

STUDY SERIES
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**Eye-tracking Study Report: Examining User Patterns for
Demographic Items on the 2007 and 2008 ACS Mail Forms**

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U S C E N S U S B U R E A U

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Date: December 1, 2009

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Subject: Eye-tracking Study Report: Examining User Patterns for Demographic Items on the 2007 and 2008 ACS Mail Forms ¹

Human–Computer Interaction Memorandum Series Number 140

1 Abstract

This usability study was requested by the Housing and Household Economics Statistics Division (HHES) to investigate the possible reasons why a sharp drop occurred in the unweighted sample number of households (from about 6,000 to 2,500) between the 2007 and 2008 ACS data where the sex of the spouse was the same as the householder. For this study, participants completed a low-fidelity version of either the 2007 or the 2008 ACS mail form and their eye movement patterns were compared. The results showed that participants tended to use many different patterns or strategies when completing the 2007 ACS form while all of the participants who completed the 2008 form used the same basic strategy. Additionally, participants reported being more satisfied with the 2008 form overall, although there was no significant difference in the amount of time taken to complete the two different versions of the form. Additionally, although participants tended to look at the gender item for longer periods of time with the 2008 form overall, the difference was not significant. Although there is evidence that participants showed less systematic eye movement patterns for the 2007 form, there was not direct evidence that the change in the form layout caused the decrease in the reporting of households where the sex of the spouse was the same as the householder.

Key Words: **Eye-tracking, survey design, American Community Survey, same-sex spouse statistics**

¹This report is released to inform interested parties of (ongoing) research and to encourage discussion (of work in progress.) The views expressed are those of the authors and not necessarily those of the U.S. Census Bureau.

2 Introduction

This study, requested by the Housing and Household Economics Statistics Division (HHES), investigated the possible reasons why a sharp drop occurred in the unweighted sample number of households (from about 6,000 to 2,500) between the 2007 and 2008 ACS data where the sex of the spouse was the same as the householder. An examination of a sample of households where the sex of the householder and the spouse was reported to be the same in 2007 compared to 2008 indicated that the majority of the decline (over 75%) occurred in households where the sex of one respondent was possibly mismarked, as judged by an examination of their first names and the box that was marked for their sex.

Although the 2008 ACS data still yields considerable same-sex spouses, the drop is very problematic because of the sensitive nature of the data and the numerous demands that have been made for the Census Bureau to release this data. The sponsors examined and dismissed many possible reasons for this decline. Through the process of elimination, they determined that a possible cause for this decline was the major change in the instrument format from a grid pattern (<http://www.census.gov/acs/www/Downloads/SQuest07.pdf>) for years prior to 2007 to a sequential pattern (<http://www.census.gov/acs/www/Downloads/SQuest08.pdf>) beginning in January 2008, as the principal outstanding yet unresolved reason for this change. The current ACS format closely mimics the format of the 2010 Census, which uses a sequential format.

One major relevant part of this change in design affects both the location and layout of the gender question. In the 2007 format, gender was the second item after the person's name, with the response of "male" and "female" vertically ordered adjacent to the name (grid layout). In the new 2008 format, gender is the third item after the name and relationship items, with the responses horizontally ordered (sequential layout). It is believed that both the question order and the layout may have affected responses to the gender item, facilitating the drop in the number of same-sex spouse households. This study examined differences in respondent gaze patterns while filling out pages 2 and 3 of the 2007 and 2008 surveys.

2.1 Research Goals

The sponsor requested that the following questions be examined to the extent possible using a digital (HTML) mock-up of the first few pages of the 2007 and 2008 ACS mail forms:

1. Did the change in this format alter the way in which respondents proceed to visualize and answer the items on the form in terms of continuity of response from one item to another?
2. Do participants overlook any items (specifically the item on gender)?

3. Is there a difference in the duration of time participants spend in answering the items between the 2007 and 2008 forms?
4. Are participants' gaze paths more continuous between the sex and relationship items in 2008? The format change removed the age item and the answering pattern is more structured by the form that forces the respondent to work through all the items for person X before going to person X+1.
5. Do the patterns of visual responses seem more confused in the grid pattern as judged by visual eye movements and where the clicks of the mouse are made?
6. Do people using the 2007 format answer all items for persons X before going to person X+1?

3 Method

In order to investigate the issues above with the lab's current equipment (Tobii 2150, which can only analyze digital on-screen stimuli), the usability lab converted the PDF versions of the 2007 and 2008 ACS mail forms into HTML pages that could be studied using the lab's current eye-tracking equipment. Pages 2 and 3 of each of the forms were converted into a double-page layout to simulate the way that a respondent would view the mail form while answering the first few questions. After a dry run where the participant found the form difficult to read when it was displayed without scrolling, the usability contact and the sponsor team decided to display the double-page layout at a legible size, although completing the form for the testing would require a participant to scroll horizontally and vertically. Participants worked on these two pages of the ACS form; the low-fidelity HTML interface did not allow them to proceed to complete the remainder of the survey. Figure 1 shows the 2007 version of the ACS and Figure 2 shows the 2008 version of the ASC mail form.

13197025

List of Residents

READ THESE INSTRUCTIONS FIRST

This survey collects information about the people who are living or staying here for more than 2 months.

On the List of Residents - **Include** everyone living or staying here for more than 2 months. In the Person 1 space, list one of the people living here who owns or rents this house or apartment. Additional household members should be counted on the list if you are staying here for more than 2 months.

Do not include anyone who is living somewhere else for more than 2 months, such as a college student living away.

If no one is staying here for more than 2 months, do not list any names in the List of Residents. Complete only pages 4, 5, and 6 and return the forms.

If you are not sure whom to list, call 1-800-354-7771.

If there are more than five people living or staying here, print their names in the space for Person 8 through Person 12. We may call you for more information about them.

After you complete the List of Residents, answer the questions asked at the top of pages 4, 5, and 6 for the first five people on the list.

13197033

NOTE: Please answer BOTH Questions 5 and 6.

5. What is this person's marital status?

6. Is this person Spanish/Hispanic/Latino? Mark (X) the "Yes" box. If not, mark the "No" box.

7. What is this person's race? Mark (X) one or more races to indicate what this person considers himself/herself to be.

Person 1 through Person 12

When you are finished, turn the page and continue with the following section.

Figure 1. ACS 2007 Mail Form (Grid Layout)

13198023

13198031

Person 1 **Person 2**

Person 3 **Person 4**

1. What is Person 1's name? Last Name (Please print) First Name MI

2. How is this person related to Person 1? Mark (X) ONE box.

3. What is Person 1's sex? Mark (X) ONE box.

4. What is Person 1's age and what is Person 1's date of birth? Please report dates at age 0 when the child is less than 1 year old. Print numbers in boxes.

5. What is Person 1's race? Mark (X) one or more boxes.

6. Is this person Spanish/Hispanic/Latino? Mark (X) the "Yes" box. If not, mark the "No" box.

7. What is Person 1's race? Mark (X) one or more boxes.

Person 1 through Person 4

ACS-12008(KF), Page 2, Base (Black) ACS-12008(KF), Page 2, Green Pastoson 354 (20 and 40%) ACS-12008(KF), Page 3, Base (Black) ACS-12008(KF), Page 3, Green Pastoson 354 (20 and 40%)

Figure 2. ACS 2008 Mail Form (Sequential Layout)

3.1 Participants

Participants for this testing were thirteen internal Census Bureau employees recruited by the Usability lab and by the sponsor team. Although none of the participants worked directly on developing the ACS mail forms, some mentioned having worked on issues related to some of the specific questions that constitute the survey. All participants volunteered their time and received no monetary compensation to participate in the study. Starting with the first participant's random assignment to the 2008 form, the participants were alternatively assigned to one of two conditions corresponding to either the 2007 or the 2008 form. Participants were assigned in this manner to ensure that equal numbers of people were assigned to each of the prototypes as the study progressed. Future testing would involve randomly assigning participants to condition as well as recruiting external (non-Census Bureau employee) participants.

3.2 Facilities and Equipment

Testing Facilities

The test participant sat in a small room (5K512), facing a one-way glass and a wall camera, in front of an LCD monitor equipped with an eye-tracking machine that is placed on a table at standard desktop height. The test participant and test administrator were in the same room for this testing.

Computing Environment

The participant's workstation consisted of a Dell personal computer, a 21-inch Tobii LCD monitor (Tobii model 2150) equipped with cameras for eye tracking, a standard keyboard, and a standard mouse with a wheel. The operating system was Windows XP for all participants.

Audio and Video Recording

Video of the application on the test participant's monitor was fed through a PC Video Hyperconverter Gold Scan Converter, mixed in a picture-in-picture format with the camera video, and recorded via a Sony DSR-20 digital Videocassette Recorder on 124-minute, Sony PDV metal-evaporated digital videocassette tape. Audio for the videotape was picked up from one desk microphone and one ceiling microphone near the test participant. The audio sources were mixed in a Shure audio system, eliminating feedback, and fed to the videocassette recorder.

Eye-Tracking

The participant's eye movements were recorded during the usability test using a trial version of Tobii Studio Enterprise Edition (Tobii Technology Inc., 2008). The Tobii eye-tracking device monitors the participant's eye movements and records eye-gaze data. This type of eye-tracking requires the calibration of each eye. Data collected from the eye-tracking device includes eye-gaze position, timing for each data point, eye position, and areas of interest. The Tobii 2150 eye tracker records data at a rate of 50 Hz. When a participant looks away or blinks, or if the eye tracker loses track of the participant's pupil, these data are recorded as missing data and this does not stop the data recording. Often, the eye tracker will regain tracking status of the participant's pupil and data recording will begin again within a few seconds following a glance away from the computer screen.

Areas of interest (AOIs) for the 2007 and 2008 ACS mail forms were defined prior to the usability evaluation and can be found illustrated spatially in Figures 3 and 4, respectively and listed in Table 1. AOIs are typically used in eye-tracking analysis to evaluate how many times and how long participants looked at a certain area of the screen. The AOIs of most interest to the current study are Person 1, Person 2, and Person 3. Future studies and reports may utilize the data from the other AOIs. The unit of measurement for a digital display on the Tobii system software and hardware is one pixel, and AOIs are defined by their X and Y pixel coordinates. The entire screen has a resolution of 1024 by 768 pixels.

