Interactive Campus Envoy Phase 4: Evaluation

Introduction

The Interactive Campus Envoy was conceived to help students get from one place to another around campus. We believe that the existing systems, such as the paper campus map and the online map, fall short of this goal since none of them combine portability, integration of different types of information, and customized routing. After presenting several alternative designs to our user base, we settled on a GPS-equipped PDA-based interface that keeps track of the user's current location, implements a single search engine for buildings, departments, people, and events, and allows fast creation of a route to any of those destinations. In Phase 4 we describe our evaluation of ICE, including our criteria, procedures, results, and improvements for the future.

Evaluation Criteria

When evaluating ICE, we wanted to compare it to the existing system but were left with a dilemma since two methods currently exist for getting around Georgia Tech—the paper map issued to all newcomers, and the online Campus Map. We chose to compare ICE to the online map for a number of reasons:

- The technology to test people walking the campus was not included in our prototype. This eliminated much of the basis for comparison to the paper map.
- ICE's interface and usability were more appropriately compared to another computer-based system.
- The paper map provides only a subset of the features shared by ICE and the online map. It has no way to look up a person, get information about a building, and doesn't provide various other features.

We judged the following criteria to be most important in our evaluation:

Learnability

We expect ICE to be used by many first-time visitors to the campus as well as students and faculty in a hurry. Since our survey showed that most students don't carry

a map after their first year at Tech, many of our prospective users might use ICE only sporadically, and might forget how to use it between trials. Also, we feel that a computer interface needs to be intuitive since few users want to read a manual before using it. A question asked participants to rate the appropriateness of the time it took to learn ICE.

Usability

This supports the learnability requirement. ICE's icons should be recognizable. The small PDA screen size shouldn't deter users. Buttons should be easy to recognize and use; gestures and other shortcuts should be intuitive and be easy to remember. Several questions were asked to assess these features. Usability is essential for the next issue:

Improvement over Current System

If ICE were not an improvement over the Campus Map it would have no purpose. Timed tasks and several questions were designed to compare the systems.

The Speed of Buttons vs. Gestures

Gesture mode was designed as a way for the user to have more control of the interface and to speed it up. Using buttons, as most conventional interfaces do, would require the user to first move the desired area to the center of the screen, and then zoom in by selecting the zoom tool and an appropriate zoom level. With ICE's gestures, a user can zoom in on an area in the corner of the screen merely by drawing a circle around it, thus controlling both the location and the size of the area he wants to look at. Gestures for zoom out and pan eliminate the need to select buttons before they will take effect, speeding up operation. A between-groups test was designed to compare participants using buttons and gestures, and a question asked which mode they preferred.

Hypothesis

We believe that using the Interactive Campus Envoy (ICE) handheld application will allow users to locate buildings on campus, navigate to locations on campus and find information about the campus faster than the existing system, and that they will prefer it to the existing system.

Usability Specifications

- Overall, users should:
- Be able to determine a route from point A to point B using the ICE system in equal or less time than the existing system.
- Indicate they prefer ICE to the existing system.
- Report they were able to learn how to use the ICE system within a reasonable amount of time.
- Indicate that gestures would improve speed.
- Indicate that gestures map appropriately to their actions.

Methods

Overview

Three tasks were designed to compare the Georgia Tech Campus Map to ICE. Two tasks required participants to search for destinations and create a route to that location; a third task exercised the pan, zoom, and probe features of both systems. A questionnaire following the tasks gathered participants' opinions of some features of the two systems and solicited information on ICE's usability.

Participants

Eight Georgia Tech graduate students who had varying degrees of familiarity of the campus volunteered to participate in the study. There were no specific age or gender requirements. A summary of their demographics follows.

1.	Gender	63% – Male 37% – Female
2.	Age	100% – 21 – 31
3.	Highest Education	75% – Bachelors Degree 25% – Masters Degree
4.	Knowledge of GT campus	38% – Beginner 50% – Average 12% – Expert
5.	Used the GT paper map	88% – yes 12% – no
6.	Used the GT website map	100% – yes
7.	Mapping Software Experience (1 – Never Used, 5 – Expert)	3.6 – Mean 2 – Min 5 – Max
8.	PDA Experience (1 – Never Used, 5 – Expert)	1.75 – Mean 1 – Min 3 – Max

Testing Environment

Four participants were tested in available conference rooms in the College of Computing Building. The other four were tested in the college's Darts Lab. The difference in testing environments was not intentional, but a factor we had to work around since no conference rooms were available during some testing times. The researchers stood behind the participant to observe and take notes as the participant completed the tasks.

Apparatus

The participants used two computers during the study, a Fujitsu PC LifeBook A1010 laptop with a 1.2 GHz Athlon 4 processor to interact with the current Georgia Tech website map and an Aqcess Technologies QBE Personal Computing Tablet with a 400 MHz Pentium II processor to interact with the ICE prototype. Participants used a touchpad when using the laptop. Each was asked if they preferred to use a regular mouse, but all said the touchpad was adequate. Participants used a stylus to interact with the tablet PC. The ICE prototype did not recognize handwriting input; therefore participants used a keyboard to enter text. Originally, a "Wizard of Oz" technique where the participant would write the text on the tablet and a researcher would enter the text with a keyboard was discussed, but discarded after the pilot test revealed that the viewing angle made it difficult for the researcher to clearly see the written letters, resulting in many time-consuming mistakes. Furthermore, by keeping the method of entering text the same for both systems, the participants could focus on the usability of the two software systems and not the conventions of the platform they run on.

Tutorials

The usability study was designed to compare two mapping systems: the Campus Map from Georgia Tech's website and the Interactive Campus Envoy (ICE). According to our demographic questionnaire, all of the participants had previously used the Campus Map. Since prior knowledge of the Campus Map might bias participants' performance in its favor, we created tutorials [Appendix A] for both systems, thus ensuring that participants were taught to accomplish the same set of actions on both systems. The tutorials contained instructions on how to complete each action, followed by a practice task. Participants were allowed to use the tutorials in place of on-line help during their timed tasks. The tutorials covered how to:

- Search and locate a building
- Zoom-in and zoom-out
- View a part of the map different from the current display
- Probe for a building's name
- Search for information about a professor
- Selecting advanced route options (ICE only)

The ICE system incorporates two methods of panning and zooming: buttons and gestures. The usability study was designed so that half the participants learned and used buttons first, and then learned gestured and used them in a non-timed task. The other half of the participants learned and used gestures first, followed by buttons. The first ICE tutorial given participants explained how to pan and zoom using their first method; following their timed tasks a shorter tutorial explained the other method of panning and zooming.

Tasks

Participants completed three tasks in the same order on each system [Appendix B]. In each task the subject started from one place on campus, searched for some information, and determined a route to another campus location. The tasks were the same on both systems, but the names of buildings and professors were changed to minimize learning effects. When designing the task scenarios, the researchers tried to choose obscure and multi-disciplinary buildings and professors so participants did not have previous knowledge of most destinations they needed to locate. The distance between the user's current starting location and ending destination for the same tasks was similar for both systems.

In the first task subjects searched for a building name, located it on the map, and then were asked to determine a well-lit route from their current location to the building. When using the Georgia Tech website map, the participant was told they could assume a route along a main road was well lit.

