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**TIGERweb: Usability Study Results
and Recommendations**

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TIGERweb: Usability Study Results and Recommendations

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Introduction

In February 2012, the Geography Division of the U.S. Census Bureau requested usability testing of the TIGERweb Web site. Two versions of the TIGERweb Web site were examined by the usability lab: a live version accessible by anyone on the Internet and a beta version. Staff in the Census Bureau's Human Factors and Usability Research Group and the Geography Division agreed on conducting 20 usability sessions, split evenly between novice and expert users. After the first few usability tests with novice users, it became apparent that the TIGERweb Web site was difficult to use and would need some major changes. Staff in the usability lab suggested splitting the 20 participants into two rounds of usability testing, allowing the developers to make changes to the Web site between usability rounds. Staff in Geography Division agreed to the suggestion. The second round was dropped.

In May and June 2012, the usability lab of the U.S. Census Bureau conducted the first round of usability testing on the TIGERweb Web site developed by the Geography Division. This report provides the methodology, results, and recommendations for the first round of usability testing on TIGERweb.

Methodology

Between May 10 and June 8, 2012, Victor Quach and Elizabeth Nichols of the usability lab at the Census Bureau conducted nine usability sessions on the TIGERweb Web site. Each session lasted one hour and each was observed by staff from the Geography Division. All tests were video and audio recorded. Participants were provided a \$40 cash honorarium. The usability test consisted of the user performing pre-specified tasks using TIGERweb and "thinking aloud" while completing the tasks. The think-aloud technique is modeled on Ericsson and Simon's (1993) approach to collecting verbal protocols. Our think aloud protocol was used to maintain a running verbal commentary of the participants' expectations and reasoning. A participant engaging in thinking-aloud verbalizes his or her available, conscious thoughts and decisions while completing the tasks so that the researcher can understand the participants' cognitive processes as they interact with the interface.

During the TIGERweb usability sessions, the test administrator encouraged the participant to continue to think-aloud, using prompts such as, "Keep talking." After each task, participants rated their experience using TIGERweb on a Post-Task questionnaire based on their experience on that task. At the end of the last task, participants rated their entire experience with TIGERweb Web site using a satisfaction-rating questionnaire. The test administrator then debriefed participants and allowed participants to orally provide feedback.

Participants

There were five novice participants and four expert participants. The novice participants were recruited through advertisements on Craigslist and local newspapers. All novice participants lived in and around the Washington, D.C. metropolitan area and most had used an online mapping tool, such as Google maps, before. The Geography Division provided the lab with a list of expert participants to contact, and the lab recruited and scheduled these individuals for test sessions. The expert participants were

demographers, Geographic Information System (GIS) experts, and urban planners from local counties in the Washington, D.C., Virginia, and Maryland areas.

Demographics, Computer Experience, Age, Novice/Expert Breakdown

The majority of participants (later on referred to as users) were age 31 and older. Please see Figure 1 (below) for a chart of the Age group breakdown.

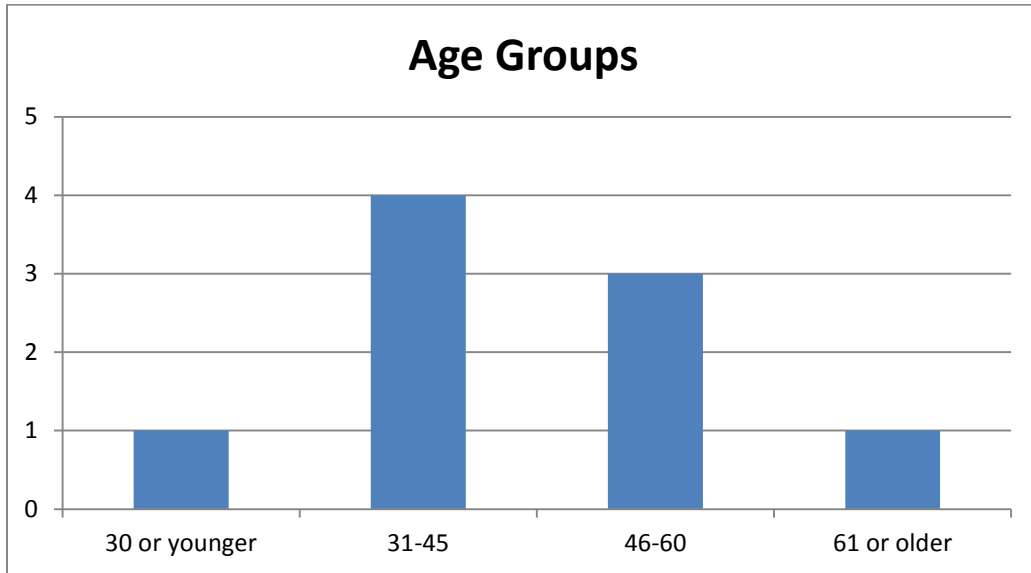


Figure 1: Age group breakdown of the nine users

Education was skewed towards people with Post-Bachelor’s degrees. Other participants ranged from having a high school degree to some college education. Please see Figure 2 (below) for the Education breakdown.