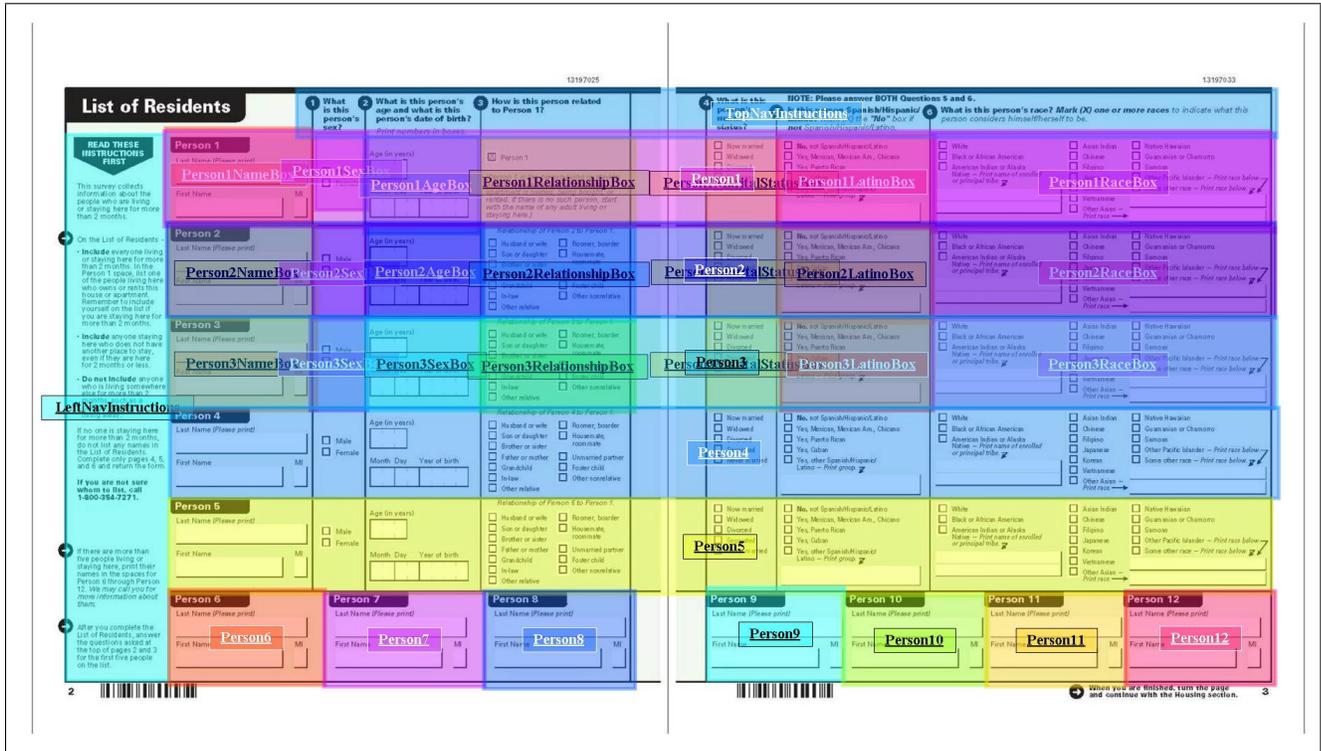


Figure 3. Areas of Interest for the 2007 ACS Mail Form

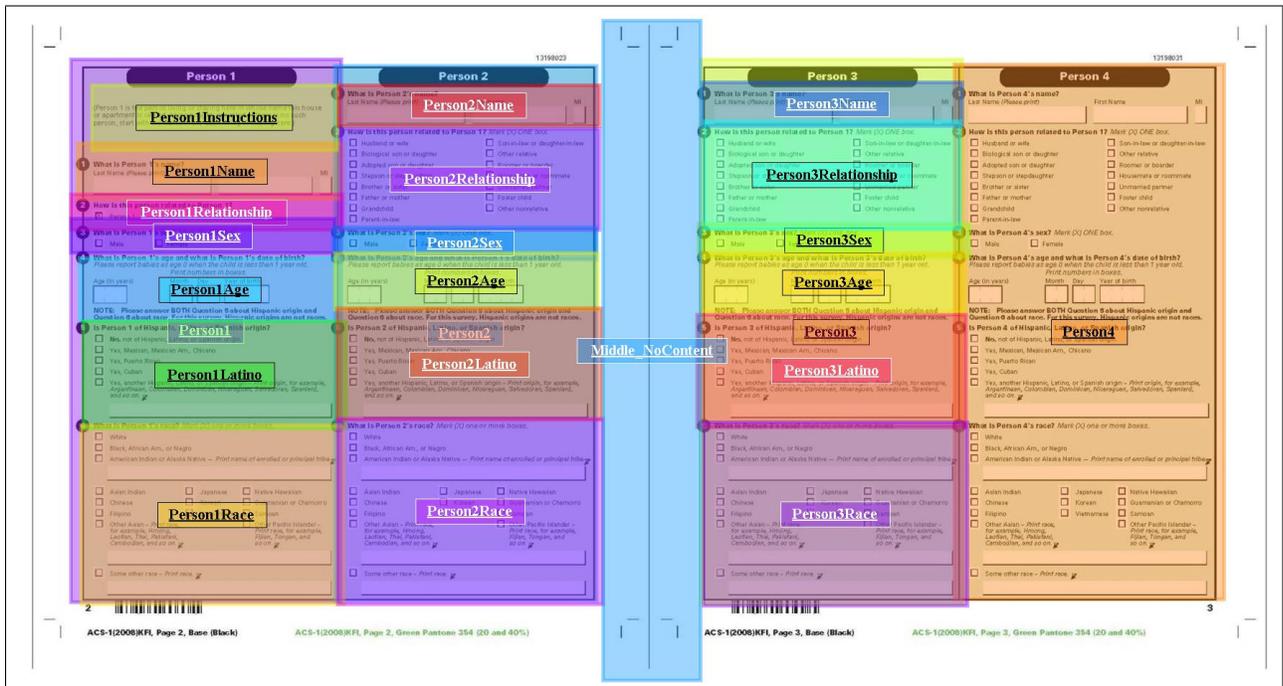


Figure 4. Areas of Interest for the 2008 ACS Mail Form

Table 1 demonstrates that there are fewer separate conceptual areas of the 2008 form than

there were for the 2007 form. Therefore, the 2008 form had fewer AOIs than did the 2007 form. The greater simplicity of the 2008 form is consistent with the basic principle of usability that recommends reducing respondent cognitive burden and potential confusion (Cappel & Huang, 2008). Also, providing space for data for 12 householders on one double-page layout is excessive for the average United States household, which only has between 2 and 3 people according to the 2000 Census (<http://factfinder.census.gov/servlet/SAFFacts>).

Table 1. Areas of Interest for the 2007 and 2008 ACS Mail Forms

2007 AOIs	2008 AOIs
Left Navigation Instructions	Person 1 Instructions
Top Navigation Instructions	–
Person 1	Person 1
Person 2	Person 2
Person 3	Person 3
Person 4	Person 4
Person 5	–
Person 6	–
Person 7	–
Person 8	–
Person 9	–
Person 10	–
Person 11	–
Person 12	–
Person 1 Name	Person 1 Name
Person 1 Sex	Person 1 Sex
Person 1 Age	Person 1 Age
Person 1 Relationship	Person 1 Relationship
Person 1 Marital Status	Person 1 Marital Status
Person 1 Latino	Person 1 Latino
Person 1 Race	Person 1 Race
Person 2 Name	Person 2 Name
Person 2 Sex	Person 2 Sex
Person 2 Age	Person 2 Age
Person 2 Relationship	Person 2 Relationship
Person 2 Marital Status	Person 2 Marital Status
Person 2 Latino	Person 2 Latino
Person 2 Race	Person 2 Race
Person 3 Name	Person 3 Name
Person 3 Sex	Person 3 Sex
Person 3 Age	Person 3 Age
Person 3 Relationship	Person 3 Relationship
Person 3 Marital Status	Person 3 Marital Status
Person 3 Latino	Person 3 Latino
Person 3 Race	Person 3 Race

3.3 Materials

Usability testing requires the use of various testing materials. Testing materials include the following items, which are provided in the appendices noted.

General Protocol

Each participant was read a general protocol, which can be found in Appendix A. The test administrator read some background material and explained several key points about the session. The general protocol emphasizes that the participant's skills and abilities are not being tested, but that the participant is helping in an evaluation of the survey form's overall usability.

Consent Form

Prior to beginning the usability test, the test participants completed a general consent form supplied in Appendix B. The consent form documents the participant's agreement to permit videotaping of the testing session and states that the study is authorized under Title 13 of the U.S. Code.

Background Survey

All of the participants filled out a background survey about their demographics, age, and computer experience. This survey can be found in Appendix C.

Questionnaire for User Interface Satisfaction (QUIS)

Each participant completed a QUIS survey (Chin, Diehl, & Norman, 2008) tailored to the interface being examined after their usability section with eye-tracking was complete. This QUIS instrument can be found in Appendix D.

4 Results

Analysis of the eye-tracking results was performed using a trial version of Tobii Studio Enterprise software (Tobii Technology Inc., 2008) and Matlab (The Mathworks, 2007). The analysis was tailored to this study in order to answer the specific questions posed by the HHES team. Although statistical analyses were performed in order to compare participant performance between the two versions of the ACS mail form, the reader should keep in mind that the number of participants was small ($n = 13$) and that the participants were not randomly sampled from a population, nor were they randomly assigned to condition. The usability team plans to conduct further testing in FY2010 with more participants using the lab's anticipated X120 eye-tracking equipment, which has a higher sampling rate of 120 Hz (120 samples are taken at regular intervals for every second of recording).

Overall, the participants who interacted with the 2007 ACS form showed much more variability in their strategy for filling out the form. Most participants did not fill out the questions on the 2007 form by following the numbered sections horizontally across pages 2 and 3 for Person X before moving on to Person X+1. Further, several participants who saw the 2007 form stated that they were not sure they were finished with this section of the survey. They proceeded to look around the form before deciding they had provided all of the information necessary for their assigned three-person household. None of the participants who saw the 2008 form made such a statement.

4.1 Differences in Visualization and Survey-Taking Strategy

Four of the sponsor's questions could be addressed by examining the scan-path pattern of the participants' gaze data. The gaze plots displayed in this section include numbered circles that represent the places that participants looked on the screen (for at least 100 milliseconds) in temporal sequential order. The time stamp for the duration of the gaze events depicted in the image can be found in the legend at the bottom-left corner of the image. Related heat maps of all of the participants' eye gaze data can be found in Appendix E.

- **Did the change in this format alter the way in which respondents proceed to visualize and answer the items on the form in terms of continuity of response from one item to another?**

This question was addressed by examining the difference in scan path patterns between participants' interaction with the 2007 form and the 2008 form. The results showed that there was a fundamental difference in the structure of the path that their gaze took while sequentially answering the questions on the form.

- **Are participants' gaze paths more continuous between the sex and relationship items in 2008?**

The overall gaze-path patterns for the participants who used the 2008 form are more consistent than are the patterns for the participants who used the 2007 form. Specifically, all of the participants who completed the 2008 form for this study completed all of the items for Person 1, all of the items for Person 2, and then all of the items for Person 3 (and one participant completed items for Person 4). However, there were a few different ways that participants completed the 2007 form. It is possible that by responding one item at a time, participants were more likely not to acknowledge responses to sex and relationship for a given person. Future work may address this issue.

- **Do people using the 2007 format answer all items for Person X before going to Person X+1?**

During this testing, most participants using the 2007 ACS form did not answer all of the questions for Person X before going to Person X+1. Several different patterns for

answering the questions for Persons 1, 2, and 3 emerged from participants' interaction with 2007 ACS form.

- **Do the patterns of visual responses seem more confused in the grid pattern as judged by visual eye movements and where the clicks of the mouse are made?**

As mentioned above, there was more variability in the scan path patterns for the participants with the 2007 form than for participants with the 2008 form. Additionally, the participant from the dry run of this study wrote on his QUIS form that he experienced “confusion about the order of the fields” for the open-ended item 9 (see Appendix D for a copy of the QUIS form).

2008 Gaze Plots

All of the participants who saw the 2008 ACS mail form completed the items in the same overall pattern: all items for Person 1, then all items for Person 2, then all items for Person 3. In the gaze path plots below, either the entire session is shown or a specific segment was selected for legibility's sake to illustrate the participant's eyes moving to the Person 2 items after completing all of the items for Person 1.

Figure 5 shows the first one minute and fourteen seconds of gaze path information for Participant 1, who saw the 2008 survey. This plot illustrates that the participant completed Person 1, then moved on to Person 2. The data from the remainder of the session are omitted in order to preserve the legibility of this plot.

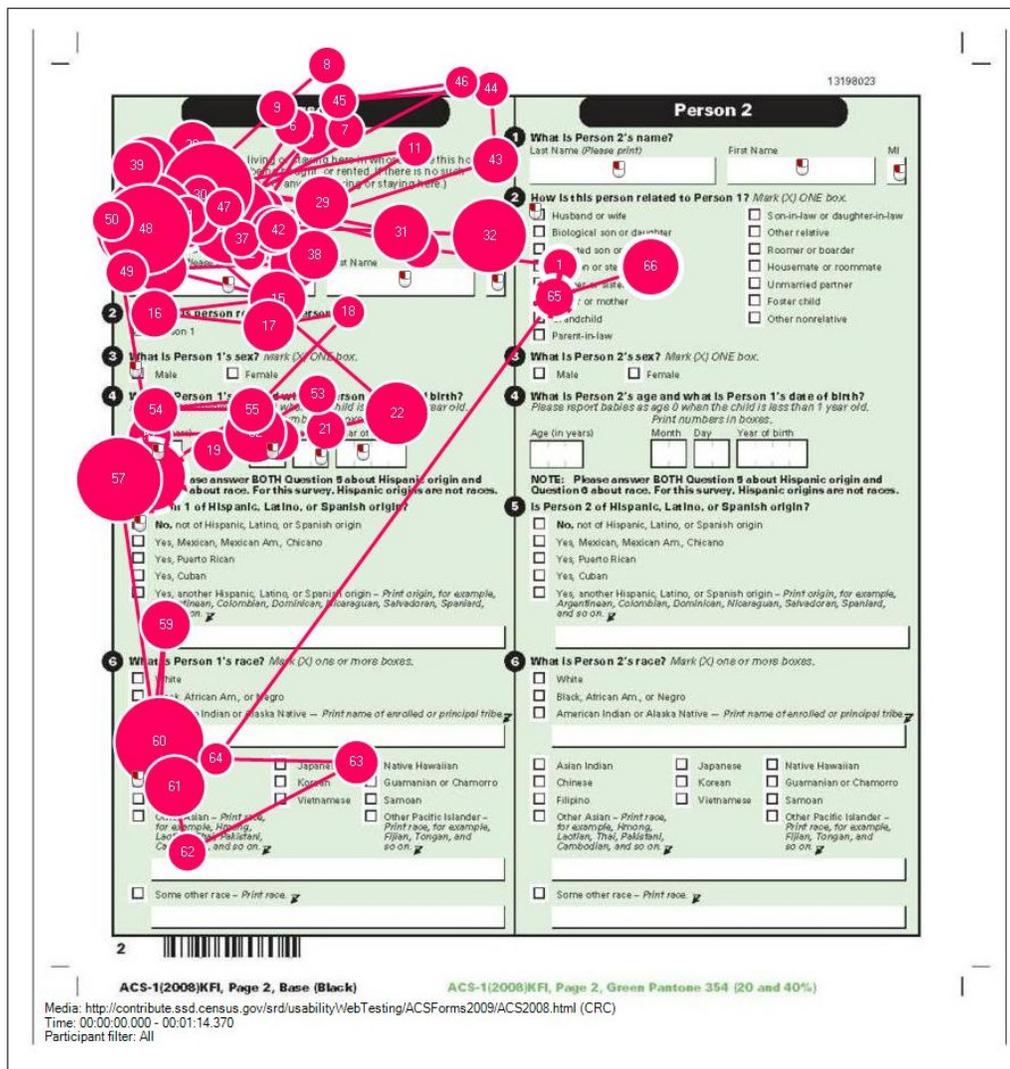


Figure 5. Gaze Plot for Participant 1: 2008 Survey

Participant 3 also completed Person 1, then moved on to Person 2 during the first two minutes and 58 seconds of the session. This person seems to have glanced at the edge of the second page of the survey while in the process of completing the first page.

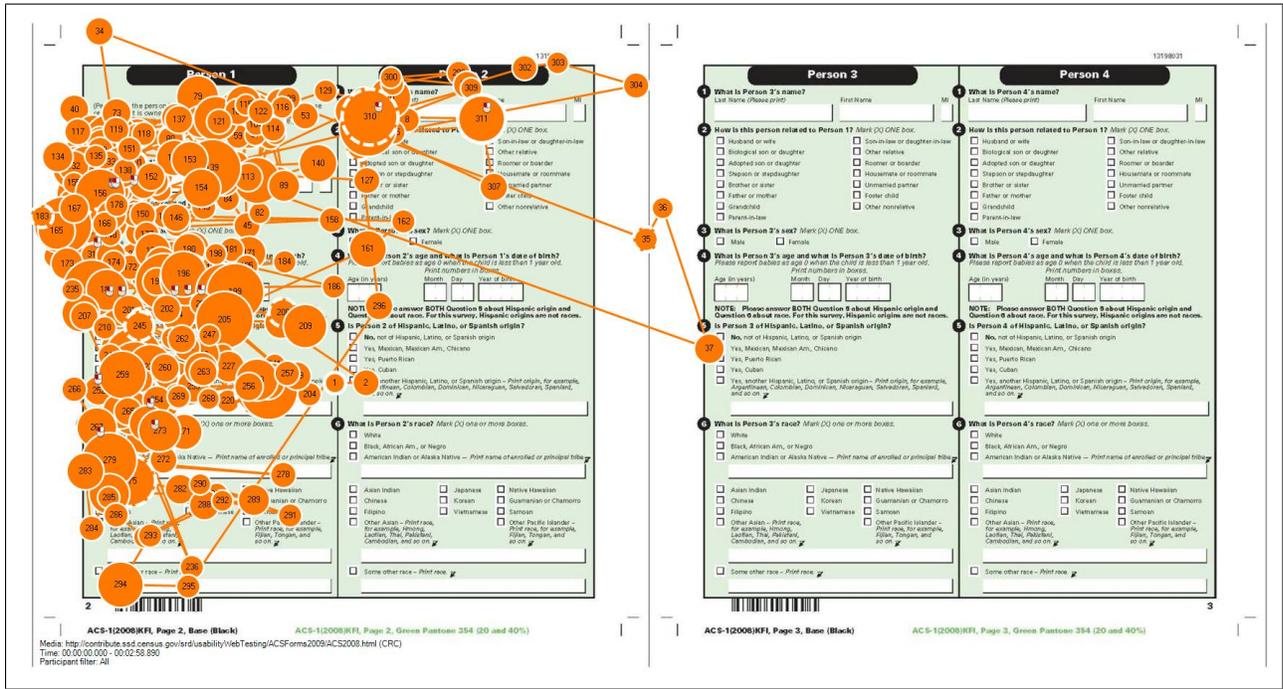


Figure 6. Gaze Plot for Participant 3: 2008 Survey

Participant 5 also completed all questions for Person 1, then Person 2, then Person 3.