This task compared the searching and routing capabilities of the Campus Map and ICE. Although the search mechanisms for both systems are comparable, routing with ICE may require fewer searches since it displays the user's current location on the map; when using the Campus Map, users may need to search for their current location in addition to their destination. ICE automatically draws a route to follow whereas the Campus Map only allows the user to locate buildings. Determining a route with the Campus Map can be difficult since when fully zoomed-out the map only shows the shape of buildings, and doesn't permit access to their names. Additionally, ICE supports routing options such as well-lit, no-stairs, and motorist routes.

In the second task participants were directed to find a professor's phone number and then determine a route from their current location to the professor's office.

This task is similar to the first, except that the object of the search is a person instead of a building. The ICE system allows users to search for people and buildings from a single page, and will create a route to the person's building on demand. The Georgia Tech website treats searching for people and buildings as separate tasks, and while there are many ways to search for information about a person, all of them require the user to exit the Campus Map. After finding the professor's phone number, participants had to return to the Campus Map and locate the professor's building to determine a route.

In task 3, the subject was told he was at a location, either the football stadium or basketball coliseum, and was looking for a nearby building but did not know its name. He was directed to probe the surrounding buildings until a researcher told him he had found the correct building. The subject then looked up some information about the building. Once the information was retrieved, he had to create a route to an unrelated building across campus.

This task was designed to exercise the pan and zoom features of both interfaces and give the user a feel for ICE so he could evaluate it in the questionnaire that followed. The task was repeated, using different destinations, when the users learned the alternative method to pan and zoom (either buttons or gestures). The free-form nature of the task provided a good basis for users to compare the two methods.

Features Not Tested

Several aspects of the ICE design were not tested during the evaluation due to time and technology constraints. The ICE system is designed to be portable and to continually provide feedback of a user's position as he follows a route. This presents special considerations not tested here. How does a user determine in which direction to start walking? How should the interface respond if a user walks off course? Since the prototype lacks GPS capabilities and cannot realistically respond to a user's movements, the study did not test these features.

Procedure

Prior to the study, potential participants were asked to complete a background questionnaire [Appendix C]. The researchers compiled the results and did a frequency distribution match based on prior mapping software and PDA experience to create two groups.

Each participant completed the tasks separately. The usability study required approximately 1 hour to complete.

The researchers followed a testing protocol [Appendix D]. An introductory speech was given explaining the purpose of the study. They were informed their abilities were not being judged rather their feedback about the mapping systems was desired to help redesign one and make it user-friendly.

Participants read and signed an informed consent form [Appendix E].

Round 1

Each participant was given a paper tutorial of the first system, either the Georgia Tech website map or the ICE map, to learn how to interact with it. All actions needed to accomplish the tasks were taught in the tutorial, which the participant completed alone and was not timed. When the participant was finished with the tutorial, he was given the three timed tasks to complete on the system.

Round 2

The participant was then given a tutorial of the second system, which covered the same functionality as the first tutorial. The participant learned and interacted with the system until he mentioned he was done. The participant was then given the three timed tasks to complete on the second system. These tasks were similar to tasks given for the first system.

Round 3

Finally, the participant was given a mini-tutorial that taught the other zooming and panning method of the ICE system. He was then given one task to complete with this

modified version of ICE that was similar to the third task given for the two prior systems. This task was not timed, but the user could still give qualitative feedback about the differences between the two methods.

The order of the three tasks was the same, but the order in which the participant interacted with each system was counterbalanced to avoid ordering effects. The groups differed in that one was first taught and timed on using the buttons to zoom-in, zoom-out, and pan on the ICE system and was then taught the gestures during the mini tutorial while the second group was first taught and timed on using gestures to zoom-in, zoom-out, and pan on the ICE system and was then taught how to use the buttons during the mini tutorial. To avoid learning effects, specific building and route information differed for all tasks.

Participants	Round 1	Round 2	Round 3
Participants 1, 5	Web	ICE buttons	ICE gestures
Participants 2, 6	ICE buttons	Web	ICE gestures
Participants 3, 7	Web	ICE gestures	ICE buttons
Participants 4, 8	ICE gestures	Web	ICE buttons

After the tasks, the participants completed a post-test questionnaire [Appendix F] that collected mostly quantitative data to test the hypotheses. The questionnaire asked about ease of use of the two systems, which system the participant prefers for different tasks, and which ICE zooming and panning method the participant prefers, and gauged the overall ICE user interface.

The researcher then asked a few open-format interview questions to elicit overall qualitative statements [Appendix G].

Results

The data collected and evaluated from the study included the time it took participants to complete the three tasks on each system, quantitative answers from the post-test questionnaire, and qualitative answers from the interview questions. Statistical tests were performed against these data to assess significance of the results.

Completion Times

Participants completed tasks 1 and 2 significantly faster when using ICE than when using the Campus Map. Task 3, which had a high degree of variability, was actually completed faster using the Campus Map. Possible reasons for this are discussed later. When the means of all 3 tasks are added, ICE was considerably faster (mean = 301 seconds) than the Campus Map (mean = 538 seconds).

Task 1, in which participants created a well-lit route to a building, was completed in an average of 204 seconds using the Campus Map and 57 seconds with ICE (Fig. 1). The difference in times proved significant ($t = 2.492$, $p < .03$). This was due to additional time required to self-locate using the Campus Map and the difficulty of using that system to create a point-to-point route that spanned more than one of its nine submaps.

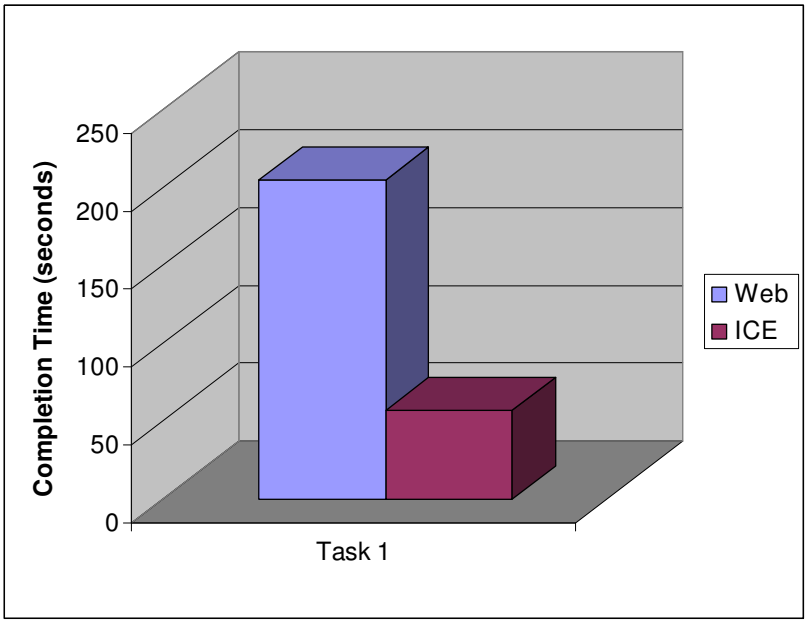

Figure 1: Task 1 completion times for web and ICE systems.