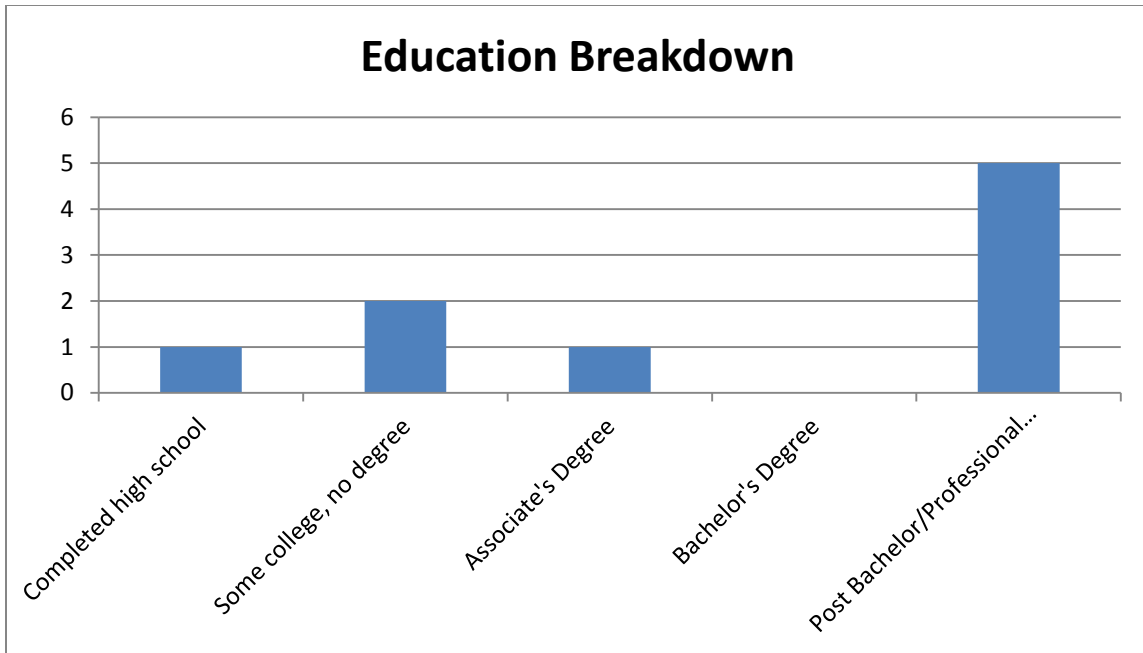


Figure 2: Education breakdown of the nine users

Most participants indicated that they did not have trouble learning how to use new Web sites, manipulate windows, or use the Internet. The three participants who indicated difficulty in learning new Web sites were all novices. Please see Table 1 (below) for the compiled responses.

Table 1: Computer Experience of the nine users*

	How difficult is it for you to learn to use Web sites that you have not visited before?	Computer windows can be minimized, resized, and scrolled through. How difficult is it for you to manipulate a computer window?	How difficult is it for you to use the Internet?
Extremely difficult	0	0	0
Very difficult	0	0	0
Moderately difficult	3	1	0
Slightly difficult	1	1	2
Not difficult at all	5	7	7

*One response is missing

Web sites Tested

Two sites were tested in the Usability study. The current version of TIGERweb that is externally available (from here on referred to as the live site) was tested until the beta Web site was available. The

TIGERweb beta Web site was tested unless problems were encountered and we had to switch back to the live site during the study. User interface differences between the live and beta site focused on the use of transitions between the windows above the map interface and the addition of a Print icon and a spatial icon on the map. The Print and spatial icons were not tested. In addition, the developers later informed us of a glitch in the beta Web site that would not show the urban area codes in the Identify tool. The tool allows users to retrieve data by clicking on a geography determined by the Census Bureau (e.g. urban area).

Tasks

Seven tasks were created for round 1 (See Appendix A: Tasks). Novice participants were asked to complete Tasks 1 through 4, while expert participants were asked to complete Task 1 and then Tasks 5 through 7 as time allowed. Experts were also asked to complete tasks between Task 2 to 4 if time were left in the session.

The test administrator (TA) instructed the participant to read the task aloud before asking them to complete the task. The participant attempted to complete each task before beginning a new task.

In order to examine the entire interface, participants received TA assistance if they were lost or confused. In most cases participants received minimal assistance in Task 1, and the TA showed the participant how to pan and scroll in the interface at the beginning of Task 2 (for novices) or Task 5 (for experts).

Eye tracking

Compiled eye tracking data cannot be provided for the maps and overlays since they were coded via Silverlight and the dynamic web elements are not compatible with the lab's Tobii eye-tracking system. In addition, since testing switched between the beta site and live site, the sample sizes for each group were small. Replays of each individual participant are available for viewing. Those replays show what participants were or were not looking at when overlays opened.

Satisfaction

To measure satisfaction with the Web site, each participant answered three satisfaction questions after each task performed (see Appendix B: Post-Task Questionnaire), and at the end of the entire session, they answered an overall 11-question survey on their satisfaction (see Appendix C: Satisfaction Questionnaire). The three-question post-task survey was online and the overall question survey was on paper.

Results

Accuracy and Efficiency

Accuracy

We measured whether users could complete each task accurately. If the user completed the task accurately (even with TA assistance) that task for that user was considered a "success."

An analysis of the success rate comparing Novices and Experts in Task 1 was conducted since all participants started with Task 1. In this task, users were asked to display a map of all the counties in Virginia. Users did not have to make any “Map Content” selections and only zooming in to the level that displayed the counties in Virginia was required for success. Table 2 (below) shows that Experts had a success rate of 75% while Novices had a success rate of 20%.

Table 2: Task 1 Success Rate by User Group

Category	N	Success Rate
Novice	5	20%
Expert	4	75%

Table 3 (below) shows the Task Success Rate broken down by user group, as well as the number of users in that group who attempted the task. Overall, the experts performed better than novices in novice tasks. However, the expert’s success rate varied when it came to the expert tasks. When participants were asked to display the urban area codes for the Washington D.C., Maryland, and Virginia metropolitan area (Task 5) users did not know where to look for information.