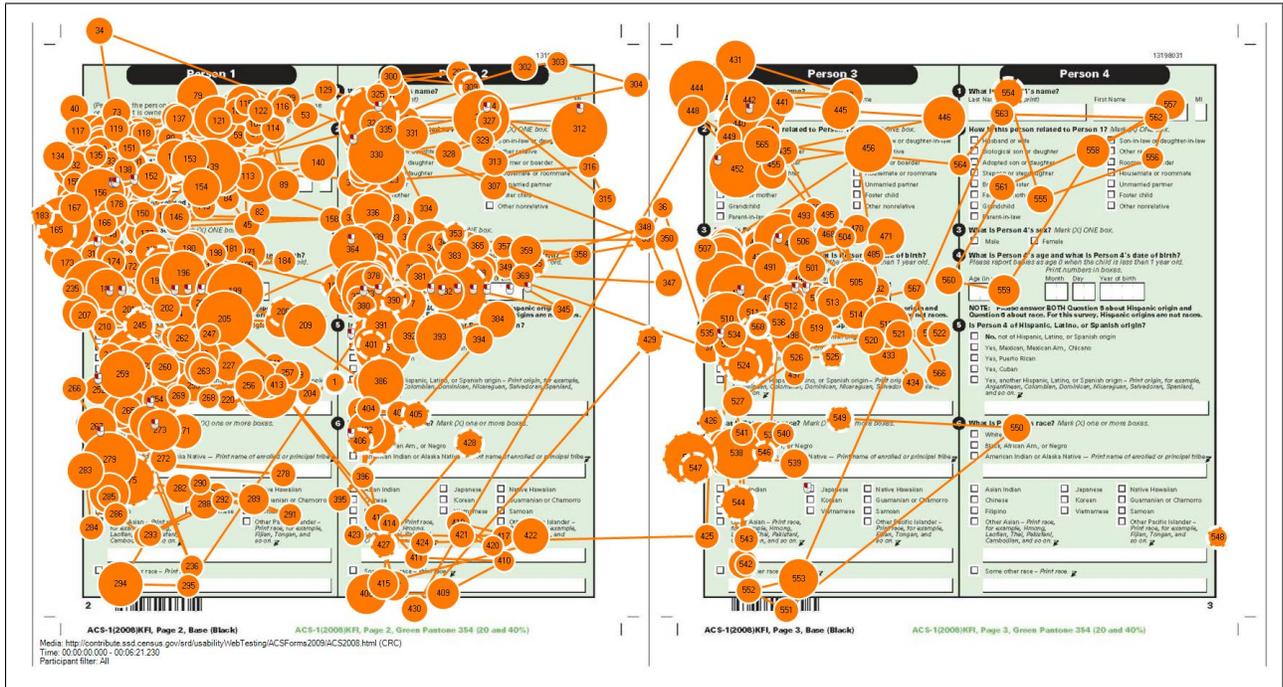


Figure 7. Gaze Plot for Participant 5: 2008 Survey

Participant 7 also completed Person 1, then moved on to Person 2 during this 48-second period.

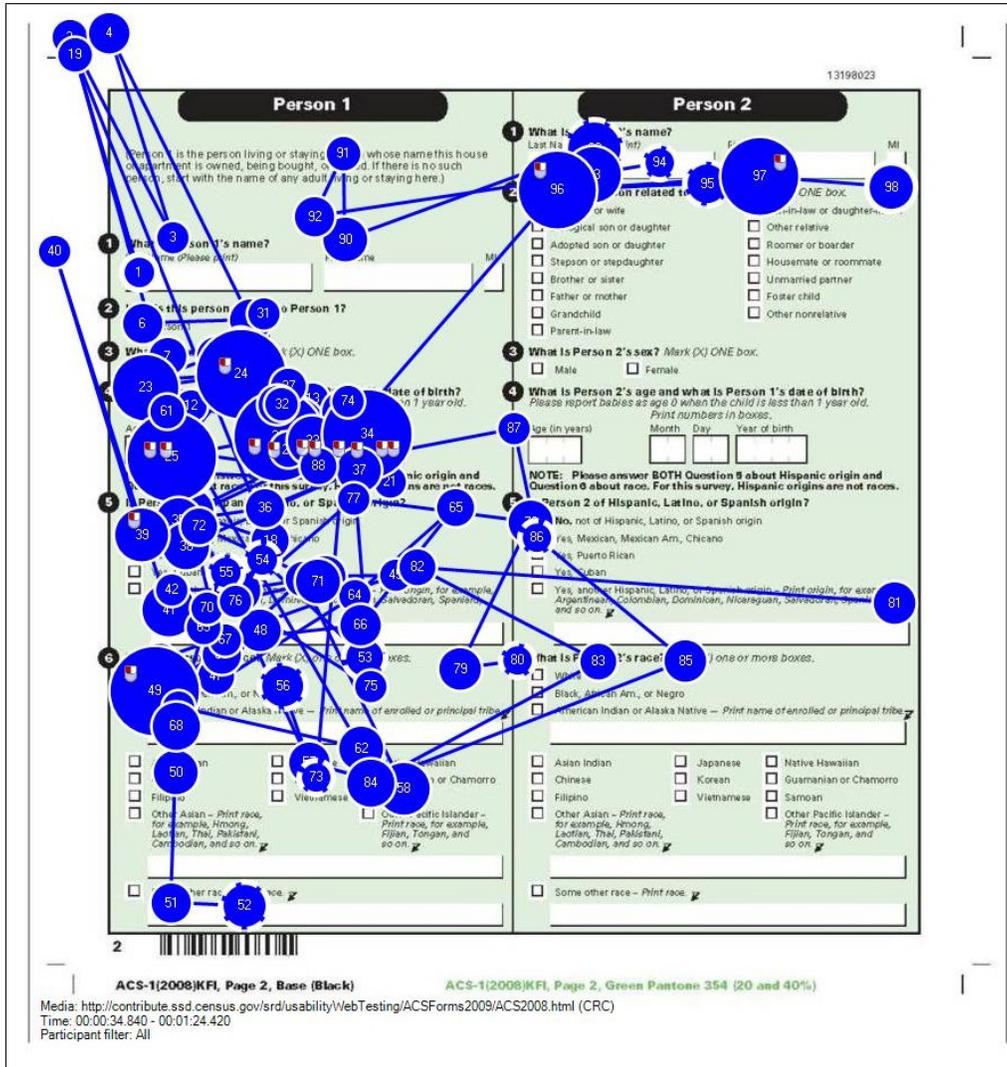


Figure 8. Gaze Plot for Participant 7: 2008 Survey

Participant 9 had no eye-tracking data available, but this person did complete all questions for Person 1, then Person 2, then Person 3. This participant's eye-tracking data were not available due to a problem with calibrating this person's eyes correctly through eyeglasses. This participant only clicked on responses for Persons 2-3 and did not do so for Person 1.

The figure displays two pages of a survey form, ACS-12008KFL, for Participant 9. The left page (Page 2) contains questions for Person 1 and Person 2, and the right page (Page 3) contains questions for Person 3 and Person 4. Each question asks for demographic information such as name, relationship to the respondent, sex, age, and race/ethnicity. The form includes checkboxes for various categories and dropdown menus for names. The participant filter is set to 'all'.

Figure 9. Mouse Click Data for Participant 9: 2008 Survey

Participant 11 also completed all questions for Person 1, then Person 2, then Person 3. This person also completed the items for Person 4 based on their own real-life household.

This participant's eye-tracking data are missing for most of the time that they were completing the form for Person 2. This loss of data was due to the eye tracker's temporary loss of contact with the participant's pupils. This participant wore glasses, which sometimes interferes with the eye tracker's ability to track the pupil.

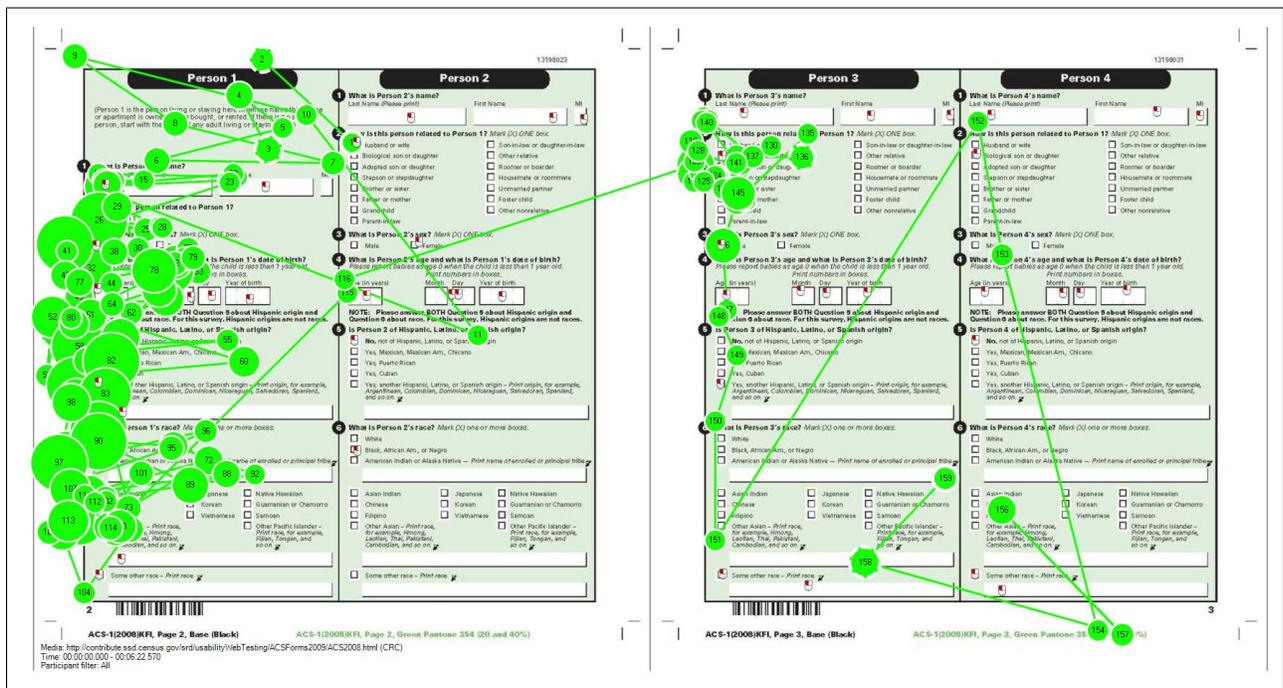


Figure 10. Gaze Plot for Participant 11: 2008 Survey

Participant 13 also completed all questions for Person 1, then Person 2, then Person 3 in the intended order.

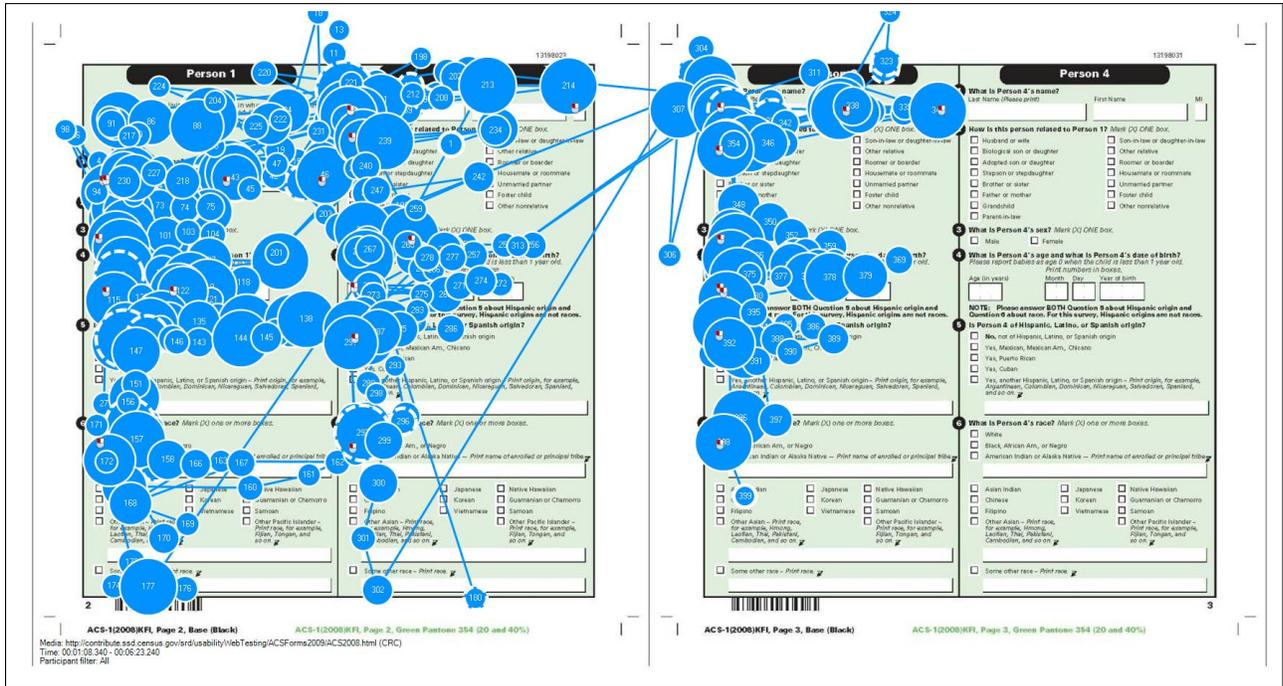


Figure 11. Gaze Plot for Participant 13: 2008 Survey

2007 Gaze Plots

In contrast to the consistent manner in which participants completed the 2008 ACS mail form, there were five different survey-taking patterns utilized by the six participants who completed the 2007 ACS mail form. Table 2 describes these patterns in general terms.

