test site.

At this stage, the user will be prompted to input their User ID. Please ensure that the user ID is typed in correctly and then click on "Begin to Instrument the Site.

Present the subject with the TASK LIST for the site, and make sure they understand the goal. When the user is familiar with the task, click on "process now."

The user should now be presented with the web-site. When they are ready to begin, have them click the "START" button at the top of the page. Allow the user to navigate the site and try to reach the goal specified in the task description.

When the user is convinced they have completed the task, have them click the "STOP" button on the last web page they visit. Then have them click the "COMPLETE" button in the extra browser window.

The user has now finished the task. A short survey will be presented to them. Again, please make sure the user enters the correct USER ID when presented with the survey.

That's it. The user has finished, and testing can begin for another subject.
It is very important that the user must hit the "Start" button at the beginning of the task, and must hit the "Stop" button and then the COMPLETE button in the small window when the task is completed. If the user does not hit the "COMPLETE" button, the server will assume the experiment is running forever. For this reason, it is critical that the users not close a browser window before the experiment is done. If something unforeseen happens, and a user does not finish the experiment properly, that machine may become unusable for the experiment and you will have to switch to another machine.

Appendix B:
Experiment Result Tabulations

Subjects working with the Italian site:

	ID	*Time*	*Avg Time*	*Finishing Location*	*Number of Clicks*	*Avg # of Clicks*	*IP Address*	*Notes*
Task 1	I1001	2:31	4:00	a8d.htm	20	19	130.207.11.79	Finished
	I1002	2:30		a8d.htm	14		130.207.15.92	Finished
	I1003	6:34		o1.htm	25		130.207.11.79	Unfinished
	I1004	3:22		a8d.htm	16		130.207.119.204	Finished
	I1005	7:28		a8d.htm	24		130.207.114.104	Finished
	I1006	4:39		a8d.htm	20		130.207.119.204	Finished
	I1007	1:21		a8d.htm	12		130.207.15.92	Finished
	I1008	1:55		a8d.htm	10		130.207.119.204	Finished
Task 2	I5001	3:36	4:01	hotel.htm	14	24	130.207.119.51	Unfinished (I1005)
	I5002	3:12		d7a.htm	17		130.207.15.92	Finished
	I5003	9:07		d7a.htm	47		130.207.119.206	Finished
	I5004	4:39		D7a.htm	29		130.207.114.102	Finished
	I5005	1:50		D7a.htm	17		130.207.119.204	Finished
	I5006	4:09		D7a.htm	23		130.207.119.204	Finished
	I5007	1:51		d6a.htm	10		130.207.15.92	Unfinished (no start or stop)
	I5008	5:01		D7a.htm	35		130.207.119.204	Finished
	I1009						130.207.119.204	

Subjects working with the U.S. 1 Site:

	ID	*Time*	*Avg Time*	*Finishing Location*	*# of Clicks*	*Avg # of Clicks*	*IP Address*	*Notes*
Task 1	U2001	3:30	3:52	a8d.htm	20	19	130.207.11.79	Finished
	U2002	6:55		a8d.htm	33		130.207.15.92	Finished
	U2003	2:00		a8d.htm	18		130.207.11.80	Finished
	U2004	1:35		a8d.htm	10		130.207.119.209	Finished
	U2005	4:35		hotel.htm	15		130.207.119.209	Unfinished
	U2006	5:06		a8d.htm	26		130.207.119.209	Finished
	U2007	2:13		a8d.htm	11		130.207.15.91	Finished
	U2008	2:53		a8d.htm	14		130.207.15.91	Finished
Task 2	U6001	4:12	4:43	d7a.htm	18	25	130.207.15.92	Finished
	U6002	6:15		d7a.htm	26		130.207.15.92	Finished
	U6003	2:51		d7a.htm	18		130.207.119.206	Finished
	U6004	3:18		d7a.htm	25		130.207.114.104	Finished
	U6005	8:26		c1.htm	53		130.207.119.209	Unfinished
	U6006	5:41		d7a.htm	33		130.207.119.209	Finished
	U6007	1:17		d7a.htm	10		130.207.119.209	Finished
	U6008	5:50		d7a.htm	12		130.207.119.209	Finished
	U2009						130.207.119.209	
	U2004	4:05		a8d.htm	18		130.207.119.51	