Task 2, retrieving information about a professor and plotting a route to his office, averaged 197 seconds to complete using the Campus Map and only 58 seconds with ICE ($t = 3.248$, $p < .01$). Extra time was spent on the Campus Map in self-location, leaving the map to look up the professor's phone number, possibly leaving the map again to check the professor's department, and the difficulty in determining a point-to-point route.

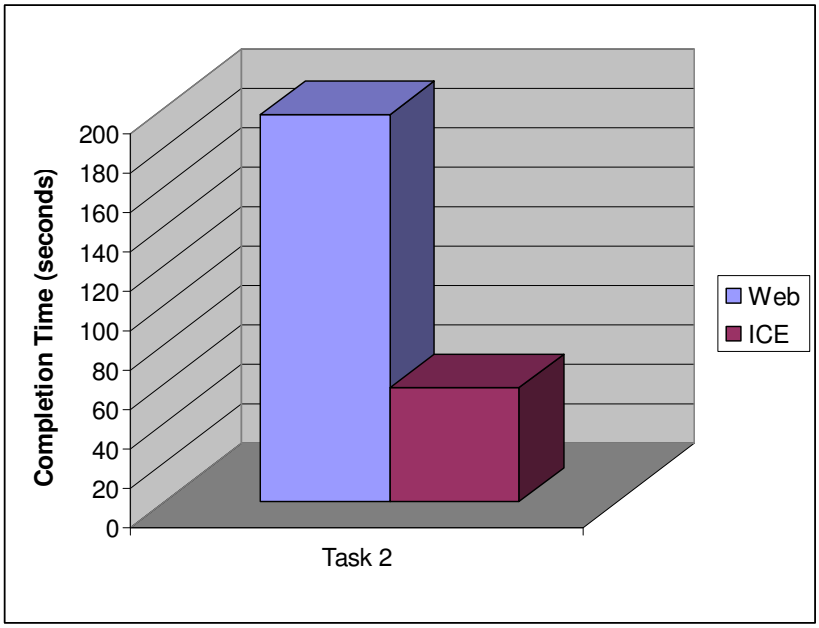

Figure 2: Task 2 completion times for web and ICE systems.

Task 3 averaged 135 seconds to complete using the Campus Map and 185 seconds with ICE, but the difference in times was not significant.

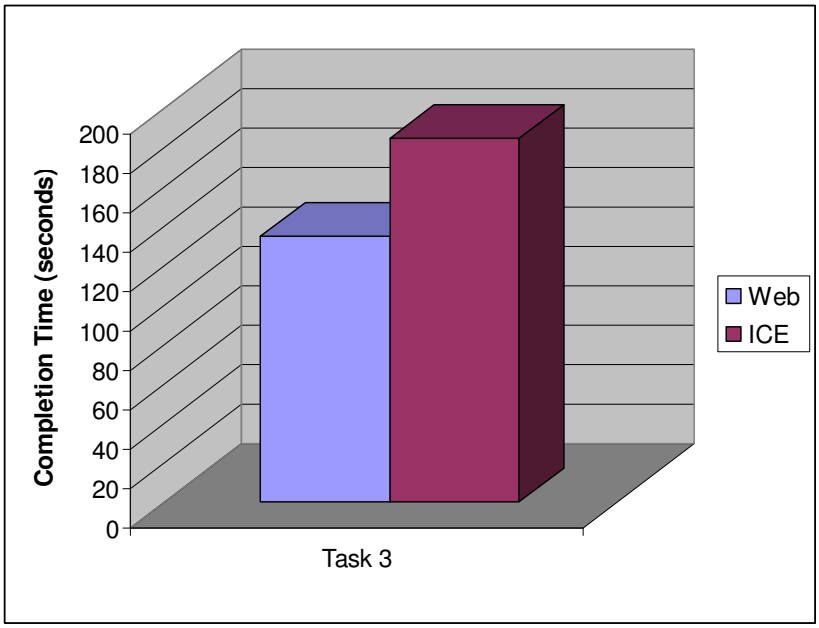

Figure 3: Task 3 completion times for web and ICE systems.

Since only task 3 was designed to exercise ICE's two methods of zooming and panning, we performed a test comparing completion times of participants who used buttons to those who used gestures. This between-groups test was not significant since one participant in each group took an extremely long time with the task, and this added a great deal of variability. However, when we examined the scatter plot of times there appeared to be a great deal of consistency within each group if the outliers were eliminated. It appeared that gesture mode was significantly faster.

To test this we performed an independent t-test after eliminating the single outlier from each group. Gesture mode proved significantly faster ($t=3.742$, $p = .02$). However, since the task only required a user to zoom and pan a few times, at best gestures could have been expected to be only a few seconds faster than buttons. The mode change probably could not explain the 53-second difference in the means of these two groups and the result may not be meaningful.

Some participants performed their tests in a quiet, non-distracting environment: the conference room at the GVU Center; others were tested at the tables in the College of Computing's Darts Lab, which is noisier and more active. We performed a between-groups test on all 6 tasks and found no significant difference in completion times of any of these tasks.

Graphs were plotted to determine whether prior mapping experience or campus knowledge affected performance on relevant tasks. ICE Task 3 was plotted against prior mapping experience (Fig. 4) but it was found that those with little or no mapping experience actually performed better than those with a moderate amount of experience.

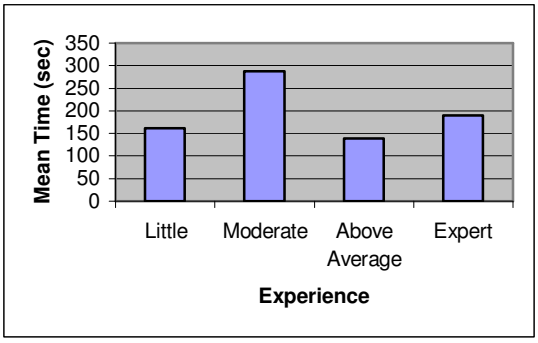

Figure 4: Mean Completion Times of ICE Task 3 by Mapping Experience

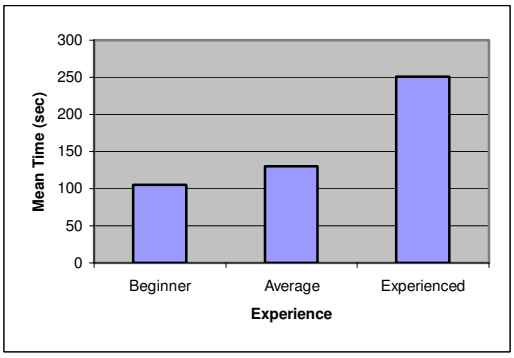

Figure 5: Mean Completion Times of Web Task 3 by Campus Experience

Task 3 on the campus map was plotted with respect to campus knowledge (Fig. 5) but prior knowledge of the campus actually demonstrated a negative effect regarding times. Once again, times for these tasks were affected by numerous factors and probably should not be used to draw conclusions.

Questionnaire Results

Our questionnaire contained 18 questions, most of which were ranked on a Likert scale of 1 to 7, where 7 indicated strong agreement and 1 indicated strong disagreement. These questions were tested for significance against a constant value of 4, which represented an “average” or “no preference” rating. Other questions were of the yes or no variety such as "Would you use ICE again?" These were tested using the Chi-Square statistic.