Table 2. Patterns of Survey–Taking Eye–Gaze Behavior for the 2007 ACS Mail Form

Pattern 1	Intended Path: 1) All items for Person 1 completed horizontally across Pages 2 and 3 2) All items for Person 2 completed horizontally across Pages 2 and 3 3) All items for Person 3 completed horizontally across Pages 2 and 3
Pattern 2	1) All items for Person 1 completed horizontally across Page 2 2) All items for Person 2 completed horizontally across Page 2 3) All items for Person 3 completed horizontally across Page 2 4) All items for Person 1 completed horizontally across Page 3 5) All items for Person 2 completed horizontally across Page 3 6) All items for Person 3 completed horizontally across Page 3
Pattern 3	1) Name items for Persons 1, 2, and 3 completed vertically down Page 2 2) Sex items for Persons 1, 2, and 3 completed vertically down Page 2 3) Relationship items for Persons 1, 2, and 3 completed vertically down Page 2 4) Marital Status items for Persons 1, 2, and 3 completed vertically down Page 3 5) Latino origin items for Persons 1, 2, and 3 completed vertically down Page 3 6) Race items for Persons 1, 2, and 3 completed vertically down Page 3
Pattern 4	1) Name items for Persons 1, 2, and 3 completed vertically down Page 2 2) Sex items for Persons 1, 2, and 3 completed vertically down Page 2 3) Relationship items for Persons 1, 2, and 3 completed vertically down Page 2 4) All items for Person 1 completed horizontally across Page 3 5) All items for Person 2 completed horizontally across Page 3 6) All items for Person 3 completed horizontally across Page 3
Pattern 5	1) All items for Person 1 completed horizontally across Page 2 2) All items for Person 2 completed horizontally across Page 2 3) All items for Person 1 completed horizontally across Page 3 4) All items for Person 2 completed horizontally across Page 3 5) All items for Person 3 completed horizontally across Pages 2 and 3

Participant 2, whose gaze plot can be seen in Figure 12, used Pattern 2 to complete the survey. This person completed the items in horizontal sequential for Person 1, then Person 2, then Person 3 for Page 2, then did the same for Page 3. This participant did not proceed directly from the relationship question for Person 1 to the marital status question for Person 1. Eye–tracking data are missing for most of the time where the participant was completing the items on Page 3, although mouse click data were captured and are displayed on the plot below.

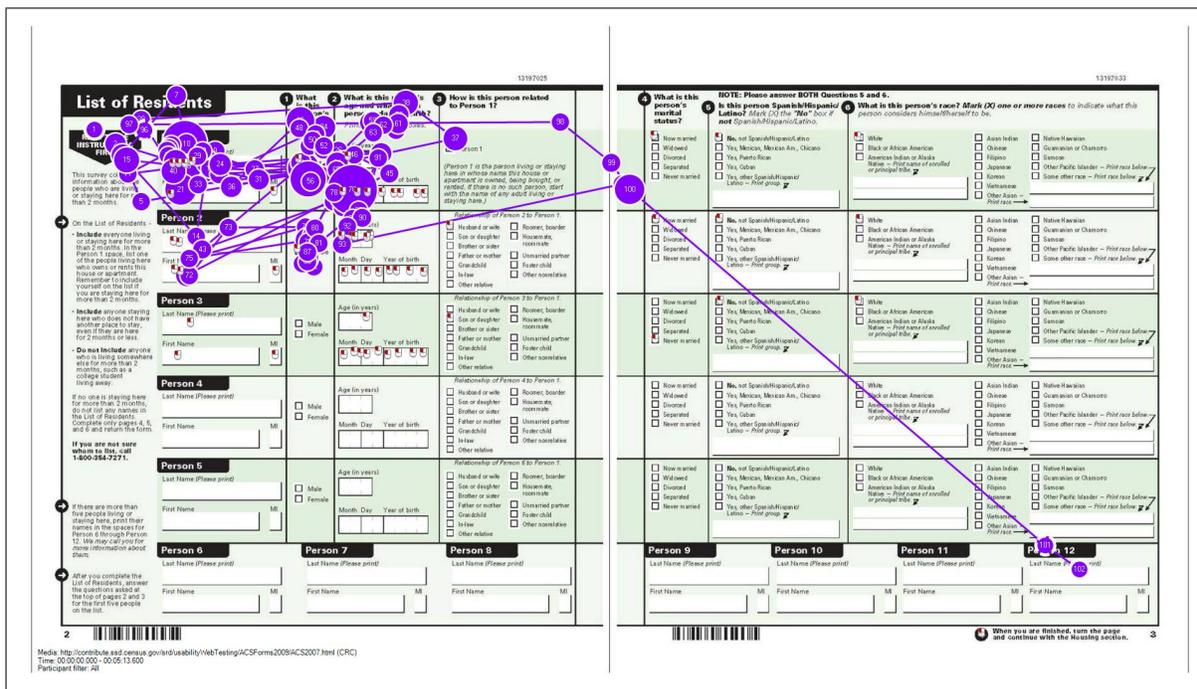


Figure 12. Gaze Plot for Participant 2: 2007 Survey. Some eye-tracking data are missing and mouse-clicks are represented by small mouse icons.

Participant 4 completed the survey using Pattern 4, and his/her gaze plots demonstrate the potentially distracting nature of the left navigation instructions. This person began to take the survey, then saw and read the instructions, and then proceeded with the survey with repeated glances back to the instructions. The following nine figures illustrate the steps in this sequence.

First, Participant 4 begins the survey by starting the name question for Person 1 (Figure 13).

The figure displays two pages of a survey form. The left page is titled 'List of Residents' and contains instructions and fields for entering information for Person 1 through Person 8. The right page is titled 'What is this person's marital status?' and contains fields for Person 9 through Person 12. The form is annotated with yellow circles and numbers (1-14) indicating gaze points. The first page also includes a barcode and a URL: <http://cognitive.usd.census.gov/Usability/WebTesting/ACSForms/2008/ACS2007.html> (CR). The participant's name is listed as 'Participant filler: n1'.

Figure 13. Gaze Plot 1 for Participant 4: 2007 Survey

Then, the participant saw and began to read the instructions (Figure 14).

Figure 14. Gaze Plot 2 for Participant 4: 2007 Survey

Then, the participant finished the name question for Person 2, then for Person 3, looked around the page, then answered the sex question for Person 1 (Figure 16).

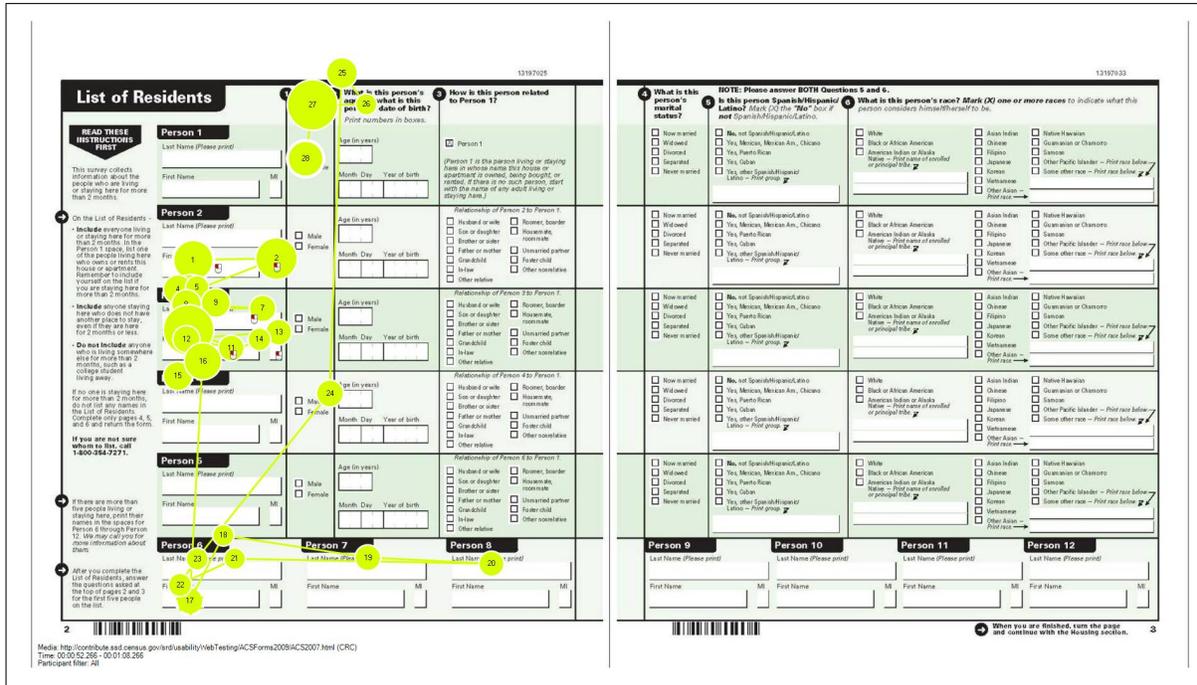


Figure 16. Gaze Plot 4 for Participant 4: 2007 Survey

Next, the participant completed the sex question for Person 2, then for Person 3, and then returned to the top of the page to complete the age question for Person 1 (Figure 17).

Figure 17. Gaze Plot 5 for Participant 4: 2007 Survey

Next, the participant completed all of the questions for Person 1 in horizontal order (marital status, Latino origin question, then race question) and then completed these items in horizontal order for Person 2 and then for Person 3 (Figure 20).

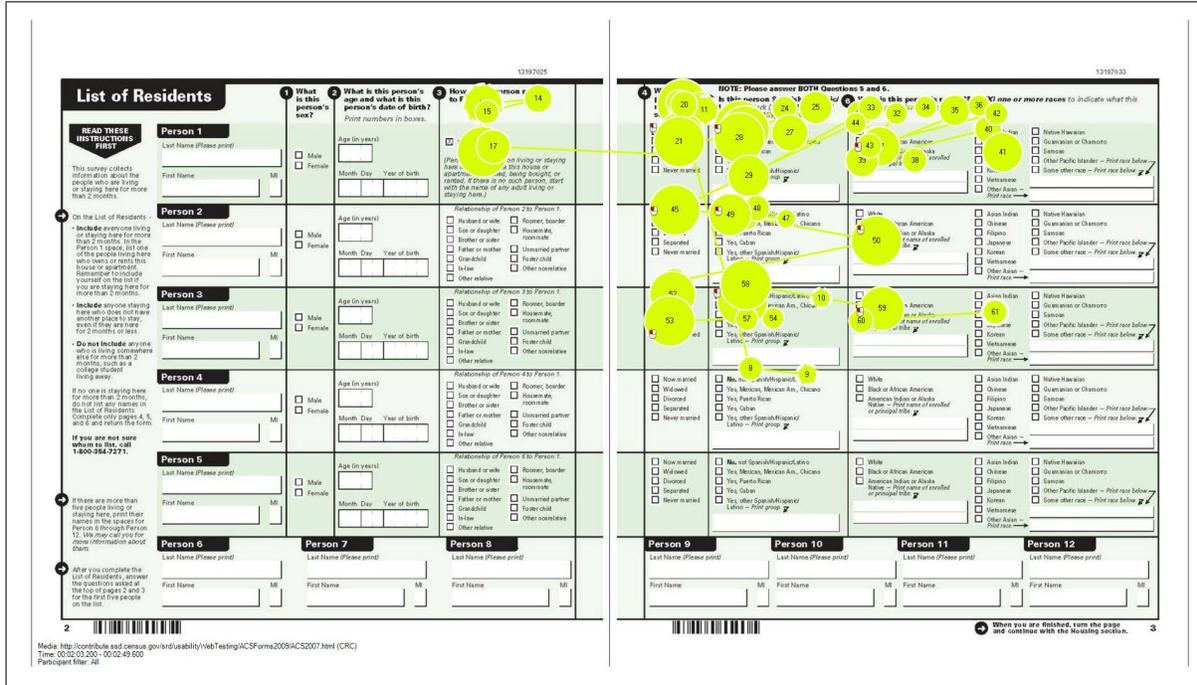


Figure 20. Gaze Plot 8 for Participant 4: 2007 Survey

Finally, the participant looked around the bottom and mentioned being unsure as to whether there is anything else to answer for the three-person household on this page, before deciding he/she was finished with the scenario (Figure 21).