Table 3: Task Success Rate broken down by User Group and Attempts

Accuracy by Tasks	All Users		Novices		Experts	
	N	Success Rate	N	Success Rate	N	Success Rate
T1	9	44%	5	20%	4	75%
T2	6	33%	5	20%	1	100%
T3	8	75%	5	60%	3	100%
T4	6	67%	4	50%	2	100%
T5	4	50%	0	NA	4	50%
T6	4	75%	0	NA	4	75%
T7	3	100%	0	NA	3	100%

Efficiency

We measured time-on-task as an indicator of how efficiently users could find the information using the interface design. The goal of an interface design is to have low time on task with high accuracy. After approximately 8 minutes the TA asked any user who had not completed the task whether he or she would like to move on; thus, there is an upper bound on the task time.

On average, users took over three minutes to complete tasks. Most of the time taken on Tasks 1 and 2 included both time to learn the interface, and time to locate an area on the map. Table 4 (below) shows the average time taken by the different user groups, as well as the number of people who were assigned the task.

Table 4: Efficiency broken down by User Group and Attempts in Minute:Second.Millisecond format

Accuracy by Tasks	All Users		Novices		Experts	
	N	Avg. Time	N	Avg. Time	N	Avg. Time
T1	9	05:18.2	5	06:33.0	4	03:44.7
T2	6	07:33.7	5	08:39.0	1	02:07.0
T3	8	06:40.4	5	08:28.4	3	03:40.3
T4	6	04:32.5	4	05:06.2	2	03:25.0
T5	4	08:39.5	0	NA	4	08:39.5
T6	4	07:46.7	0	NA	4	07:46.7
T7	3	05:21.7	0	NA	3	05:21.7

Satisfaction

At the completion of the last task, participants answered a questionnaire that assessed their satisfaction with the entire Web site. Table 5 (below) shows the satisfaction results averaged across all users, novices, and experts. The questionnaire (Appendix C) is rated on a scale from 1 to 9, with 1 being an unfavorable response, and 9 being the most favorable response to the questionnaire item. The averages indicate that satisfaction for user groups tended to center around the middle points of the scale. However, notably, experts were less satisfied with TIGERweb than novices when it came to SATQ3, SATQ5, SATQ10, and SATQ11c. Specifically, these questions referred to the terminology used throughout the Web site, arrangement of information on the screen, and Census Bureau-specific terminology. SATQ11c referred to the user’s perception of difficulty in using the Web site.

Table 5: Satisfaction Questionnaire Results

SATQ	All Users		Novices		Experts	
	N	Average	N	Average	N	Average
SATQ1	9	4.56	5	5.4	4	3.5
SATQ2	9	6.11	5	6.2	4	6
SATQ3	8	5.50	4	4.75	4	6.25
SATQ4	9	4.78	5	5	4	4.5
SATQ5	9	5.78	5	5.4	4	6.25
SATQ6	9	4.44	5	5.4	4	3.25
SATQ7	9	4.00	5	4.4	4	3.5
SATQ8	9	5.11	5	5.6	4	4.5
SATQ9	9	4.00	5	4.4	4	3.5
SATQ10	9	6.00	5	5.8	4	6.25
SATQ11a	9	3.17	5	3.1	4	3.25
SATQ11b	9	3.00	5	3	4	3
SATQ11c	9	3.11	5	2.4	4	4

Post Task Satisfaction

Participants were verbally instructed to answer a short three-item questionnaire after each task to assess the Web site based on the Task they completed. This allows us to examine if satisfaction is linked to the difficulty of a task as well as different areas of the Web site. For example, users may find Task 1 easy since they zoom in to the state of Virginia to display the counties. However, finding the population and housing units in Delaware (Task 7) may be more frustrating. Three statements were used on the Post Task Questionnaire. The first question, "Using TIGERweb is a frustrating experience," examined whether users found the site frustrating to use when trying to accomplish a particular task. The second question, "TIGERweb is easy to use," assessed their perceived ease in trying to complete the task. The last question, "I have to spend too much time correcting things with TIGERweb," assessed whether they think they have to keep modifying their selections or actions to get to their desired result. Participants rated how strongly they Agreed (a 7 on the questionnaire) or Disagreed (a 1 on the questionnaire) with each statement. The following three figures chart the Post Task results with the lines representing each of the three statements and the X axis representing the Task. Please keep in mind that Frustrating (-) and Corrections (-) are negative statements, therefore higher ratings on the scale are worse. While Easy (+) is a positive statement and higher ratings are better.

Figure 3 (below) shows the Post Task results for all nine users. Overall, most ratings were centered on the scale (represented by the middle point 4).