System Ease of Use

Participants were asked to rate the ease of use of both systems for determining a route, retrieving information, and zooming. The ICE system was rated easier to use than the website map for all three functions (Fig. 5). The Campus Map got a poor score (mean=2.75) when rated on its ability to help participants determine a route between two points, and got average scores regarding ability to get information and to zoom in and out. None of these were significant. Ratings of ICE's abilities in determining a route, getting information, and zooming in or out all proved significantly favorable. When asked to rate the appropriateness of time needed to learn the ICE system, participants gave a favorable score of 4.88, which approached significance, but fell short (t=1.825, p = .111).

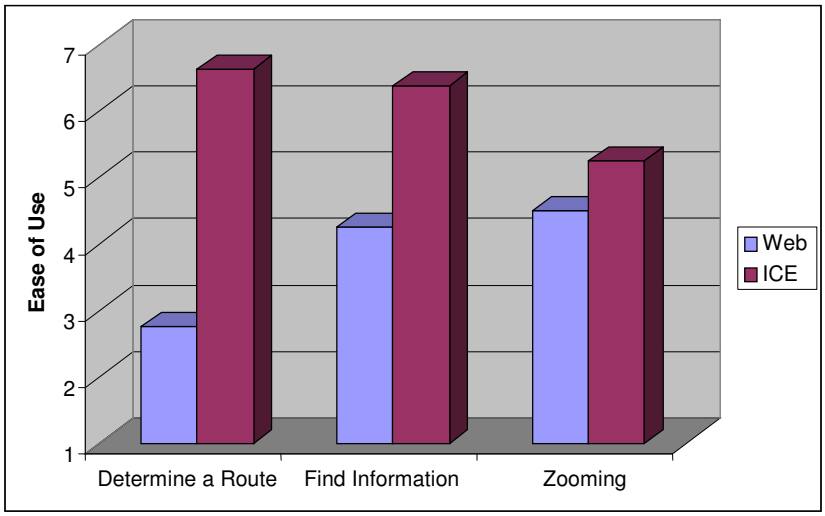

Figure 6: Ease of Use comparison of web and ICE systems.

Mapping System Preference

All participants preferred the ICE system for determining a route, while only 63% preferred ICE for retrieving information. When asked which system participants preferred overall, all preferred the ICE system to the web map. These were tested using a Chi-square distribution and all except retrieving information significantly favored ICE.

Appropriateness of Gestures

Participants rated the zoom-in, zoom-out, and pan gestures (Fig. 7). All proved significantly favorable, surprising us since the zoom-out gesture was primarily chosen because it was easy to program and not because we agreed upon its appropriateness.

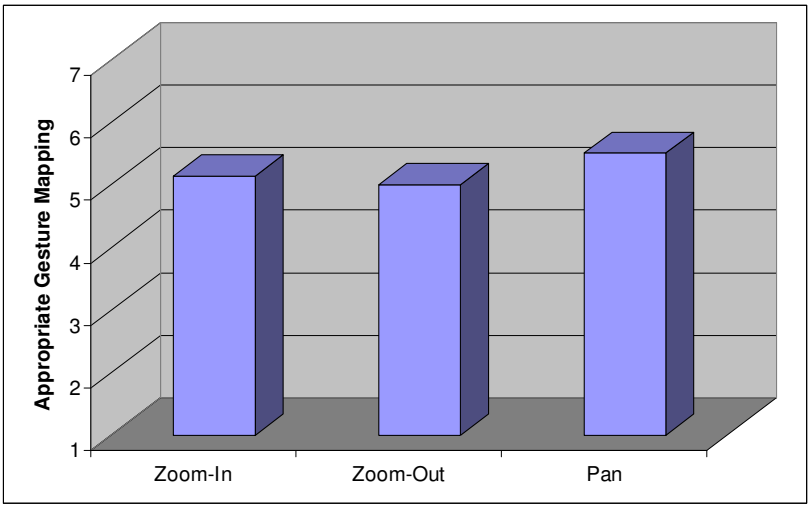

Figure 7: Appropriateness of gestures on ICE system.

Buttons or Gestures Preference

Contrary to our hypothesis, 63% of participants favored buttons to gestures. However, on closer examination of these results, we found that all 4 participants who first learned gestures preferred buttons, and gestures preferred by 3 of 4 of the users who first learned buttons. We used Pearson's Correlation to test whether users preferred the ICE mode they used first and found that users significantly preferred the mode they learned second ($r = -.775$, $p = .024$).

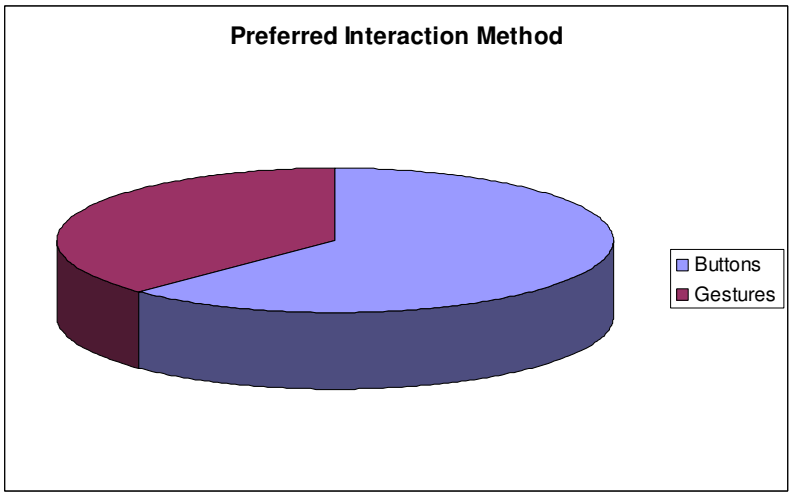

Figure 8: Preference of Buttons vs. Gestures.

ICE Usability

Participants were asked several questions to assess the overall usability of the ICE system. The statement "The icons were easy to recognize" received a rating of 6 out of 7 ($t = 7.48$, $p < .001$). Participants thought the application did a favorable job of responding the way they thought it should and gave it a rating of 5.38 ($t = 5.23$, $p = .001$). When asked to predict how well they would do if they performed the same tasks on ICE in the future; subjects responded with a mean rating of 5.88 out of 7 ($t = 8.27$, $p < .001$). Finally, when they were asked if they would use the ICE system, everyone said they would.

Interview Results

Following the post-test questionnaire, a researcher asked each subject whether anything about the ICE system annoyed them, what ICE did well, and what additional features might be included.

What Annoyed Users:

Several of our participants thought the display was too small. Some mentioned having difficulty with the search results screen since the first result was not automatically selected, and most buttons on the screen were disabled until a selection was made. This was especially problematic if the search returned only one result. One participant did not like the fact that the pop-up menu disappeared when he eased up on the stylus, and mentioned that the menu might be hidden under the user's hand. Other problems noted were the lack of an error message when a search returned no results, and that the zoom-in routine did not always interpret a circle properly. One participant, while in button mode with zoom-in selected, was annoyed that when he tried to probe a building name, it zoomed in on the map instead.

What ICE Did Well:

Participants liked the automatic creation of routes and the fact that the system displayed the user's current location. Half of our participants mentioned the integration of buildings, departments, people, and events in a single search database. Three people noted that ICE allowed the user to have control over the display, pointing out that you could locate two places on the map without having to change screens, and that you could define the viewable portion of the map. Two participants liked the routing options

and one liked the concept of gestures, even though “they are not quite there.” In general, participants thought it was good, consistent, and well integrated.