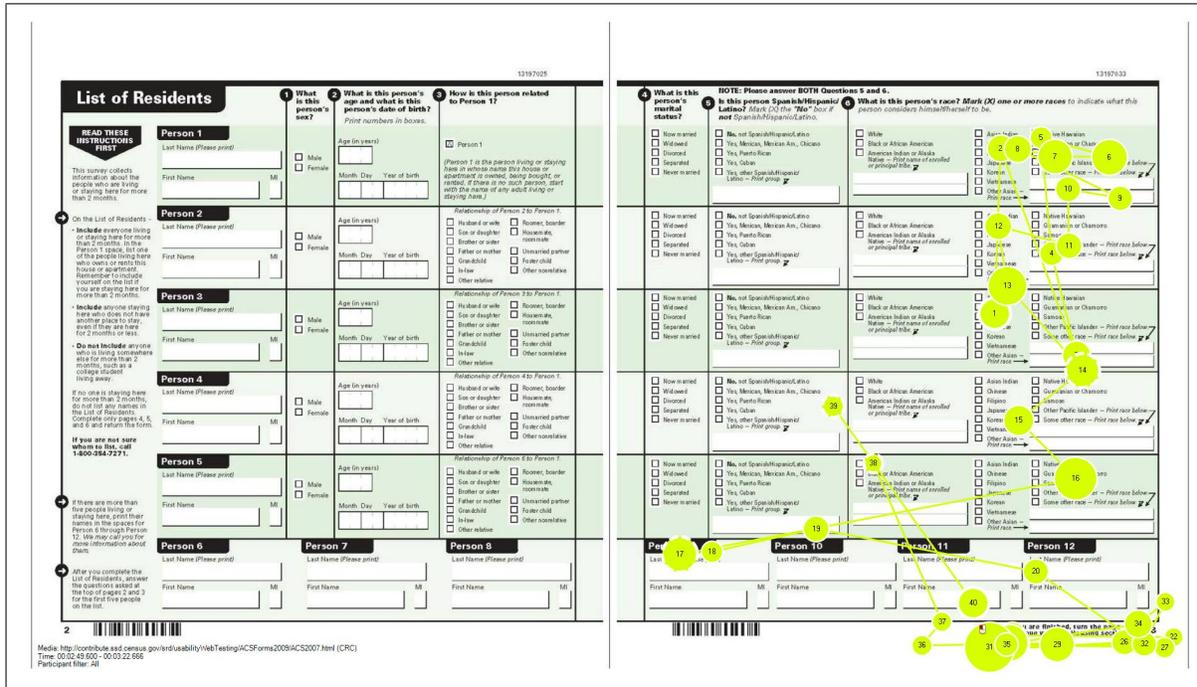


Figure 21. Gaze Plot 9 for Participant 4: 2007 Survey

Participant 6 used Pattern 5 to complete the survey. This person first looked around the pages, then read the instructions, then completed all of the questions for Person 1 horizontally and sequentially on Page 2 before horizontally and sequentially completing all of the questions for Person 2 on Page 2 (Figure 22). The following four figures illustrate this process.

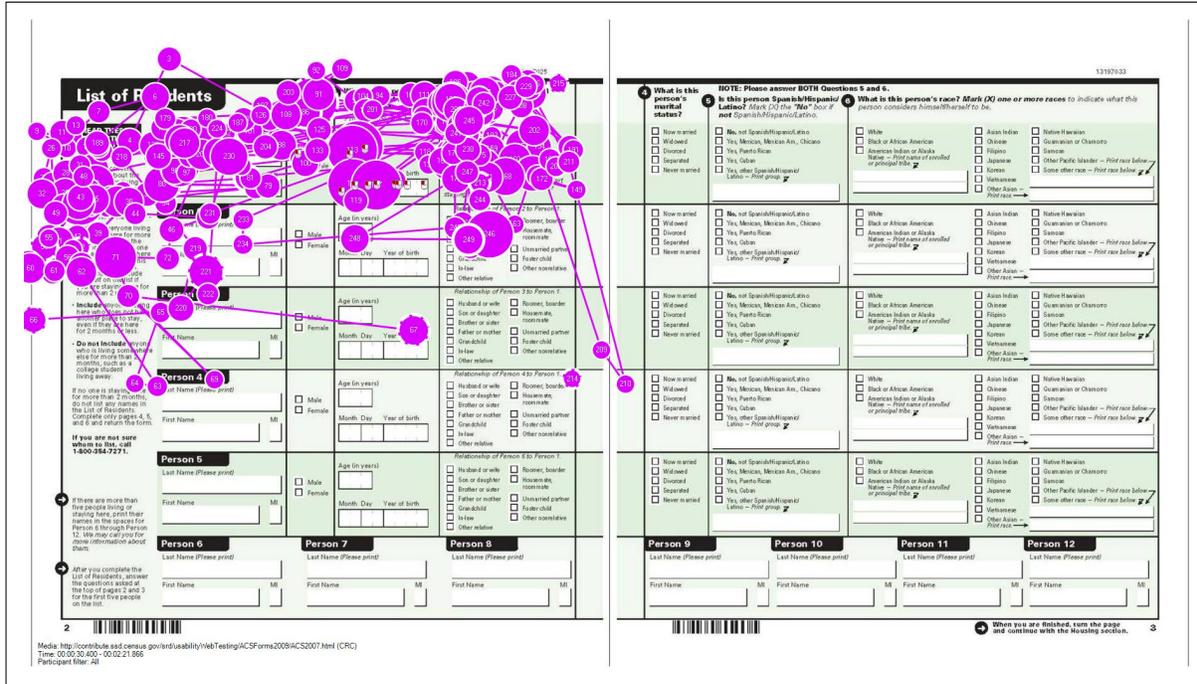


Figure 22. Gaze Plot 1 for Participant 6: 2007 Survey

Next, the participant horizontally completes the items for Person 1 on Page 3 (Figure 23).

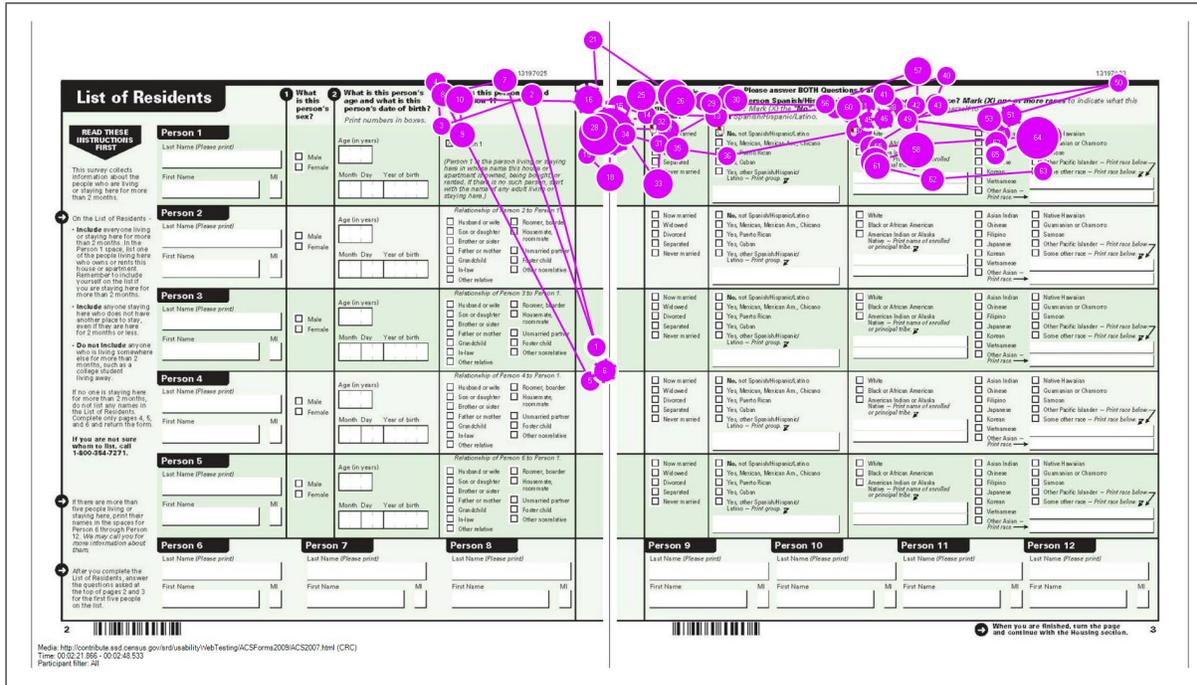


Figure 23. Gaze Plot 2 for Participant 6: 2007 Survey

Then, the participant demonstrates evidence of confusion as they are completing the survey. Specifically, the participant finishes the items for Person 2 horizontally on Page 3 before looking at the items for Person 3 on the Page 3. The participant then looks back at the name item for Person 3 on Page 2. Next, the participant looks at the left navigation instructions before filling out the items for Person 3 on Page 2 horizontally and sequentially (Figure 24).

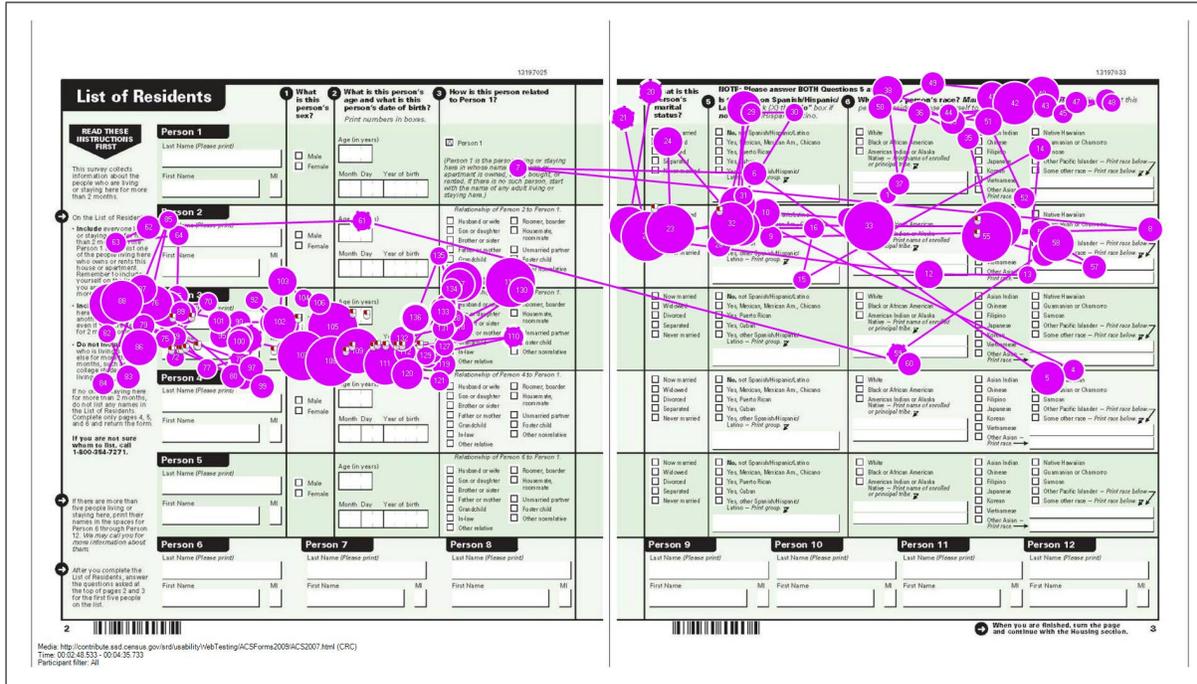


Figure 24. Gaze Plot 3 for Participant 6: 2007 Survey

Finally, the participant finishes the items for Person 3 on Page 3 in horizontal order, but with repeated glances to the instructions/column labels at the top of Page 3. The participant looks at again at the left navigation instructions on Page 2 and then around the pages before deciding that they have completed the required items for the scenario (Figure 25).

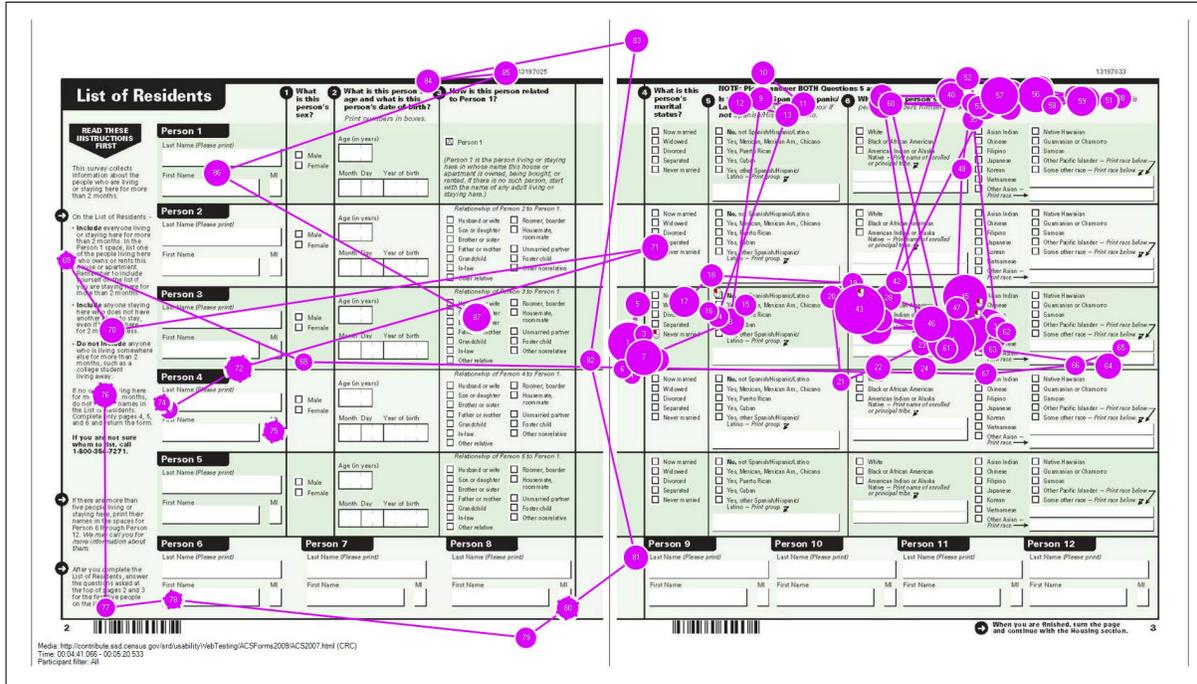


Figure 25. Gaze Plot 4 for Participant 6: 2007 Survey

Participant 8 (Figure 26) showed Pattern 3 for completing the survey and started the name item for Person 1, then read the left navigation instructions before completing the rest of the survey items. This participant completes the items in a vertical order, completing the Page 2 items, then looking again at the left navigation instructions before completing the Page 3 items in the following order: Page 2: Person 1 name, Person 2 name, Person 3 name, Person 1 sex, Person 2 sex, Person 3 sex, Person 1 age, Person 2 age, Person 3 age, Person 1 relationship, Person 2 relationship, and Person 3 relationship. In between Page 2 and Page 3, the participant looked at the left navigation instructions again. Page 3: Person 1 marital status, Person 2 marital status, Person 3 marital status, Person 1 Latino origin, Person 2 Latino origin, Person 3 Latino origin, Person 1 race, Person 2 race, Person 3 race, then looks around page before deciding survey scenario is complete.