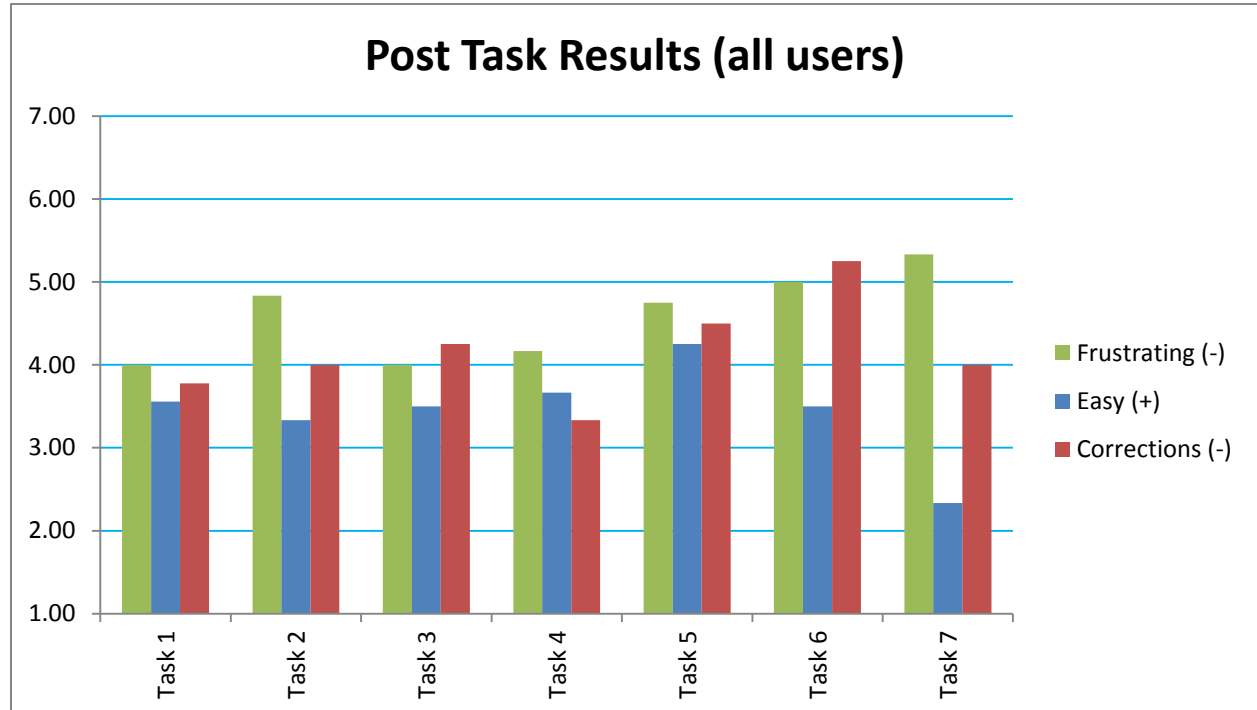


Figure 3: Post Task results for all nine users. Not all users completed all tasks.

Figure 4 (below) shows the Post Task results for the five novices who were assigned Tasks 1 -4. Although most novice participants did poorly on their assigned tasks, Figures 4 and 5 show that they did not seem to be any more frustrated than the expert users. Additionally, they reported that the Web site was somewhat difficult to use.

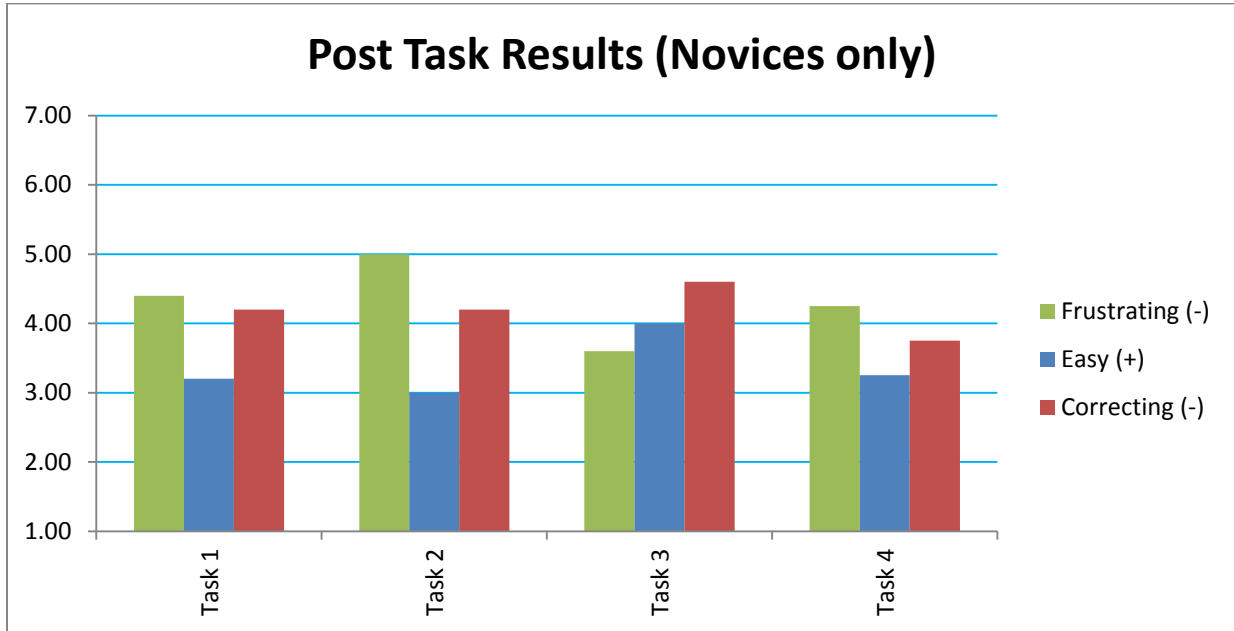


Figure 4: Post Task Results for the 5 Novices. These Novices only attempted Tasks 1 through 4.

Figure 5 (below) shows the Post Task results for the four experts that generally received Task 1 and Tasks 5 through 7. Some of these experts also completed Tasks 2 – 4 depending on the amount of time left after completing the expert tasks. Task 2 does not have an average because only one expert user was assigned the task. Overall, expert users were more critical of TIGERweb. Experts were particularly frustrated with TIGERweb (Tasks 5 – 7) and thought they had to keep making corrections to get to their goal.