What Could We Improve?

Few participants offered suggestions for improvement. Two ideas mentioned were wireless connectivity to access building occupants’ websites and the addition of landmarks or waypoints that users can position on the map as points that they know how to get to.

Discussion

Our hypotheses were largely confirmed. For tasks 1 and 2, mean completion times were 3 to 4 times faster on ICE than on the existing web site. Participants felt that gestures mapped appropriately to their actions and all users stated that they preferred ICE to the current web interface.

ICE task 3, which exercised gestures and buttons, was completed faster on average using gestures. However, it is likely that these times depended on other factors and we cannot state that gestures were faster than buttons. Also, users slightly preferred buttons to gestures, although as mentioned previously, there was a strong correlation between the position in which buttons or gestures was learned and users’ preference.

ICE users did believe that the system was learned in an appropriate amount of time. That this proved significant despite an average rating of only 4.88 on a scale of 1 to 7 indicates that most users agreed with this assertion. Indeed, seven of our eight participants rated ICE’s learnability as average or better, with six of eight rating it better than average. Users indicated that they would be able to perform these tasks easily using ICE in the future.

Good Design Points

Participants liked ICE’s point-to-point creation of routes, the fact that it combines all search options into a single engine, and appreciated the various route options. Our icons were easy to recognize and most users had little trouble with the flow of the system—on only their second ICE task, half of our participants retrieved a professor’s phone number and plotted a route to his office in 31 seconds or less (mean = 27 seconds). On the Web the fastest four participants averaged 142 seconds—nearly five times as long.

Changes to the ICE System

In the course of testing, several shortcomings and improvements were suggested by the subjects. Some of these problems were due to the implementation of the prototype. Although the implementation was never meant to be absolutely complete, it was believed to be good enough for usability testing. However, there were a few cases where it fell short. These are discussed in Prototype issues.

Interface Issues:

Language of the system help screens:

Some of the language in the system help pages should be changed to be clearer to a larger portion of the population. The necessity for this change was made apparent by confusion of the meaning of certain statements in the tutorials, which were based on the system help screens, and is discussed in more detail later. Several changes were pointed out by users or were discerned from watching users interact with ICE.

Automatic selection of the first result of the "search results" page:

Currently, there is no default selection of a result on the search results page, and several buttons such as "Get Info" and "Plot on Map" remain disabled. Several users, when asked to get information about a person, would search for that person, be presented with a single result, and not know how to proceed. We plan to automatically select the search result if only single item is returned. Further research is needed to determine if the first item in a larger list should be automatically selected.

Notification for "no results found":

In several instances users entered search criteria that returned no result. This confused some users who were not sure if there truly were no results or if the search had not yet completed.

Links from information pages to web pages:

When a user views information about a building or person, the information could include the ability to open a web page pertinent to the building or person being viewed.

Improved "Center-user" icon:

One button, which resembles a target, allows users to re-center the map around their current location. Although this button was not tested in the usability study, some participants commented that its purpose was unclear. This icon should be changed to better express its purpose.

Prototype Issues:

Better gesture recognition:

First of all, there should have been more leeway in probing buildings for information. To probe a building, the user must press and hold the mouse pointer. While this is relatively easy for a mouse, when using the stylus on the tablet PC, there was still some "jitter" in the pointer, even if the stylus was held almost completely still. Therefore, the system did not interpret the user's intentions as fast as it should have and the code to indicate that a building has been probed should take this into account. Another unforeseen side effect was that users would accidentally draw a very small circle when trying to probe a building, and the map would zoom all the way in on a very small point. The user then had to zoom back out to show a meaningful area of the map.

Second, there should have been more leeway in the "zoom in" gesture. The prototype requires that the start and end points of the gesture be within a certain proximity of each other to be interpreted as a circle. Thus, if a user draws a circle by tracing one and a half times around the perimeter the gesture would not be recognized.

A building's selection area should be the entire building:

For the prototype, a building's selection area for probing was a point in the middle of the building, necessitating the user to probe in a building's center to get a result. This presented a problem when probing larger buildings, or when probing small buildings that appeared large when the zoom factor was high.

Lower the zoom in limit:

The current prototype allows users to zoom in so that a single building takes up the entire screen. It was pointed out that this level of zoom was not needed and verified by the fact that nobody intentionally zoomed in as far as possible in the tests. Furthermore,

if the user accidentally zoomed in that far, it just took additional time to zoom back out again.

Problems Found with the Testing Method

During the evaluation study, the researchers discovered problems, which they would change if they ran the study again in the future. Most of these were not previously detected because the test designers were familiar with the goals of each test and the system. In the future, more pilot testers should probably be used to better detect these problems prior to the study.

Couldn't probe all buildings

In tasks where users were required to probe buildings, the scenarios were set up such that not all of the buildings immediately around the target would elicit information when probed. This caused two problems. If some users found a building that gave no information when probed, they might assumed that any building that didn't immediately pop up a menu to get information was simply not activated. In some cases, this was true, but in others the subject simply had not waited long enough or kept the stylus still enough. The second problem was that when probing a non-activated building for information, some subjects inadvertently traced small circles with the stylus. This caused the map to zoom in accidentally, confusing the user and preventing the development of an accurate mental model of the interface—especially so for those participants who had only learned buttons at the time of the first test, and were unaware that drawing a circle would cause ICE to zoom in.

Landmarks for probing tasks were too large

For probing tasks, the user was given a large, obvious landmark and asked to probe around it for a certain building. For example, one of the landmarks was Bobby Dodd Stadium. This proved to be a problem because the size required more search area than a small structure would have needed. This large search area, coupled with the previously mentioned incompleteness of campus information and the shortcomings of the probing gesture, irritated some users. The task was evidently too vague and probably not the best method for testing probing ability.

No strict script for the testers to interact with the user

One fact that may have influenced results was there was no script for the researchers to interact with the users. A script was initially written, but it was determined that the researcher just reading from a script was too impersonal. Therefore, the script was replaced with bulleted items to allow the tester to cover all necessary points while addressing the user in a more personal manner. It turned out, however, that the lack of a script could have resulted in some users being given more information than others, and that could have affected the results of the test.

Task language not always appropriate

Two of the users being tested were not native English speakers, so they did not understand some of the instructions given to them. For example, one did not understand what it meant to “probe” a building. When describing how to probe, they were instructed to allow the mouse pointer to “linger” over a building. Neither understood this word. Correct terminology should have been, “press and hold”.

Appendix A: Experiment Tutorial

ICE Phase 1: Buttons

Search
If you enter data into the destination box and press “Search,” a result screen appears listing all items with names that contain the search field, ordered in “best-fit” sequence. From this screen, you can select an item and plot its location on the map, create a route from your current location to the item, and perform other tasks.

Task: Search for Bill Caldwell. Retrieve information about him by clicking the ‘Get Information' button. Return and create a route to his office.

 **Zoom-In:** Click on the zoom-in tool to activate zoom-in mode. Once activated, you may click anywhere on the map to show an enlarged section of the map, centered on the selected point.