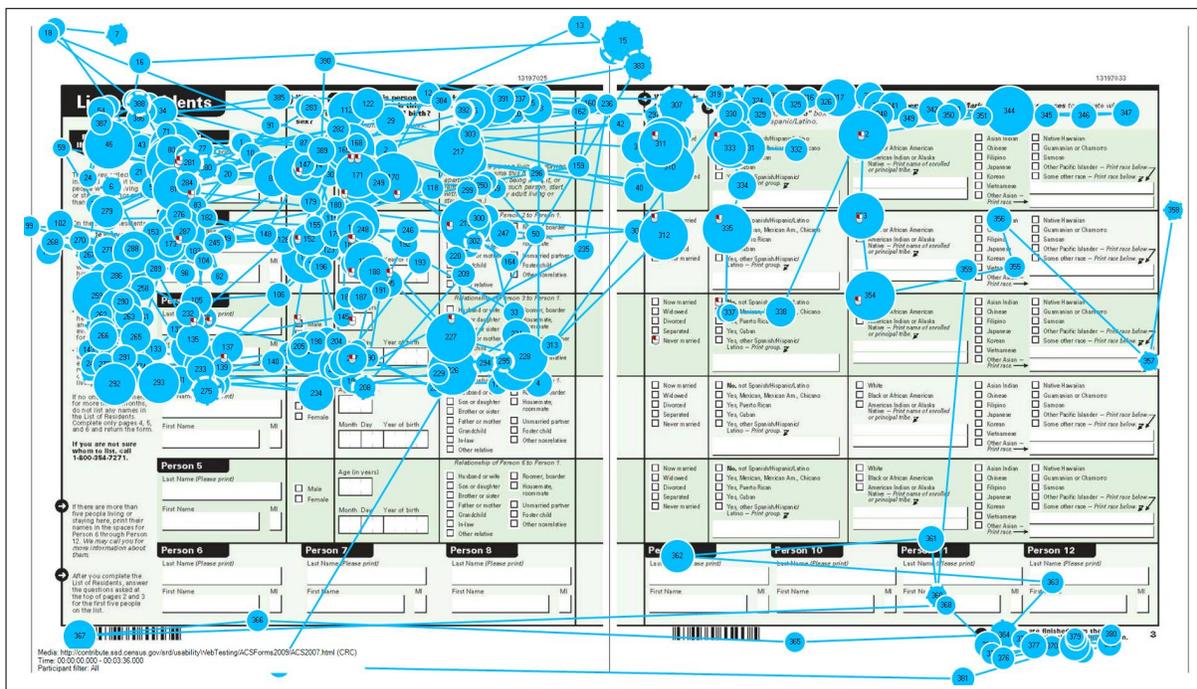


Figure 26. Gaze Plot for Participant 8: 2007 Survey

Participant 10 filled out the form using Pattern 1, which was in the horizontal item order (in horizontal, sequential order across Pages 2 and 3 for each person, consistent with the numbered instructions at the top of the pages)(Figure 27). However, this person did look at the left navigation instructions after starting the items for Person 1.

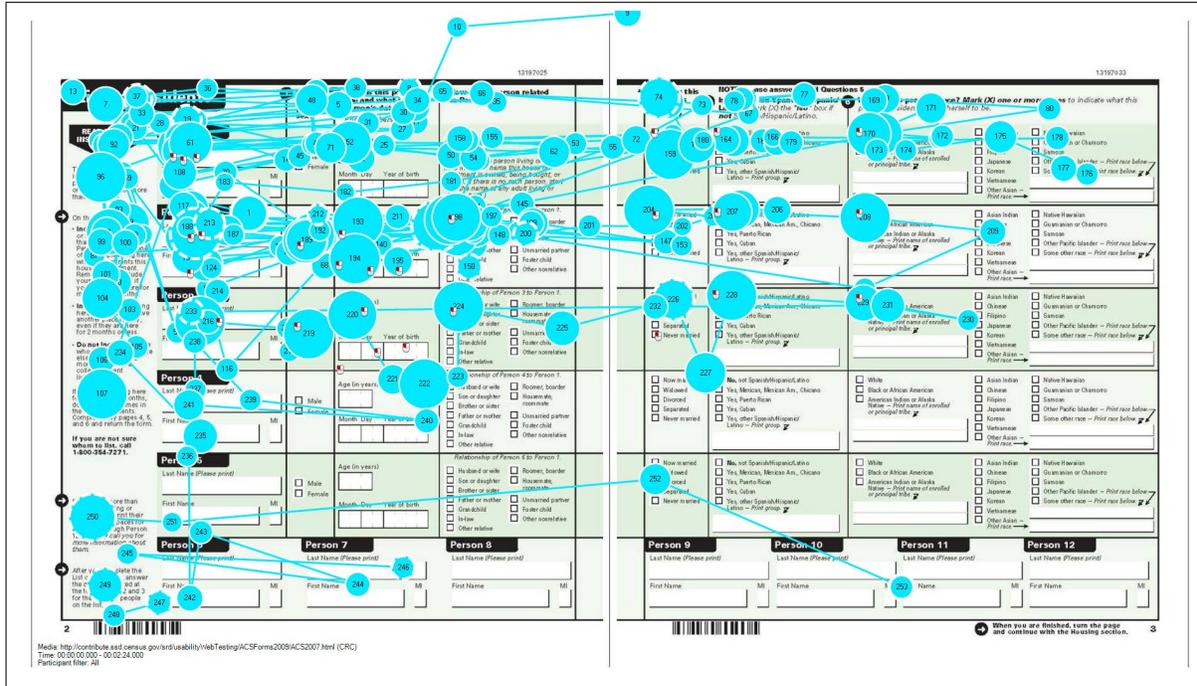


Figure 27. Gaze Plot for Participant 10: 2007 Survey

Participant 12 (Figure 28) completed the survey using Pattern 2. This person filled out all of the items for Person 1 on Page 2, then read the left navigation instructions, then completed the items for Person 2 in horizontal sequential order on Page 2, then completed the items for Person 3 in horizontal sequential order on Page 2 (although there are no data available for the sequence of time that the participant was completing the Person 3 items on Page 2). Then, the participant completed the items on Page 3 for Persons 1, 2, and 3 in horizontal sequential order on Page 3 before looking around the page and deciding that the scenario was complete.

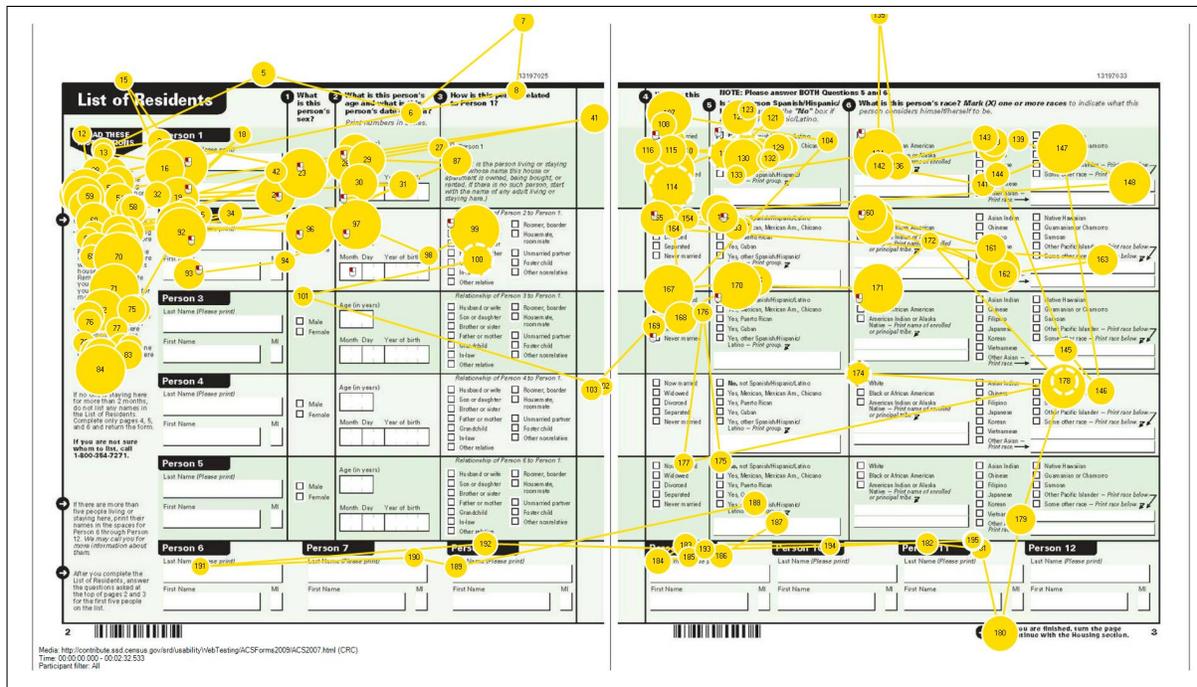


Figure 28. Gaze Plot for Participant 12: 2007 Survey

4.2 Overlooked items

- Do participants overlook any items (specifically the item on gender)?

While all of the participants for both the 2007 and 2007 forms either mentioned aloud how they would answer the gender item and/or clicked on the item with the mouse, not all of them answered this item immediately after completing the first item (name question). There is also some evidence that suggests that even when participants answer this question, they do not necessarily pay active attention to this question or look at it for very long. For example, one participant (P6) mentioned that he would select “female” as the answer to this question for Person 2, but he did not gaze at the box containing this question (e.g, Area of Interest “Person 2 Sex”) nor did he make a complete mouse click on it. The usability contact recommends further testing using the paper questionnaire and the X120 eye tracker to investigate this issue.

Table 3. Fixation Duration (Seconds) on the Gender Item for the 2007 ACS Mail Form

2007 Form			
Participant	Person 1 Sex	Person 2 Sex	Person 3 Sex
P2	2.85	1.10	0
P4	1.73	1.40	6.86
P6	3.29	0.12	11.02
P8	3.19	3.45	5.37
P10	1.44	5.00	3.59
P12	2.82	1.67	0.18
Average	2.55	2.12	4.50
Std. Dev.	0.78	1.80	4.20

Table 4. Fixation Duration (Seconds) on the Gender Item for the 2008 ACS Mail Form

2008 Form			
Participant	Person 1 Sex	Person 2 Sex	Person 3 Sex
P1	0	3.05	2.33
P3	10.22	3.03	3.36
P5	5.04	6.32	7.50
P7	3.07	1.85	2.35
P11	4.01	0	0.56
P13	28.49	9.93	0
Average	8.47	4.03	3.55
Std. Dev.	10.36	3.55	2.67

Tables 3 and 4 present the average fixation duration (e.g., amount of time that a person fixated upon a specific area of the survey) in seconds for the gender item for the 2007 and 2008 survey forms. Participant 9 was dropped from this analysis because no eye-tracking data were recorded for this participant because of an equipment problem. As the tables show, participants tended to look at the gender items for longer periods of time for the 2008 form than for the 2007 form for Person 1 and Person 2. The participants tended to look at the gender item for Person 3 for longer periods of time for the 2007 form than for the 2008 form. However, these differences were not significant ($\alpha = 0.05$) in an independent samples t-test for the gender item for Person 1 ($t(10) = -1.40, p > 0.05$), Person 2 ($t(10) = -1.18, p > 0.05$), or Person 3 ($t(10) = 0.90, p > 0.05$).

These statistics may be impacted by missing data caused by participants' eye blinks and temporary equipment failure and should be considered as estimates only. This does suggest that for the 2007 form, the fixation duration on this item is generally short, which could suggest that some respondents are missing this question or could be reporting in error.

4.3 Duration of Survey–Taking Session

- **Is there a difference in the duration of time participants spend in answering the items between the 2007 and 2008 forms?**

On average, participants spent 4 minutes and 0.8 seconds on the 2007 form and 4 minutes and 3.9 seconds on completing the scenario using the 2008 form. This difference was not statistically significant ($\alpha = 0.05$) in an independent samples t–test ($t(11) = 0.061, p > 0.05$). Further testing is planned using the actual paper mail survey forms to see whether there is a difference in the time it takes to actually complete the forms using paper and pencil. A larger number of participants will also give future analysis more power to detect statistical differences.

4.4 Cluster Analysis Plots

An analysis of where participants looked most was performed using Tobii Studio Enterprise software (Tobii Technology Inc., 2008). The clusters in Figures 29 and 30 represent the areas where participants looked the most. The areas roughly correspond to the Areas of Interest defined for this study, which are based on each question item for the survey forms. The percentages in Figure 29 include Participant 9 in the results, for whom no eye-tracking data were recorded. Therefore, the clusters that indicated that 86% of the participants looked at them can also be interpreted to mean that all of the participants with available eye-tracking data looked at them.

One observation about both the 2007 and 2008 Cluster Analysis plot is that the clusters are much smaller for the items on Page 3 than they are for the items on Page 2. This pattern might be an indicator that people are not attending to as much of the content for the items on Page 3. This may be problematic with respect to the 2007 form, since people tended to employ very different sequential strategies for completing the items on this form.