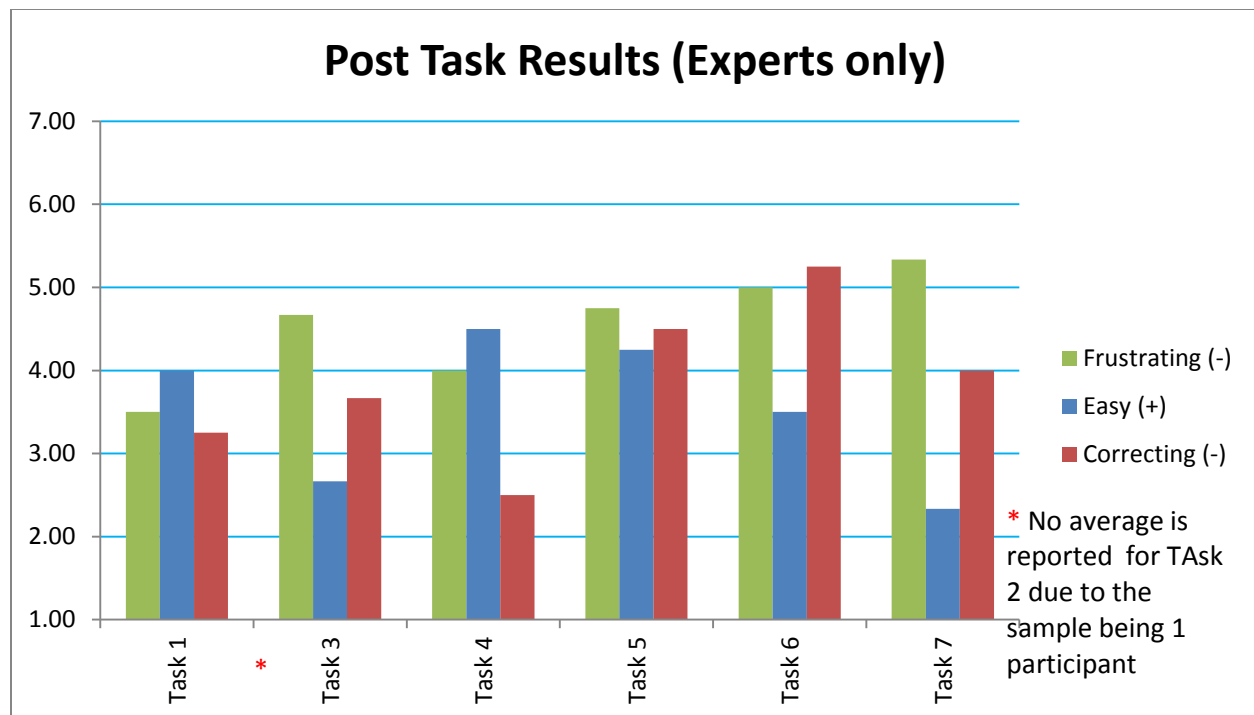


Figure 5: Post Task Results for the 4 Experts. These Experts usually attempted Task 1, and Task 5 – 7. However, some experts also completed Tasks 2 – 4. Only one expert participant completed Task 2; thus, no data are reported for Task 2.

Usability Findings

The next section discusses interface design issues that caused users difficulty in completing the tasks. The issues are divided into high-priority issues, medium-priority issues and low-priority issues.

High Priority

Map Content Overlay Confusion

Issue: The majority of novice and expert users did not know how to proceed past the “Map Content” box without TA assistance. Users often clicked on the layers in the “Map Content” box, and expected to be taken to a screen displaying the information they had just selected. Some users looked for a button within the box to take them to the information while others said they expected to be taken to the information after making a selection. In most cases, this led to task failure since some participants did not know how to close or minimize the box. One expert user moved the “Map Context” box and clicked the map in rapid succession. Other users were puzzled why some labels were checked by default. For example, it was not clear to the user why hydrography, the mapping of water topographic features, was checked by default. Although bodies of water are potentially useful as a resource for locating one’s position, this is not conveyed to the user. One user who figured out how to use map content learned to turn off hydrography.

Recommendation: Do not have the “Map Content” box cover the map in the beginning. Before a user makes a selection, the “Map Content” box is transparent; however, this has not cued the user that there is a map behind the box in our observations. Re-position the box so users can see a map or do not have

it open until the user clicks on the “Map Content” icon. Another option is to make the content box a side bar that the user can either open or close but not move. One expert made that suggestion. Other tool features could be added to the side bar, eliminating the need for some of the icons.

Legend Overlay Confusion

Issue: Users who were tested on the beta site often tried to click on the items inside the “Legend” overlay. The “Legend” overlay appeared on the right hand side of the beta Web site and showed relevant layer data as the user zoomed in or out of the Web site. Due to a bug, the “Legend” often remained on the screen, blocking content that appeared behind it (such as the Help dropdown). Often users clicked on the items in the overlay, particularly state, and expected to have an option to choose what state they wanted information from. Out of the six users tested as of 5/29/2012, only one mentioned that it was a Legend that showed information as you zoomed in and out.

Recommendation: Based on e-mails with the developers of TIGERweb, we have no recommendation about the “Legend” being stuck on the page since it is a bug. However, we suggest that the team identify a way for users to interact with the “Legend” to find their data. For example, if they clicked on State, they should be able to reposition themselves on a state by choosing the corresponding name. In later usability sessions the bug was resolved and the overlay no longer appeared. We are unsure if this “overlay” was an intended feature or a debugging tool.

Query is Complicated

Issue: Users often mentioned that they would like to be able to search for the geography or road we asked them to find in the task. One expert user said, “Map needs some type of conventional navigation. ... things that people would try to find in a street map if they were trying to find their location.” When asked, this same expert user said, “Some of the basic navigation is really poor.” There is an “inability to do a simple geographic search, to have a location in mind and put it in a search tool.” In trying to complete Task 1, a novice participant said, “I don’t see a search.”

A query function is available on TIGERweb; however, it does not function like any other mapping Web site search tool that users would be familiar with (e.g., Google Maps, MapQuest, Bing Maps). For example, one participant tried entering a school name when asked to locate his/her county’s school district. The query function, see Figure 6, requires the user to make several selections as to the layer and map extent before they can search. As a result, the search did not work for most users, as they chose the incorrect layer, or accidentally selected map extent. For example, one participant selected Metropolitan areas when looking for Suitland instead of Census Designated Places. Although TIGERweb is designed for people who are familiar with Census Bureau terminology, people who are unfamiliar with Census Bureau jargon may use it. When the TA asked one user what he expected from a query tool, he mentioned a search where he could type something in. An expert user said there should be a place “where I can just type it in.” And even expert participants had difficulty identifying the right resource to use when encountering the terminology in Figure 7. Other users tried to enter their road names and received “Sorry! No features are found.” The vagueness of the error message may lead to the user to think either the data does not exist or the query tool is broken. We also noticed on one occasion a user

typed in “virginia” and received the error message before capitalizing “Virginia.” However, users are not informed that the query tool is case-sensitive.