 **Zoom-Out:** Click on the zoom-out tool to activate zoom-out mode. Once activated, you may click anywhere on the map to show more of the map centered on the selected point. Map items will appear smaller.

 **Pan:** Clicking on the hand enables you to drag the map in pan mode.

Task: Zoom in anywhere on the map and click on the pan tool. Drag the map right. Drag the map up. Drag the map left. Zoom out.

 **Draw:** Multiple actions are supported in this mode including probing the names of locations, plotting a building, creating a route and getting detailed information for a plotted location.

Probe Location Name: In draw mode, if the stylus lingers on a building a window will display the building’s name.
When an item is probed a menu appears allowing you to:

- Plot the building on the map
- Create a route to the building
- Get Information about a building

Task: Zoom in on the College of Computing. Probe it to see its name. Drag the stylus to plot the building on the map.

Appendix A: Experiment Tutorial

Get Detailed Information:
- Plotted Point: In draw mode, click to get detailed information.
- Unplotted Point: In draw mode, hold the stylus on it. When the pop-up menu appears, drag to the "Get Information" option.

Task: Click on College of Computing to retrieve information

Advanced Options: **Click the "Advanced" button on the map to set advanced options. These are:**

Search Options: Select one or more options to narrow your search to buildings, departments, people, and events or some combination.

Route Options: Allows you to specify route criteria for your trip. You may request a "no-stairs" route optimized for wheelchair and bicycle users, a well-lit path, or automobile route.

Browse: You can browse any or all of these categories

Task: Select a "no-stairs" route optimized for wheelchair and bicycle users,

Appendix A: Experiment Tutorial

Gestures:

 **Draw:** Multiple actions are supported in this mode; each is determined by the gesture drawn on the screen. This mode supports **pan, zoom in, zoom out,** and other features.

Zoom-In: Draw a circle on the map. The map zooms in on the enclosed area. *(This does not need to be a perfect circle but does need to begin and end in roughly the same place.)*

Zoom-Out: Draw an arrow pointing upwards (^). The map zooms out

Pan: Drawing a line on the map drags it in the direction of the line.

> Task: Zoom in on the College of Computing by drawing a circle around it. Drag the map to the left. Drag the map up. Drag the map to the right. Zoom out.

Draw mode also supports probing the names of locations, plotting a building, creating a route and getting detailed information for a plotted location. These are done the same way as noted in the previous section.

Appendix A: Experiment Tutorial

ICE Phase 1: Gestures

Search
If you enter data into the destination box and press "Search," a result screen appears listing all items with names that contain the search field, ordered in "best-fit" sequence. From this screen, you can select an item and plot its location on the map, create a route from your current location to the item, and perform other tasks.

> Task: Search for Bill Caldwell. Retrieve information about him by clicking the 'Get Information" button. Return and create a route to his office.

 **Draw:** Multiple actions are supported in this mode; each is determined by the gesture drawn on the screen. This mode supports **pan, zoom in, zoom out, probing the names of locations, plotting a building, creating a route** and **getting detailed information** for a plotted location.

Zoom-In: Draw a circle on the map. The map zooms in on the enclosed area. *(This does not need to be a perfect circle but does need to begin and end in roughly the same place.)*

Zoom-Out: Draw an arrow pointing upwards (^). The map zooms out

Pan: Drawing a line on the map drags it in the direction of the line.

> Task: Zoom in on a building by drawing a circle around it. Drag the map to the left. Drag the map up. Drag the map to the right. Zoom out.

Probe Location Name: If the stylus lingers on a building a window will display the building's name.
When an item is probed a menu appears allowing you to:

- Plot the building on the map
- Create a route to the building
- Get Information about a building

> Task: Zoom in on the College of Computing. Probe it to see its name. Drag the stylus to plot the building on the map.

Get Detailed Information:

- Plotted Point: In draw mode, click to get detailed information.
- Unplotted Point: In draw mode, hold the stylus on it. When the pop-up menu appears, drag to the "Get Information" option.

Task: Click on College of Computing to retrieve information

Advanced Options: Click the "Advanced" button on the map to set advanced options. These are:

Search Options: Select one or more options to narrow your search to buildings, departments, people, and events or some combination.

Route Options: Allows you to specify route criteria for your trip. You may request a "no-stairs" route optimized for wheelchair and bicycle users, a well-lit path, or automobile route.

Browse: You can browse any or all of these categories

Task: Select a "no-stairs" route optimized for wheelchair and bicycle users,

Appendix A: Experiment Tutorial

Buttons:

 **Zoom-In:** Click on the zoom-in tool to activate zoom-in mode. Once activated, you may click anywhere on the map to show an enlarged section of the map, centered on the selected point.

 **Zoom-Out:** Click on the zoom-out tool to activate zoom-out mode. Once activated, you may click anywhere on the map to show more of the map centered on the selected point. Map items will appear smaller.

 **Pan:** Clicking on the hand enables you to drag the map in pan mode.

> Task: Zoom in anywhere on the map and click on the pan tool. Drag the map right. Drag the map up. Drag the map left. Zoom out.

When using tools, draw mode supports probing the names of locations, plotting a building, creating a route and getting detailed information for a plotted location. These are done the same way as noted in the previous section.

Appendix A: Experiment Tutorial

Online map instructions:

Zoom-In: You may click on one of nine map sections to zoom in on that section

Zoom-Out: Clicking the Map Home link on the left side of the page will return you to the full map.

Probe Location Name: When zoomed in, if the stylus lingers on a building, a window will display the building's name. Clicking on the building will display more information.

> Task: Zoom in on the upper left section of the map.
> Hold the cursor over some buildings without clicking to see their names. Click on a building to display its information.
> Zoom out by clicking the label "Map Home" on the upper left.

Search
Enter one or more letters in the text box and press "Search Campus Map." You may search on building names by pressing 'Building Names' or search departments by pressing the 'Building Occupants' button.

> Task: Search for the Mason Building. Locate it on the map.

Get Detailed Information: Department
If you search 'Building Occupants', some occupants names will appear underlined and in blue type. Clicking on the name or blue line will display the occupant's web page. You are able to browse information provided by the department. Click the 'back' button to return.

> Task: Search for the College of Computing. Click its link to get connected to its web site.

Get Detailed Information: Person
If you don't know the person's department, you may click 'Site Search' on the upper right-hand corner of the web page to access Georgia Tech's search engine.

> Task: Search for John Stasko. Find his phone number.

Appendix A: Experiment Tutorial

Browse: You can browse buildings or occupants by clicking the A-Z Building Index or A-Z Occupant Index buttons on top of the map.

Appendix B: Experiment Tasks

Online: Experiment 1:

You are currently at the Student Center and it is dark outside. You need to determine a well-lit route to the Couch Building. Use the search function to locate the building. You can assume sidewalks along roads are well lit.

Online: Experiment 2:

You are currently at the J. Erskine Love Manufacturing Building. You have a tentative meeting with Zenzi M. Griffin. Get her phone number. You complete a call to her and confirm a meeting. Determine a route to her office.

Online: Experiment 3:

You are currently at the College of Computing. You need to go to a building near the Alexander Memorial Coliseum (basketball arena) but the name escapes you at the moment. However, you are confident you will recognize it when you see the name.

Zoom in and probe for buildings near the basketball arena. When you find the correct building, the researcher will tell you. Get the building's occupants.