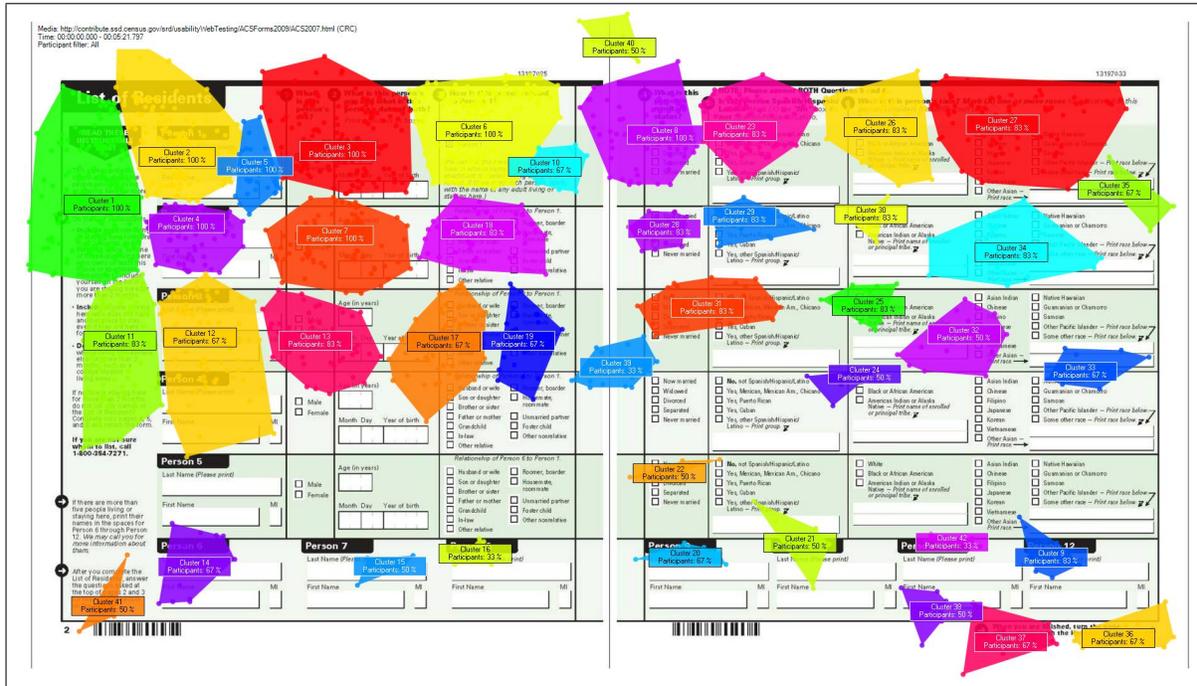


Figure 29. Cluster Analysis for the 2007 ACS Mail Form

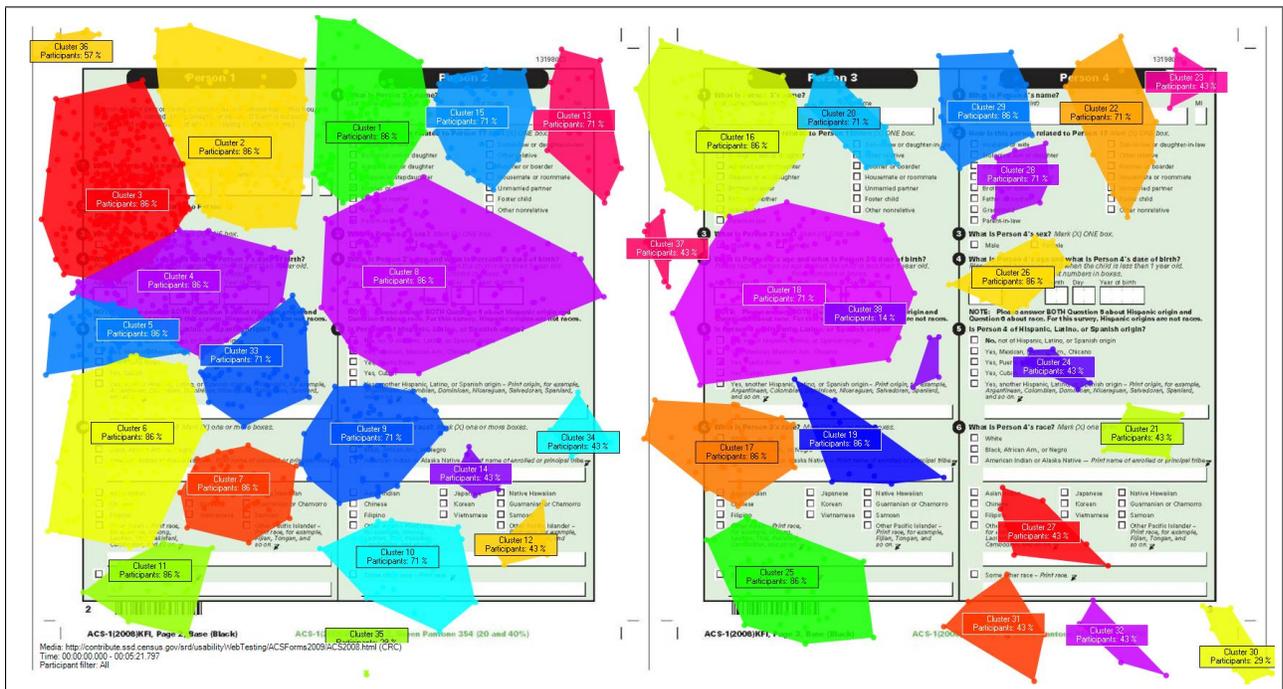


Figure 30. Cluster Analysis for the 2008 ACS Mail Form

4.5 Usability Findings

In addition to addressing the sponsor’s specific questions, the usability team observed some other potential usability issues with the ACS mail forms.

- Based on the heat maps for all of the participants and for both versions of the ACS mail survey, participants look most frequently overall at the upper left section of the survey. This finding suggests that placing important text, such as brief instructions for completing the form, in this region might be appropriate.
- Left-Margin Instructions on the 2007 form may cause an interruption of the participants’ survey-taking process. Both the gaze plots and the heat maps show that for the 2007 ACS mail form, participants tend to spend a considerable amount of time and look frequently at the instructions on the left-hand side of the display. Often, they had already started completing the information for Person 1 when they noticed and then read these instructions. That is, the participants tended to initially overlook these instructions and then read them after already deciding which resident to list as Person 1. The instructions then, are distracting for these respondents and have interrupted the survey completion process. In the field, respondents may forget whom they listed as Person 1 after already starting the survey. If they have already completed the sex information for person 1 and the name information for Person 2, read the instructions, and then come back to the sex box for Person 2, it is possible that they could have forgotten which resident is Person 2 and mark the incorrect sex for Person 2. Further testing of this issue is planned.
- There are differences in respondents’ choices of which householder to list as Person 1. Some participants may tend to list someone else in the household as Person 1 instead of themselves, which may have an impact on their overall survey-taking strategy. For instance, Participant 1 listed her spouse as Person 1 and herself as Person 2. This issue may be exacerbated by the distraction caused by the participants’ tendency to read the left navigation instructions after they had already begun the survey. Some people may have a higher likelihood to begin the survey with his/her spouse as Person 1, *then* read the instructions after completing the gender question for Person 1, *then* continue with Person 2 and unintentionally switch Person 1 and Person 2 in their short-term memory before filling out the rest of the questions for Person 2 on page 2. Further testing is planned to examine whether certain demographic characteristics are predictive of whether a respondent will list themselves as Person 1 or Person 2.
- For the 2007 form, the labels “Person 1,” “Person 2,” etc., are not carried over from Page 2 to Page 3. This may cause the respondent to flip back and forth between Page 2 and 3 while taking the paper survey. There may also be some non-sampling error issues with the data collected on Page 3 because participants may be attempting to complete the questions on Page 3 using their short-term memory to recall to which person the questions are referring. The format of the 2008 form more naturally groups

the information together and allows the respondent to see the name of Person 1, Person 2, Person 3, etc. on the same page while they answer the rest of the questions.

- The relationship question for Person 1 is unintuitive and potentially confusing. This item asks the question of how Person 1 is related to Person 1, which generated many comments among participants that this concept is confusing. Figures 31 and 32 illustrate the appearance of this item on the 2007 and 2008 forms, respectively. Many tried to respond to the question before realizing that the answer was pre-checked because Person 1 is the same person as Person 1. This item seems unnecessary and may cause a disruption in the respondent’s survey-taking process. Also the answer “Person 1” does not really answer the question, “How is this person related to Person 1?” For instance, “self” might be a more logical and meaningful option. However, this might not be the best option for instances where the person filling out the survey is not Person 1 (e.g., it is Person 1’s spouse”).

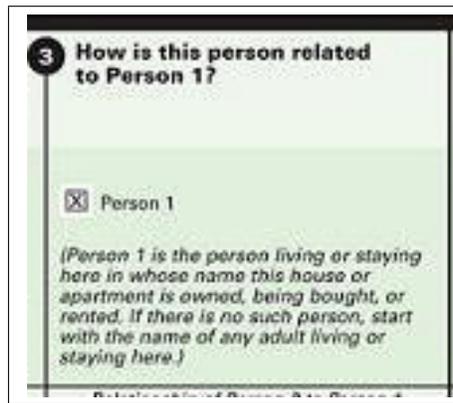


Figure 31. Person 1 Self-Relationship Item: 2007 ACS Mail Form



Figure 32. Person 1 Self-Relationship Item: 2008 ACS Mail Form

4.6 Questionnaire for User Interface Satisfaction (QUIS)

A copy of the tailored QUIS survey used in this study can be found in Appendix D. Tables 5 and 6 provide the QUIS scores from each participant.

Table 5. QUIS Scores for the 2007 Mail Forms

2007 Form								
P/Item	1	2	3	4	5	6	7	Mean
P2	7	9	9	7	7	7	7	7.57
P4	5	5	5	5	4	4	5	4.71
P6	4	4	7	4	7	8	7	5.86
P8	6	6	6	4	6	6	6	5.71
P10	6	6	7	6	7	7	7	6.57
P12	6	4	8	8	4	8	7	6.43
Mean	5.67	5.67	7.00	5.67	5.83	6.67	6.50	6.14
Std. Dev.	0.94	1.70	1.29	1.49	1.34	1.37	0.76	0.88

Table 6. QUIS Scores for the 2008 Mail Forms

2008 Form								
P/Item	1	2	3	4	5	6	7	Mean
P1	7	7	7	8	8	8	8	7.57
P3	8	8	8	8	8	8	8	8.00
P5	7	7	6	7	5	7	7	6.57
P7	8	8	8	8	8	8	8	8.00
P9	9	9	9	9	9	9	9	9.00
P11	7	7	6	7	6	8	8	7.00
P13	8	8	8	8	9	9	8	8.29
Mean	7.71	7.71	7.43	7.86	7.57	8.14	8.00	7.78
Std. Dev.	0.70	0.70	1.05	0.64	1.40	0.64	0.53	0.75

Overall, participants' satisfaction scores were significantly higher ($\alpha = 0.05$) for the 2008 ACS form than the 2007 form in an independent samples t-test ($t(11) = 3.36, p < 0.05$).

Comments (Item 8)

Participants had the opportunity to write in comments at the end of the QUIS instrument for Item 8. Some of the comments were related to the less-than-ideal digital display of the survey pages, which required vertical and horizontal scrolling. This is an artifact of the stimulus used and further testing with the paper forms and the X120 Tobii eye tracker for real-world stimuli is planned. Here is a summary of the comments provided:

2007 Form

- P2: I may have missed instruction on how to code age - e.g., 060, 60, etc., (age 60), but it was not obvious to me. Form fills up more than screen size; necessary to scroll

both vertically and horizontally- could be a problem for large households, if respondent forgot sequence of persons on the left side, then tried to identify characteristics on the right./ My clarity about Hispanic & race questions may be misleading, since I have been closely involved with these 2 questions in my world.

- P7: Difficult to see entire page online, but survey form was relatively straightforward.

2008 Form

- P1: Page over/next button would be nice. Easy enough. I don't rate 1s or 9s
- P9: Very clear.
- P11: Item question layout- person related - biological son & daughter - takes away from visual first glance. *NOTE: Participant commented that this should just say "son or daughter" and then have "biological" in parenthesis following these terms because he missed the "son or daughter" part on first glance.*

5 Limitations

As with most laboratory research, there are some scope-related limitations to this testing. First, participants were not randomly assigned to condition for this preliminary testing. Although they were assigned alternately to one condition (2007 form) or the other (2008 form), the first participant was randomly assigned to his/her condition. Future rounds of testing on this issue will incorporate the methodological strategy of random assignment to condition for each participant. However, since the ACS form has already been changed, it would not be productive to continue to study its potential flaws. Therefore, future work will explore a similar issue of grid versus sequential layout with respect to the "race" question on the ACS and Decennial Census Forms. Second, the number of participants per condition is associated with low statistical power. When statistical power is insufficient, true effects may not be detected. Future rounds of testing will incorporate larger numbers of participants to increase statistical power.

Another limitation of this study was the digital mock-up of the ACS forms that was neither the true-to-life paper mail form, nor an interactive web survey. Efforts to use as realistic of an ACS form as possible will be incorporated into future rounds of testing.

Finally, internal Census Bureau participants were recruited for testing in order to reduce the amount of time the recruitment process normally takes because of the sponsor's deadline for results. Although none of these participants was associated with the actual layout design of the survey, several had worked on the questions that the ACS contains. Future testing will include recruiting participants who are not Census Bureau employees and who have not had experience working with ACS forms or questions.

6 Discussion and Future Directions

This usability study showed that participants tended to use many different patterns or strategies when completing the 2007 ACS form while all of the participants who completed the 2008 form used the same basic strategy. Additionally, participants reported being more satisfied with the 2008 form overall, although there was no significant difference ($\alpha = 0.05$) in the amount of time taken to complete the two different versions of the form. Additionally, although participants tended to look at the gender item for longer periods of time with the 2008 form for the Person 1 and Person 2, the difference was not significant. Because of the unusual sequences of eye movements for participants completing the 2007 form, it is possible that this change in layout contributed to the errors or nonresponse while completing the gender question. The lack of significance in the statistical testing in this study may be due to the small sample size and an associated lack of statistical power. Future experimental work on this “sequential” versus grid layout is planned for comparing different versions of the “race” question on paper and online for 2010.

The usability team plans to conduct further testing with more participants after the planned upgrade to our equipment occurs during the spring of 2010. Further investigation into differences in the duration of time that participants need to complete the forms and their gaze-path patterns while completing the forms using real ACS questions and/or forms will greatly add to the results from this preliminary study. With the Tobii X120, we will be able to test differences in the patterns of eye movements and other behavior as participants actually use a pen or pencil to complete a paper version of the mail survey questions.

7 Acknowledgements

The author wishes to thank Debbie Griffin, Martin O'Connell, and Betty Murphy, for reviewing this paper. Thanks also to Martin O'Connell, Terry Lugaila, and Robert Kominski, who provided input during the development of the protocol for this study.