Query

Select Map: Metropolitan and Micropolitan Statistical Areas

Within the Map Extent

Select Layer:

- Combined New England City and Town Areas
- New England City and Town Area Divisions
- Metropolitan New England City and Town Areas
- Micropolitan New England City and Town Areas
- Combined Statistical Areas
- Metropolitan Divisions
- Metropolitan Statistical Areas
- Micropolitan Statistical Areas

Provide at least one field before submitting the query

Name:

AND

GEOID:

Submit Query

Figure 6: Query requires making a layer selection and filling in a field

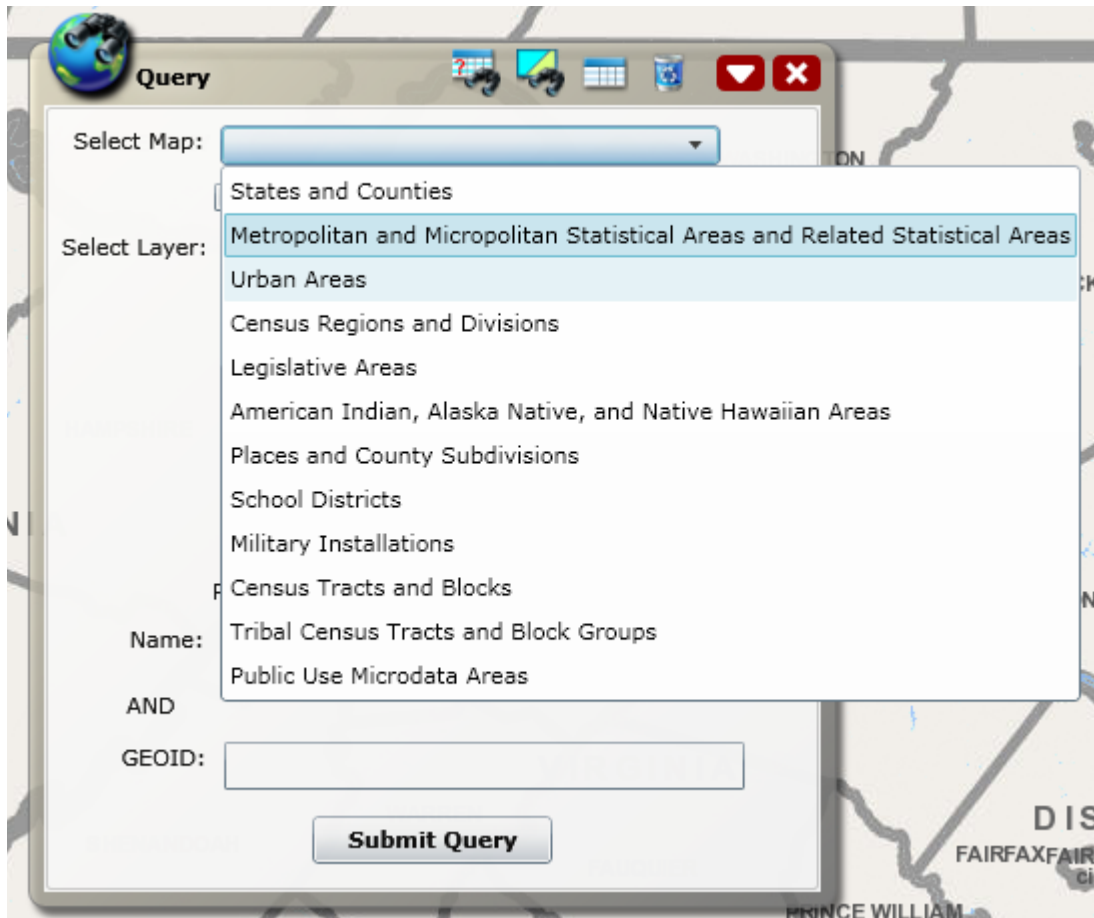


Figure 7: The Query tool requires users to select a map

Recommendations:

- Simplify the query function to a generic text search and place the advanced filtering functions in a separate tab.
- Further specify that users should select one field from above. It may also help to bold part of the message to help it stand out.
- Avoid using Census Bureau jargon.
- Offer guidance to participants when no results are found.
- Use case insensitivity.

Slow to Load

Issue: The site is slow to load, and most of the users commented on the loading time. The long load times often gave users the impression that nothing was on the map. For example, when it came to roads users would zoom out after zooming in since they thought nothing was there when in fact the layers were loading.

Recommendation: If possible, decrease load time. See Loading Indicator issue as well.

Loading Indicator

Issue: The loading indicator appears faintly on the bottom of the screen. When users are looking for information they focus their attention at the middle of the screen; thus they may miss these indicators. Participants often commented that there was nothing on the map while, the indicator showed the layers loading. One participant mentioned that he didn't see a loading indicator and "was expecting a spinning wheel or something." When the TA pointed out the loading indicator in the debriefing, the participant replied, "I didn't see that and the bar wasn't obvious."

Recommendation: Re-design the loading indicator so it is more prominent. Place the indicator in the middle and use colors that will differentiate it from the background.