Before you head there you remember that you have an appointment at the Rehab Technology Center. Find the Rehab Center and determine a path there from the College of Computing.

Appendix B: Experiment Tasks

ICE: Experiment 1:

You are currently at the Student Center and it is dark outside. You need to create a well-lit route to the Carnegie Building. Use the search function to locate the building.

ICE: Experiment 2:

You are currently at the Baker building. Find Michael Gamble's office hours. Plot a route to his office.

ICE: Experiment 3:

You are currently at the College of Computing. You need to go to a building near Bobby Dodd Stadium but the name escapes you at the moment. However, you are confident you will recognize it when you see the name.

Zoom in and probe for buildings near the football stadium. When you find the correct building, the researcher will tell you. Get the building's address.

Before you head there you remember that you have an appointment at Ivan Allen College. Find Ivan Allen College and create a path to it from the College of Computing.

ICE: Experiment 4:

You are currently at the College of Computing. You need to go to a building near Chandler Stadium (the baseball field). You don't remember its name, however, you are confident you will recognize the name when you see it.

Zoom in and probe for buildings near the baseball stadium. When you find the correct building, the researcher will tell you. Get the building's address.

Before you head there you remember that you have to go pick up a package at Central Receiving. Find Central Receiving and create a path to it from the College of Computing.

Appendix C: Demographic Questionnaire

Interactive Campus Envoy
Demographic Questionnaire

Participant #_____

1. What is your gender?

   Male Female

2. Which of the following ranges includes your age?

   □ 16 – 21
   □ 21 – 31
   □ 31 – 41
   □ 42 or Older

3. What is the highest-level degree you have completed?

   □ High School
   □ Bachelors
   □ Masters
   □ Doctorate

4. How would you rate your knowledge of the Georgia Tech campus?

   □ Beginner
   □ Average
   □ Expert

5. Have you ever used the Georgia Tech paper campus map?

   Yes No

6. Have you ever used the Georgia Tech website's campus map?

   Yes No

7. Rate your experience level with mapping software (MapQuest, Microsoft MapPoint, etc.).

Never used				Expert
1	2	3	4	5

8. Rate your experience level using a personal digital assistant (PDA) (Palm Pilot, iPAQ).

Never used				Expert
1	2	3	4	5

Appendix D: Protocol

Participants	Round 1	Round 2	Round 3
Participants 1, 5	Web	ICE buttons	ICE gestures
Participants 2, 6	ICE buttons	Web	ICE gestures
Participants 3, 7	Web	ICE gestures	ICE buttons
Participants 4, 8	ICE gestures	Web	ICE buttons

Participants 1 and 5

1. Greet participant

2. Read script

3. Have participant read and sign informed consent

4. Participant sits in front of the laptop. Display GT website map. Give participant the web tutorial. Do not time.

5. Give participant Web Task 1. Time participant.

6. Give participant Web Task 2. Time participant.

7. Give participant Web Task 3. Tell participant they found the building when they touch on **Human Resources**. Time participant.

8. Participant sits in front of the tablet. Load Tutorial Scenario. Give participant ICE buttons tutorial. Do not time.

9. Load ICE Task 1. Give participant ICE task 1. Time participant.

10. Load ICE Task 2. Give participant ICE task 2. Time participant.

11. Load ICE Task 3. Give participant ICE task 3. Tell participant they found the building when they touch on **Wardslaw Building**. Time participant.

12. Load tutorial scenario. Disable buttons. Give participant ICE gestures tutorial. Do not time.

13. Load ICE task 4. Disable buttons. Give participant ICE task 4. Tell participant they found the building when they touch on **Psychology Building**. Do not time participant.

14. Give participant post-test questionnaire.

15. Rename log files to Part#Task#.log

16. Thank participant for his/her time and show him/her out.

Appendix D: Protocol

Participants	Round 1	Round 2	Round 3
Participants 1, 5	Web	ICE buttons	ICE gestures
Participants 2, 6	ICE buttons	Web	ICE gestures
Participants 3, 7	Web	ICE gestures	ICE buttons
Participants 4, 8	ICE gestures	Web	ICE buttons

Participants 2 and 6

1. Greet participant

2. Read script

3. Have participant read and sign informed consent

4. Participant sits in front of the tablet. Load Tutorial Scenario. Give participant ICE buttons tutorial. Do not time.

5. Load ICE Task 1. Give participant ICE task 1. Time participant.

6. Load ICE Task 2. Give participant ICE task 2. Time participant.

7. Load ICE Task 3. Give participant ICE task 3. Tell participant they found the building when they touch on **Wardslaw Building**. Time participant.

8. Participant sits in front of the laptop. Display GT website map. Give participant the web tutorial. Do not time.

9. Give participant Web Task 1. Time participant.

10. Give participant Web Task 2. Time participant.

11. Give participant Web Task 3. Tell participant they found the building when they touch on **Human Resources**. Time participant.

12. Participant sits in front of the tablet. Load tutorial scenario. Disable buttons. Give participant ICE gestures tutorial. Do not time.

13. Load ICE task 4. Disable buttons. Give participant ICE task 4. Tell participant they found the building when they touch on **Psychology Building**. Do not time participant.

14. Give participant post-test questionnaire.

15. Rename log files to Part#Task#.log

16. Thank participant for his/her time and show him/her out.

Appendix D: Protocol

Participants	Round 1	Round 2	Round 3
Participants 1, 5	Web	ICE buttons	ICE gestures
Participants 2, 6	ICE buttons	Web	ICE gestures
Participants 3, 7	Web	ICE gestures	ICE buttons
Participants 4, 8	ICE gestures	Web	ICE buttons

Participants 3 and 7

1. Greet participant

2. Read script

3. Have participant read and sign informed consent

4. Participant sits in front of the laptop. Display GT website map. Give participant the web tutorial. Do not time.

5. Give participant Web Task 1. Time participant.

6. Give participant Web Task 2. Time participant.

7. Give participant Web Task 3. Tell participant they found the building when they touch on **Human Resources**. Time participant.

8. Participant sits in front of the tablet. Load Tutorial Scenario. Give participant ICE gestures tutorial. Do not time.

9. Load ICE Task 1. Disable buttons. Give participant ICE task 1. Time participant.

10. Load ICE Task 2. Disable buttons. Give participant ICE task 2. Time participant.

11. Load ICE Task 3. Disable buttons. Give participant ICE task 3. Tell participant they found the building when they touch on **Wardslaw Building**. Time participant.

12. Load tutorial scenario. Give participant ICE buttons tutorial. Do not time.

13. Load ICE task 4. Give participant ICE task 4. Tell participant they found the building when they touch on **Psychology Building**. Do not time participant.

14. Give participant post-test questionnaire.

15. Rename log files to Part#Task#.log

16. Thank participant for his/her time and show him/her out.

Appendix D: Protocol

Participants	Round 1	Round 2	Round 3
Participants 1, 5	Web	ICE buttons	ICE gestures
Participants 2, 6	ICE buttons	Web	ICE gestures
Participants 3, 7	Web	ICE gestures	ICE buttons
Participants 4, 8	ICE gestures	Web	ICE buttons

Participants 4 and 8

1. Greet participant

2. Read script

3. Have participant read and sign informed consent

4. Participant sits in front of the tablet. Load Tutorial Scenario. Give participant ICE gestures tutorial. Do not time.

5. Load ICE Task 1. Disable buttons. Give participant ICE task 1. Time participant.

6. Load ICE Task 2. Disable buttons. Give participant ICE task 2. Time participant.

7. Load ICE Task 3. Disable buttons. Give participant ICE task 3. Tell participant they found the building when they touch on **Wardslaw Building**. Time participant.