Subjects working with the U.S. 2 Site:

	ID	*Time*	*Avg Time*	*Finishing Location*	*Number of Clicks*	*Avg # of Click*	*IP Address*	*Notes*
Task 1	2U3001	3:13	5:56	a8d.htm	25	23	130.207.15.92	Finished
	2U3002	8:29		a8d.htm	60		130.207.15.92	Finished
	2U3003	2:25		a8d.htm	16		130.207.11.80	Finished
	2U3004	4:00		a8d.htm	15		130.207.119.204	Finished 2u2004
	2U3005	4:49		a8d.htm	22		130.207.119.204	Finished
	2U3006	1:46		a8d.htm	14		130.207.119.204	Finished
	2U3007	0:29		c1.htm	4		130.207.119.51	10/22 1:53
	2U3008	19:20		a8d.htm	*100*		130.207.119.204	Finished
Task 2	2U7001	2:00	2:17	d2c.htm	16	14	130.207.15.90	Unfinished
	2U7002	5:00		d7a.htm	25		130.207.119.209	Unfinished U27002
	2U7003	2:05		d7a.htm	13		130.207.119.51	Finished
	2U7004	1:21		d7a.htm	9		130.207.114.102	Finished
	2U7005	0:58		d7a.htm	9		130.207.119.204	Finished
	2U7006	2:15		d7a.htm	9		130.207.119.51	Finished
	2U7007	1:35		c1.htm	5		130.207.119.204	Unfinished
	2U7008	3:03		d7a.htm	21		130.207.119.204	Finished
	2U3007			Crash Crash			130.207.15.90 130.207.15.91	
	2U3006			No finish; crashed			130.207.119.209	
	2U3009						130.207.119.204	

Subjects working with the Greek Site:

	ID	*Time*	*Avg Time*	*Finishing Location*	*Number of Clicks*	*Avg # of Clicks*	*IP Address*	*Notes*
	G4001	2:49		a8d.htm	14		130.207.15.92	Finished
	G4002	10:03		a8d.htm	41		130.207.15.92	Finished
	G4003	4:27		hotel.htm	26		130.207.11.80	Unfinished 64003
Task 1	G4004	2:26	3:50	a8d.htm	16	25	130.207.119.204	Finished G2004
	G4005	0:53		a8d.htm	10		130.207.119.51	Finished
	G4006	3:30		a7d.htm	16		130.207.119.51	Unfinished
	G4007	4:01		o1.htm	15		130.207.15.91	Unfinished
	G4008	2:50		a8d.htm	14		130.207.15.91	Finished
	G8001	5:30		d7a.htm	33		130.207.15.90	Finished
	G8002	4:05		d7a.htm	11		130.207.119.209	Finished
	G8003	2:25		d7a.htm	11		130.207.119.51	Finished
Task 2	G8004	3:17	3:18	d7a.htm	18	17	130.207.119.209	Finished
	G8005	2:28		d7a.htm	13		130.207.119.51	Finished
	G8006	3:28		d7a.htm	17		130.207.15.92	Finished
	G8007	2:03		d7a.htm	14		130.207.15.92	Finished
	G8008	2:08		d7a.htm	13		130.207.15.92	Finished
	G8004		crash				130.207.119.204	
	G4009						130.207.119.51	
	G4005		Crash	a4d.htm			130.207.119.209	

Appendix C:
Subject Surveys

The following are the analysis tables from the surveys taken by each subject in this experiment. They are generally divided and compared among the subjects who worked with the Italian site, with the original U.S. site, with the improved U.S. site, and those who worked with the Greek site. There are 16 subjects working with each site. Therefore, the percentages in the following tables are out of 16 subjects for all sites.