Medium Priority

Icons

Issue: Novice users had greater difficulty than experts in figuring out what the icons in Figure 8 represented. One user mentioned that he would like to search for a geography, and went into Help looking for a search tool. He did not find the Query tool until the TA asked about it in the Debriefing. He further commented on the icons, saying that they are not intuitive. Another user said, "That's an interesting icon for Map Content." For the user, the icon was not conveying "Map Content" to them. Another, expert when asked to find Suitland, MD, said, "who knows where Suitland is really. I have to zoom into MD to find it. There should be type it in and it could take you to that area." This user later found the query after the TA asked if she thought there was any other way to look for Suitland. An expert user said that she only knew to use the "i" icon to find urban area codes because the same icon is used in ArcMap. This user may have missed the "i" icon had she not been an "ArcMap" user. This user praised the use of words under the three icons containing the panning tool and suggested that words be under all the icons. At the first task, a novice user said that she would go to Help and then pointed with her mouse to the "i" icon. For the imagery icon, one novice user said that she assumed it would provide information like what Google Earth provides. This is not the case. The tool shows a "satellite" view of the planet when you zoom far enough out, but oddly the U.S. always remains in a more plain view.



Figure 8: "Map Contents", "Identify", and "Query" icons

Recommendation: Use more established icons so users can bring past experience with other mapping Web sites to TIGERWeb. For example, instead of binoculars, one could use a magnifying glass. Instead of mouse hovers, place the words under the icons. Place all the icons in one row or eliminate most of the icons and use a side bar to contain the tools as suggested earlier.

Layers

Issue: Users rarely zoom in far enough for the labels to pop up. Combined with the time taken to load the relevant layers, users are receiving the impression that the information does not exist. Users mentioned that having state labels from the start would help someone who is unfamiliar with United States geography to locate a state. One expert user in particular said she would expect that state initials would show up from the very beginning. Likewise, users thought that roads should be visible at a higher zoom level since they frequently thought the roads didn't exist. Often this resulted in the TA having to instruct the user to zoom in more. Combined with the unfamiliarity of the layers, users have to guess and zoom in to see if they found the right label. One expert user did not like having to zoom past the county level since "you lose the topography of the bigger area." Another expert user understood why the zoom levels were in place but thought roads should be at a higher level to help users identify where they were. Even users who were familiar with their surrounding geographies had difficulty orienting themselves due to the zoom level. This resulted in additional time spent panning the map.

Recommendation: Show the labels associated with a layer sooner (at a higher zoom level).

Level of information and design of the identify results tool

Issue: The "identify results" tool provides a lot of information that is perhaps not needed. An expert user said, "This attribute dump is a little bit frustrating if I've only asked for a couple of things in there to suddenly be getting aerial hydrography.... Going through these meaningless attributes is quite annoying." This expert suggested a user who wants the latitude and longitude would probably download the information and not need it in a display. This same expert did not immediately find the population counts for Delaware even though she quickly brought up the results for Delaware using the "identify results" tool. The combination of geographic results in the "identify results" pane and the fact that the two demographic items were labeled with an acronym resulted in her failure to find the population count.

Recommendation: Consider allowing the user to identify the data he or she is interested in similar to the design of "Map Contents". Additionally, label the data with the data source year. Consider clearly identifying geographic and demographic data separately. The urban area codes are not available for geographic areas in the identify tool and this should be corrected in the beta.

Color and Boundary Identification

Issue: Users had difficulty differentiating the different layers when multiple selections were made. For example, one novice user identified his/her school district but also thought it was hydrography. Another participant, an expert user, had difficulty discerning an urbanized area from his other selections despite de-selecting irrelevant layers to clean up the map.

Recommendation: One user suggested having a visual indicator next to the layer in "Map Contents." He also suggested in a later task having a way to call out an area by putting it in a separate container. Notably, he also works on GIS services for Alexandria, VA and is working on a similar mapping program.

Low Priority

Census Bureau Jargon

Issue: Terminology such as GEOID and HU100 are Census Bureau jargon that may be unfamiliar to users of TigerWeb. Novice participants often commented on the jargon and wondered what it was. Other expert participants pointed out terminology such as micropolitan that users wouldn't understand. When asked "what does micropolitan mean" by the TA the participants either provided an accurate guess, inaccurate guess, or a "I don't know." Sometimes this resulted in the participants navigating by guessing. One participant said "Places and County Subdivisions" and said, "I don't know why I clicked that.. but.." One expert participant commented that although she knows some Census Bureau terminology she was confused.

Recommendation: There doesn't seem to be a lack of space on the Information overlay. For terminology such as POP100 and HU100, write out what they represent. For other terms such as GeoID it may be helpful to have a reference or dictionary in Help that users could refer to.

Minimized Overlays

Issue: Users often clicked on the icon of a collapsed overlay. For example, one expert participant minimized the "Map Contents," "Identify," and "Query" windows and stacked them in a corner. When he needed one of these tools he would then click the associated icon several times wondering why it didn't come up before realizing he needed to expand the window. Despite acknowledging that he needed to always expand the window first, he continued to do this for the rest of the session.

Recommendation: Expand the windows when a user clicks on the icon. The current method of expanding the overlays requires the participant to realize his/her mistake.

State Click

Issue: Users expected the map to react to single mouse click on a state. Users were expecting that information will come up when they click on geography, similar to the current implementation of the "Identify" tool. One user specifically mentioned this when he clicked on a school county boundary without using the "Identify" tool and expected information on the school county. An expert user said that she wanted to click on a highlighted area to obtain information about that area without having to use another tool.

Recommendation: We are unsure where the user's mouse click behavior came from. Our test users have had experience using Google Maps, MapQuest, and other mapping tools online and none of these tools use single mouse clicks. As such, the only recommendation we have is an instruction to double-click.