8. Participant sits in front of the laptop. Display GT website map. Give participant the web tutorial. Do not time.

9. Give participant Web Task 1. Time participant.

10. Give participant Web Task 2. Time participant.

11. Give participant Web Task 3. Tell participant they found the building when they touch on **Human Resources**. Time participant.

12. Participant sits in front of the tablet. Load tutorial scenario. Give participant ICE buttons tutorial. Do not time.

13. Load ICE task 4. Give participant ICE task 4. Tell participant they found the building when they touch on **Psychology Building**. Do not time participant.

14. Give participant post-test questionnaire.

15. Rename log files to Part#Task#.log

16. Thank participant for his/her time and show him/her out

Appendix E: Consent Form

Consent to be a Research Participant, GA Tech School of Psychology and College of Computing
CS/PSY 6750, Human – Computer Interaction (HCI), Fall, 2002

Project: CS/PSY 6750 Homework 3: Navigation Through Web Pages
Principal Investigator: Dr. Bruce N. Walker (404-894-8265)
Experimenter (student): Jean M. Miskelly (Miskelly@cc.gatech.edu), Mark Richman (marktruly@lycos.com),
Brian Lee (blee@cc.gatech.edu), Tianfei Liao (liaotianfei@hotmail.com)
Location: College of Computing, Georgia Institute of Technology
Duration of Each Session: 1 hour **Number of Sessions:** 1
Total Compensation: Course credit: none (volunteer participants)
Approximate Number of Participants: 8 adult volunteers (friends, family, students)
Participation limitations: Normal or corrected to normal vision and hearing.

General: You are being asked to volunteer for a research project studying human-computer interaction.

Study Description: We are comparing the effectiveness of two mapping systems of the Georgia Tech campus in allowing a user to accomplish the tasks of searching for and acquiring route and campus information.

Procedures: You will complete a task of acquiring specific information on the systems, as directed in the instructions. You may be asked to perform these tasks quickly and/or accurately. You may also be asked about your methods of interaction and your opinions, before, during, and after completing the tasks.

Benefits: There is no direct benefit to you, however; your participation will help advance scientific knowledge in the area of mapping and interactive software, as well as assisting these student researchers learn about the practical aspects of conducting usability studies, and designing user interfaces.

Costs: There are no costs to you by participating in this study.

Foreseeable Risks or Discomforts: This study is expected to involve no more than minimal risks associated with reading instructions and navigating through a Web site and application software using a mouse, a keyboard, and a stylus.

Confidentiality: The following procedures will be followed to keep your personal information confidential in this study: The data that is collected about you will be kept private to the extent allowed by law. To protect your privacy, your records will be kept under a code number rather than by name. Your records will be kept in locked files and only the course teaching staff and the student researchers you worked with will be allowed to look at them. Your name and any other fact that might point to you will not appear when results of this study are presented or published. Note, however, that there is no intent to publish the results of this class project. To make sure that this research is being carried out in the proper way, the Georgia Institute of Technology IRB will review study records.

Injury/Adverse Reaction: Reports of injury or reaction should be made to the supervising instructor, listed above. Neither the Georgia Institute of Technology nor the researcher has made provision for payment of costs associated with any injury resulting from participation in this study.

Appendix E: Consent Form

Contact Persons: If you have questions about this research, call or write the instructor, listed above. For Fall 2002, the contact instructor will be Dr. Bruce Walker (404-894-8265); School of Psychology, GA Tech, 274 5th Street, Atlanta, GA 30332-0170.

Statement of Rights: You have rights as a research volunteer. Taking part in this study is completely voluntary. If you do not take part, you will have no penalty. You may stop taking part in this study at any time with no penalty. If you have any questions about your rights as a research volunteer, call or write: The Institutional Review Board, Office of Research Compliance, 505 Tenth Street, 3rd floor, Campus 0420. Phone: 404-894-6942; Fax: 404-385-0864.

Signatures: A copy of this form will be given to you if you wish. Your signature on the back of this sheet indicates that the researchers have answered all of your questions to your satisfaction and that you consent to volunteer for this study. A witness will sign as well, acknowledging your informed consent as indicated by your signature.

Signatures on reverse…

Appendix F: Post-test Questionnaire

Interactive Campus Envoy

Post-test Questionnaire

Participant #_____

Comparing Systems

1. How easy was it to determine a route from one place on campus to another place on campus using the Georgia Tech website map?

   Not Very Easy Very Easy
   1 2 3 4 5 6 7

2. How easy was it to find information about a professor on campus using the Georgia Tech website map?

   Not Very Easy Very Easy
   1 2 3 4 5 6 7

3. How easy was it to zoom-in or zoom-out using the Georgia Tech website map?

   Not Very Easy Very Easy
   1 2 3 4 5 6 7

4. It took an appropriate amount of time to learn the Interactive Campus Envoy.

   Strongly Disagree Strongly Agree
   1 2 3 4 5 6 7

5. How easy was it to determine a route from one place on campus to another place on campus using the Interactive Campus Envoy?

   Not Very Easy Very Easy
   1 2 3 4 5 6 7

6. How easy was it to find information about a professor on campus using the Interactive Campus Envoy?

   Not Very Easy Very Easy

Appendix F: Post-test Questionnaire

1 2 3 4 5 6 7

7. How easy was it to zoom-in or zoom-out using the Interactive Campus Envoy?

   Not Very Easy Very Easy
   1 2 3 4 5 6 7

8. Which mapping method did you prefer for determining a route?

   ☐ Georgia Tech website map ☐ Interactive Campus Envoy

9. Which mapping method did you prefer for retrieving information?

   ☐ Georgia Tech website map ☐ Interactive Campus Envoy

10. Which mapping method did you prefer for overall? Please explain.

    ☐ Georgia Tech website map ☐ Interactive Campus Envoy

<u>Comparing ICE Modes</u>

11. Which method did you prefer when interacting (zoom-in, zoom-out, pan) with the ICE map? Please explain.

    ☐ Selecting button ☐ Drawing gestures

Appendix F: Post-test Questionnaire

12. The zoom-in gesture mapped appropriately for the action.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

13. The zoom-out gesture mapped appropriately for the action.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

14. The pan (move map) gesture mapped appropriately for the action.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

<u>ICE User Interface</u>

15. The icons were easy to recognize. Please explain.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

16. When you interact with the Interactive Campus Envoy, the application responded the way you thought it should. Please explain.

Appendix F: Post-test Questionnaire

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

17. How well do you think you would perform the same tasks in the future using the Interactive Campus Envoy?

Not Very Well						Very Well
1	2	3	4	5	6	7

18. Would you use the Interactive Campus Envoy? Please explain.

☐ Yes ☐ No

Appendix G: Interview Questions

Participant #_____

Interview Questions

1. Did anything annoy you about the ICE system?

2. What did you think it did really well?

3. What else would you want it to do?