Table 1

Site Easy To Navigate				
	Italian Site	US Site	US2 Site	Greek Site
Strongly Agree	12.5	18.75	37.5	31.25
Agree	31.25	43.75	18.75	31.25
Neither	43.75	12.5	31.25	0
Disagree	12.5	25	6.25	37.5
Strongly Disagree	0	0	6.25	0

Table 2

Site Design Appealing				
	Italian Site	US1 Site	US2 Site	Greek Site
Strongly Agree	12.5	0	12.5	31.25
Agree	62.5	62.5	56.25	31.25
Neither	25	25	25	0
Disagree	0	12.5	6.25	37.5
Strongly Disagree	0	0	0	0

Table 3

Color Appealing				
	Italian Site	US1 Site	US2 Site	Greek Site
Strongly Agree	25	0	18.75	43.75
Agree	43.75	37.5	37.5	43.75
Neither	12.5	31.25	18.75	12.5
Disagree	18.75	31.25	12.5	0
Strongly Disagree	0	0	12.5	0

Table 4

Feel Comfortable with Task 1				
	Italian Site	US1 Site	US2 Site	Greek Site
Strongly Agree	12.5	0	25	
Agree	75	63.5	0	
Neither	12.5	12.5	12.5	
Disagree	0	12.5	62.5	
Strongly Disagree	0	0	0	

Table 5

Feel Comfortable with Task 2				
	Italian Site	US1 Site	US2 Site	Greek Site
Strongly Agree	25	25	25	
Agree	37.5	37.5	62.5	
Neither	25	12.5	0	
Disagree	12.5	25	0	
Strongly Disagree	0	0	12.5	

Table 6

Perceived Hotel Location				
	Italian Site Users	US1 Site Users	US2 Site Users	Greek Site Users
Greece	18.75	12.5	12.5	50
Spain	75	87.5	87.5	37.5
Thailand	6.25	0	0	12.5

Table 7a

Page Preference (By: Italy site users)									
IT vs. USA2		GR vs. USA		GR vs. USA2		GR vs. IT		USA vs. USA2	
Italy	USA2	Greece	USA	Greece	USA 2	Greece	Italy	USA	USA2
75	25	81.25	18.75	87.5	12.5	25	75	50	50

Table 7b

Page Preference (By: USA site users)				
IT vs. USA2	GR vs. USA	GR vs. USA2	GR vs. IT	USA vs. USA2

Italy	USA2	Greece	USA	Greece	USA 2	Greece	Italy	USA	USA2
80	20	71.5	28.5	75	25	43.75	56.25	68.75	31.25

Table 7c

Page Preference (By: USA2 site users)									
IT vs. USA2		GR vs. USA		GR vs. USA2		GR vs. IT		USA vs. USA2	
Italy	USA 2	Greece	USA	Greece	USA 2	Greece	Italy	USA	USA2
66.7	33.3	80	20	68.75	31.25	56.25	43.75	31.25	68.75

Table 7d

Page Preference (By: Greece site users)									
IT vs. USA2		GR vs. USA		GR vs. USA2		GR vs. IT		USA vs. USA2	
Italy	USA 2	Greece	USA	Greece	USA 2	Greece	Italy	USA	USA2
87.5	12.5	81.25	18.75	100	0	43.75	56.25	56.25	43.75

Table 8

	Gender		Age		
	Male	Female	<20	21-25	26-30
Italian Site	37.5	62.5	93.75	6.25	0
US1Site	43.75	56.25	68.75	31.25	0
US2Site	62.5	37.5	81.25	18.75	0
Greek Site	62.5	37.5	68.75	31.25	0

Table 9

Colorblindness			
Italian Site	US1 Site	US2 Site	Greek Site
No	No	No	No
100	100	100	100

Table 10

Handedness							
Italian Site		US1 Site		US2 Site		Greek Site	
Right	Left	Right	Left	Right	Left	Right	Left
100	0	100	0	87.5	12.5	81.25	18.75

Table 11

Native Language				
	Italian Site	US1 Site	US2 Site	Greek Site
English	100	100	100	100

Table 12

English Speaking				
	Italian Site	US1 Site	US2 Site	Greek Site
1	0	0	0	0
2	0	0	0	0
3	0	0	0	6.25
4	0	6.25	0	31.25
5	100	93.75	100	62.5

Table 13

English Reading				
	Italian Site	US1 Site	US2 Site	Greek Site
1	0	0	0	0
2	0	0	0	0
3	0	0	0	6.25
4	0	18.75	0	31.25
5	100	81.25	100	62.5