Left Navigation Tools

Issue: The left navigation tool is one of three navigation tools available to users but most users did not use this part of the interface until the TA showed them how to use it. The buttons are transparent until a mouse hovers over it, and as a result may have led to users ignoring them. Typically, gray is used to

indicate inactive or inaccessible options. The transparency in Figure 9 may have led to the impression that these tools were not available.



Figure 9: TigerWeb's Navigation tool blends into the background

Suggestion: Make the navigation tools more opaque or use a darker gradient to make it visually distinct. Both MapQuest and Google Maps have navigation tools that appear active. Please see Figure 10 (below) for a comparison.



Figure 10: Mapquest (left) and Google Maps (right) use contrast to highlight the Navigation tool.

Demographic and detailed boundary information

Issue: At least two expert users expressed interest in being able to “turn on” demographic data associated with the geography they had selected, just as they turned on boundary information. One user expressed interest in obtaining specific school boundaries, not just boundaries at a higher level. One novice user wanted to see the list of schools associated with the user-specified boundary when working through Task 2.

Recommendation: Consider linking the geographic data to other data sources to create a rich tool for multiple uses.

Help

Issue: One expert user tried to use the help files. She said, “Help file doesn’t seem to be for TIGERweb.” Other users who consulted Help also did not find it useful. A novice user sought Help during Task 2 and found nothing that would assist her. One user mentioned in the debriefing that it would have been nice to have a way to consult help on the Web site. When the TA pointed out the icon, the user responded that she must have been too focused on finding an answer.

Suggestion: Update the help for TIGERweb. Help should be specific to this Web site and not an advertisement for other Web sites. If the icon sets are re-organized, make Help stand out visually.

Spatial search query tool

Issue: The usefulness of the spatial search query tool is not apparent. One expert user said that she wondered what she would use it for during the final overview of the system. The intended functionality of this feature is to allow users to create shapes or boxes that allow them to zoom in to a specific area; however, the shapes only appear after a user makes several selections as to which layer they want.

Recommendation: Clarify the use of the spatial tool.

Unit numbers

Issue: Users familiar with other mapping tools expected that they can search for a street number. An expert user appeared surprised when the TA said the system did not contain street numbers. A novice user said that the system should be able to provide a map so a person could get from one area to another. This user appeared to assume from this comment that street numbers would be available. One expert user said that she realized unit numbers were not available.

Recommendation: Make it clear that street numbers are not available.

Map

Suggestion: One expert said that the water lines should be below the layer for the state lines. Both authors noticed and commented to each other that the size of Alaska was too big in comparison to the lower 48 states of the U.S.; however, none of the participants made any comments regarding the size of Alaska.

Conclusion

TIGERweb proved to be a challenging application for all novice users and some of the expert users. One novice user who could not accomplish any of the tasks said, "I don't like TIGERweb. ... It is difficult." The low success rate, satisfaction scores, and relatively high time-on-tasks provide quantitative data that TIGERweb could use some improvement.

Because TIGERweb is a publicly-accessible Web site, developers should focus on creating a simple design for the novice user, with advanced features available in a tab. We recommend developers focus on creating a simple search tool and a side-bar containing the geographic and demographic data available to select.

Improving load time and when the layers appear will help users find areas of interest. Expert users would find it useful if demographic data were available as well as better color and boundary identification.

References

Ericsson, K. A. & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data*. Revised edition. Cambridge, MA: The MIT Press.

Appendix A: Tasks

Question 1: Imagine you are moving to Virginia. You want to see a map of Virginia with the outline of all the counties and their names. Using TIGERweb, what would you do to find this information?

Question 2: Now imagine you are moving to Virginia and you have school-aged children. You heard Fairfax County has the best schools. You want to see the school boundaries for Fairfax county using TIGERweb. Once you find the information, trace the county boundary and the school boundary with your mouse.

Question 3: Using TigerWeb find the street that you live on. Display the street and county school district for your street.

Question 4: Using TIGERweb, what State Legislative District do you live in?

Question 5: Using TIGERweb, display the Washington DC, VA, MD urban area boundaries and the county boundaries that they are associated with. Also, obtain the urban area codes

Question 6: An interviewer needs a map of roads in Suitland, Maryland that overlays places with census tracts. Using TIGERweb, create a map for this interviewer.

Question 7: Using TIGERweb, obtain number of housing units and number of people for the state of Delaware.

Appendix B: Post-Task Questionnaire

Using TIGERweb is a frustrating experience.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

TIGERweb is easy to use.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

I have to spend too much time correcting things with TIGERweb.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

Appendix C: Satisfaction Questionnaire

Please circle the numbers that most appropriately reflect your impressions about using this Web-based instrument.

- | | | | | | | | | | | | |
|---------------------------------------------------------|--------------|---|---|---|---|---|---|---|---|----------------|--|
| 1. Overall reaction to the Web site: | terrible | | | | | | | | | wonderful | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 2. Screen layouts: | confusing | | | | | | | | | clear | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 3. Use of terminology throughout the Web site: | inconsistent | | | | | | | | | consistent | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 4. Information displayed on the screens: | inadequate | | | | | | | | | adequate | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 5. Arrangement of information on the screen: | illogical | | | | | | | | | logical | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 6. Tasks can be performed in a straight-forward manner: | never | | | | | | | | | always | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 7. Organization of information on the site: | confusing | | | | | | | | | clear | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 8. Navigation: | impossible | | | | | | | | | easy | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |
| 9. Overall experience of finding information: | difficult | | | | | | | | | easy | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | not applicable | |

10. Census Bureau-specific terminology:

too frequent

appropriate

1 2 3 4 5 6 7 8 9 not applicable

11. Overall reaction to the Web site:

Terrible

Wonderful

1 2 3 4 5 6 7

Frustrating

Satisfying

1 2 3 4 5 6 7

Difficult

Easy

1 2 3 4 5 6 7

13. Additional Comments (use the back of this paper if necessary):