Table 14

Year of English				
	Italian Site	US1 Site	US2 Site	Greek Site
<1 year	0	0	0	0
2-4	0	0	0	6.25
4-6	0	0	0	0
6-10	12.5	6.25	0	0
>10 years	87.5	93.75	100	93.75

Table 15

Time Using PC				
	Italian Site	US1 Site	US2 Site	Greek Site
1-2 Years		6.25	6.25	12.5

> 2 Years	100	93.75	93.75	87.5

Table 16

Mouse Usage				
	Italian Site	US1 Site	US2 Site	Greek Site
Very Frequently	100	93.75	100	100
Frequently	0	6.25	0	0

Table 17

WWW Usage				
	Italian Site	US1 Site	US2 Site	Greek Site
Very Frequently	93.75	87.5	81.25	87.5
Frequently	6.25	12.5	18.75	12.5
Seldom	0	0	0	0

Table 18

Undergrad Major				
	Italian Site	US1 Site	US2 Site	Greek Site
Science	12.5	12.5	12.5	6.25
Engineering	56.25	56.25	56.25	68.75
Business	0	18.75	6.25	6.25
Other	6.25	6.25	0	0
Computing	25	6.25	25	18.75

Table Reference

Table 1 Shows the opinion of the subjects on whether the site is easy to navigate. Seems like most of the people from each site agreed with it (Greece site users have a little more than 1/3 disagreed).
Table 2 Shows whether the color of the site is appealing to the users. While most users from each site agreed, the Greece site has a little more than 1/3 users disagreeing).
Table 3 Shows what the subjects think about regarding if the site design is appealing. Majority of users from Italy, USA2, and Greek site concentrated on "Strongly agree", "Agree", and "Neither". Users from the USA site, however, split pretty evenly between "Agree", "Neither", and "Disagree".
Table 4 Shows the whether the subjects felt comfortable with Task 1, depending on which they performed. The percentages for subjects are out of 8 instead of 16, as half of the subjects were given this task to work with.
Table 5 Shows the whether the subjects felt comfortable with Task 2, depending on which they performed. The percentages for subjects are out of 8 instead of 16, as half of the subjects were given this task to work with.
Table 6 Shows where the subjects think the hotel is located. Majority of users from Italy, USA, and USA1 sites thought the hotel is in Spain, while 50% of the Greek site users thought the site is in Greece. Most of the remaining half thought it's in Spain as well.
Table 7 The 4 tables a, b, c, and d shows which page designs the subjects prefer. The Italian site users' order of preference: Italian, Greek, split even when comparing the 2 US designs. Users for USA site prefer: Italian, Greek, USA, USA2. USA2 site users' prefer: Italian, Greek, USA2, USA. Users for Greek site prefer: Italian, Greek, USA, USA2.
Table 8 Shows the gender and age of the subjects of these two sites. There are more females in Italian site and USA site and more males in the other two. Majority of the people are just shy of 20.
Table 9 Shows the subjects' colorblindness. No one is colorblind.
Table 10 Shows whether the subjects are left-handed or right-handed. In Italian and USA sites, everyone is right-handed. In the other two, majority are right-handed.
Table 11 Shows the native language of the subjects. They are all English. However, the question needs to be revised to reflect more diversity.
Table 12 Shows the subjects' English speaking ability on a scale of 1 to 5. Most are 5, the highest level.
Table 13 Shows the subjects' English reading ability on a scale of 1 to 5. Most are 5, the highest level.
Table 14 Shows the number of years the subjects had exposure to English on a regular basis. Most chose "Greater than 10", which was the highest level in the choices.
Table 15 Shows the length of time the subjects have been using a PC. Most chose "More than 2 years", which was the highest level in the choices.
Table 16 Shows the frequency of mouse usage among the subjects. Most chose "Very frequently".
Table 17 Shows the frequency of WWW usage among the subjects. Most chose "Very frequently".
Table 18 Shows the undergraduate major of all the subjects. Engineering and Science appear to be the majority for users in Italian and USA sites; engineering and computing appear to be the majority for users in USA2 and Greek sites
The new follow-up mini-survey indicates that there are 15 people out of a total of 36 that prefers USA site design over the IT one. That is 42%, which means that the other 58% prefers the IT site design.

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