8 References

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9 Appendix A: General Protocol

General Introduction

Thank you for your time today. My name is Kathy, and I will be working with you today. We will be evaluating the design of the ACS form by having you work on a scenario that I will give you. Your experience with the site is an essential part of our work. We are going to use your comments to give feedback to the developers of the site. I did not create the form, so please share both your positive and negative reactions to the form. And remember, there is no right or wrong answer. We are not evaluating you or your skills, but rather you are helping us see how well the form works.

First, I would like to ask you to read and sign this consent form. It explains the purpose of the session and informs you that we would like to videotape the session, with your permission. Only those of us connected with the project will review the tape. We will use it mainly as a memory aid. We may also use clips from the tape to illustrate key points about the design of the Web pages. Before we get started, I would also like you to complete this computer usage and Internet experience questionnaire.

Hand the participant the consent form; give time to read and sign; sign own name and date.

Start the tape when the participant signs the form.

Before we get started, please take a moment to complete this computer usage and Internet experience questionnaire.

Hand the participant the computer usage survey to complete.

We are going to do some eye tracking as well as have you work on a scenario that I will give you. Although the form that I will show you is not fully functional, I would like you to walk me through what you would do as you would fill out the form for the household that I have assigned to you. When I refer to your household, remember that I am asking you to fill out the form for you, your spouse, and your four-year-old child.

I would like you to tell me your impressions and thoughts about the form as you work through the form and to go ahead and click where you would click if this were a fully functional web survey. I would like you to “think aloud” and talk to me about your decisions. So if you expect something to happen, tell me about what you expect. If you expect to see some piece of information, tell me about that as well. This means that as you work on completing the form, talk to me about what you are doing, what you are going to do, and why.

Finally, during the session, I may remind you to talk to me if you get quiet, not to interrupt your thought process simply to remind you to talk to me. Please focus on verbalizing what

you are thinking and expecting to happen. We are interested in the reasoning behind your actions, not just what you are doing.

Before we get started, let's practice thinking aloud, since it's not something that you would normally do while using a Web site. *Pull up www.wtop.com.* Describe your thought process as you select a new story that you find interesting to read.

After think-aloud practice is complete:

Now I am going to calibrate your eyes for the eye-tracking. I am going to have you position yourself in front of the screen so that you can see your nose in the reflection at the bottom of the monitor. To calibrate your eyes, please follow the blue dot across the screen with your eyes.

Do Calibration

Now that we have your eyes calibrated, we are ready to begin.

Continue with Test

ONLY TASK:

For this study, imagine that your household consists of you, your spouse, and a four-year-old child. Please use the survey form shown online to complete the American Community Survey for these three people living in your household. Although you will not be able to fill in the questions, go ahead and tell me about what you would enter in these boxes and why you chose the answers that you did. As you tell me about your answers, please click directly on the form as if you were filling it out online.

Do you have any questions?

Start study and pull up the ACS form using Tobii Studio.

When the session is complete, the participants will fill out the QUIS survey for the ACS form they used.

10 Appendix B: Consent Form



Consent Form
Usability Study of the ACS Form

Each year, the Census Bureau conducts many different usability evaluations. For example, the Census Bureau routinely tests the wording, layout and behavior of products, such as Web sites and online surveys, in order to obtain the best information possible from respondents.

You have volunteered to take part in a study to improve the usability of the ACS form. In order to have a complete record of your comments, your usability session will be videotaped. We plan to use the tapes to improve the design of the product. Staff directly involved in the usable design research project will have access to the tapes. Your participation is voluntary and your answers will remain strictly confidential.

This usability study is being conducted under the authority of Title 13 USC. The OMB control number for this study is 0607-0725. This valid approval number legally certifies this information collection.

I have volunteered to participate in this Census Bureau usability study, and I give permission for my tapes to be used for the purposes stated above.

Participant's Name: _____

Participant's Signature: _____ Date: _____

Researcher's Name: _____

Researcher's Signature: _____ Date: _____

Figure 33. Consent Form for Current Study

11 Appendix C: Background Survey

YOUR ANSWERS ARE CONFIDENTIAL

Demographics

1. What is your age? _____

2. Are you male or female? _____

3. What is your level of education?

- grade school
- some high school
- high school degree
- some college
- 2-year college degree
- 4-year college degree
- some postgraduate study (e.g., M.A., M.B.A., J.D., Ph.D., M.D., programs)
- postgraduate degree (e.g., M.A., M.B.A., J.D., Ph.D., M.D.)

4. How often do you use ACS data products?

- Daily
- Weekly
- Monthly
- Less than once a month
- Do not use

5. What statistics courses have you completed?

- Advanced graduate-level statistics
- Advanced undergraduate/beginning level graduate statistics courses only
- Introductory statistics courses only
- No statistics courses completed

6. Rate your level of expertise with statistics.

- Novice (Just beginning to use statistics or rarely use them)
- Intermediate (Moderate experience with statistics)
- Expert (A great deal of experience with and/or frequent use of statistics)

Figure 34. Background Survey Page 1

Computer Experience

1. Do you use a computer at home, at work, or both?

(Check all that apply.)

- Home
- Work
- Somewhere else, such as school, library, etc.

2. If you have a computer at home,

a. What kind of modem do you use at home?

- Dial-up
- Cable
- DSL
- Wireless (Wi-Fi)
- Other _____
- Don't know _____

b. Which browser do you typically use at home? Please indicate the version if you can recall it.

- Firefox
- Internet Explorer
- Netscape
- Other _____
- Don't know _____

c. What operating system does your home computer run in?

- MAC OS
- Windows 95
- Windows 2000
- Windows XP
- Windows Vista
- Other _____
- Don't know _____

3. On average, about how many hours do you spend on the Internet per day?

- 0 hours
- 1-3 hours
- 4-6 hours
- 7 or more hours

4. Please rate your overall experience with the following:

Circle one number.

	No experience					Very experienced			
Computers	1	2	3	4	5	6	7	8	9
Internet	1	2	4	5	5	6	7	8	9

5. What computer applications do you use?

Mark (X) for all that apply

- E-mail
- Internet

Figure 35. Background Survey Page 2

- Word processing (MS-Word, WordPerfect, etc.)
- Spreadsheets (Excel, Lotus, Quattro, etc.)
- Accounting or tax software
- Engineering, scientific, or statistical software
- Other applications, please specify _____

For the following questions, please circle one number.

	Not Comfortable				Comfortable
	1	2	3	4	5
6. How <i>comfortable</i> are you in learning to navigate new Web sites?					
7. Computer windows can minimize, resized, and scrolled through. How <i>comfortable</i> are you in manipulating a window?	Not Comfortable				Comfortable
	1	2	3	4	5
8. How <i>comfortable</i> are you using, and navigating through the Internet?					
9. How <i>often</i> do you work with any type of data through a computer?	Never				Very Often
	1	2	3	4	5
10. How <i>often</i> do you perform complex analyses of data through a computer?					
11. How <i>often</i> do you use the Internet or Web sites to find information? (e.g., printed reports, news articles, data tables, blogs, etc.)					
12. How <i>familiar</i> are you with the Census (terms, data, etc.)?	Not familiar				Very familiar
	1	2	3	4	5
13. How <i>familiar</i> are you with the current American Community Survey (ACS) and American FactFinder (AFF) sites (terms, data, etc.)?					
	1	2	3	4	5

Figure 36. Background Survey Page 3

12 Appendix D: Questionnaire for User Interface Satisfaction (QUIS)

Please circle the numbers that most appropriately reflect your impressions about using the ACS form.

1. Overall reaction to the ACS form:	terrible	1	2	3	4	5	6	wonderful	7	8	9	not applicable
2. Layout of Questions:	confusing	1	2	3	4	5	6	clear	7	8	9	not applicable
3. Use of terminology throughout the form:	inconsistent	1	2	3	4	5	6	consistent	7	8	9	not applicable
4. Clarity of instructions the form:	inadequate	1	2	3	4	5	6	adequate	7	8	9	not applicable
5. Location of instructions on the form:	illogical	1	2	3	4	5	6	logical	7	8	9	not applicable
6. Ease of filling out form:	never	1	2	3	4	5	6	always	7	8	9	not applicable
7. Overall experience of filling out form:	difficult	1	2	3	4	5	6	easy	7	8	9	not applicable
8. Additional Comments:												

Figure 37. QUIS Instrument

13 Appendix E: Eye-Tracking Heat Maps for All Participants

13.1 Heat Maps for the 2007 ACS Mail Form

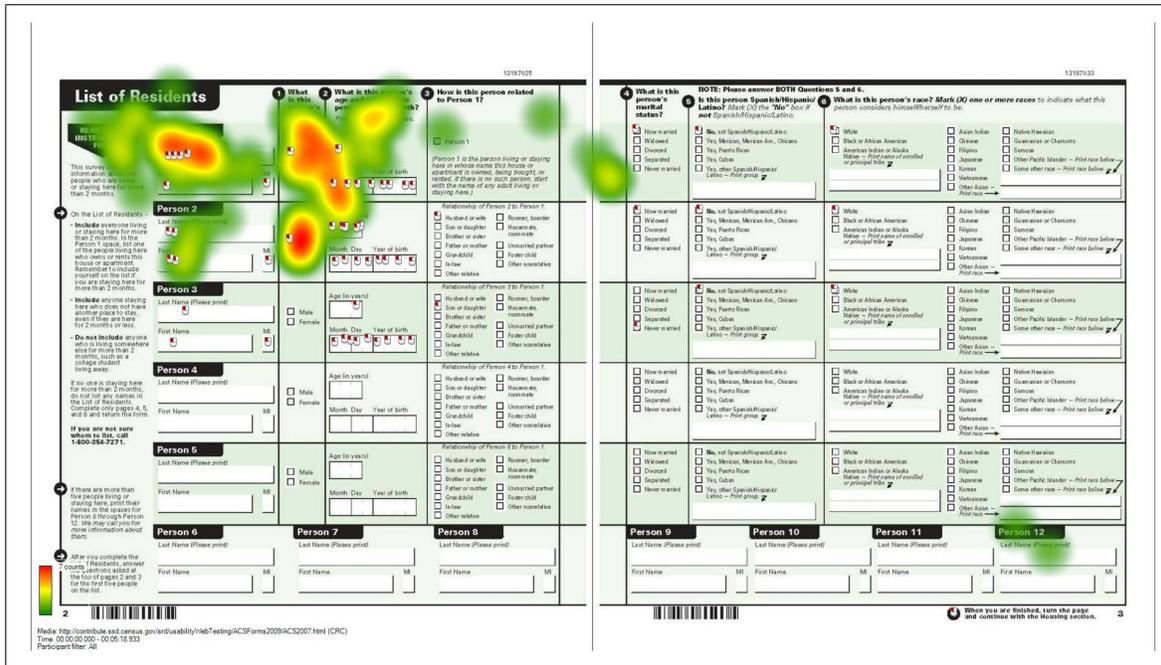


Figure 38. 2007 ACS Mail Form Heat Map: Participant 2



Figure 39. 2007 ACS Mail Form Heat Map: Participant 4

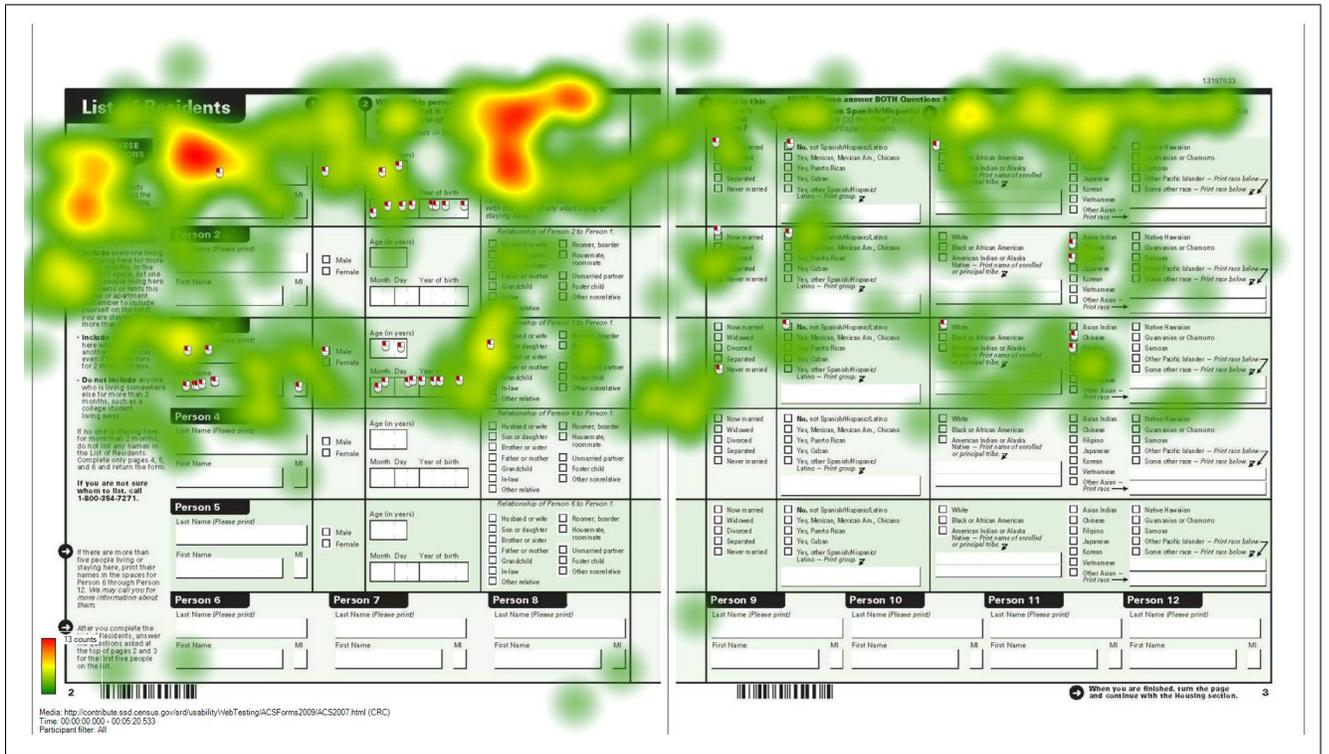


Figure 40. 2007 ACS Mail Form Heat Map: Participant 6

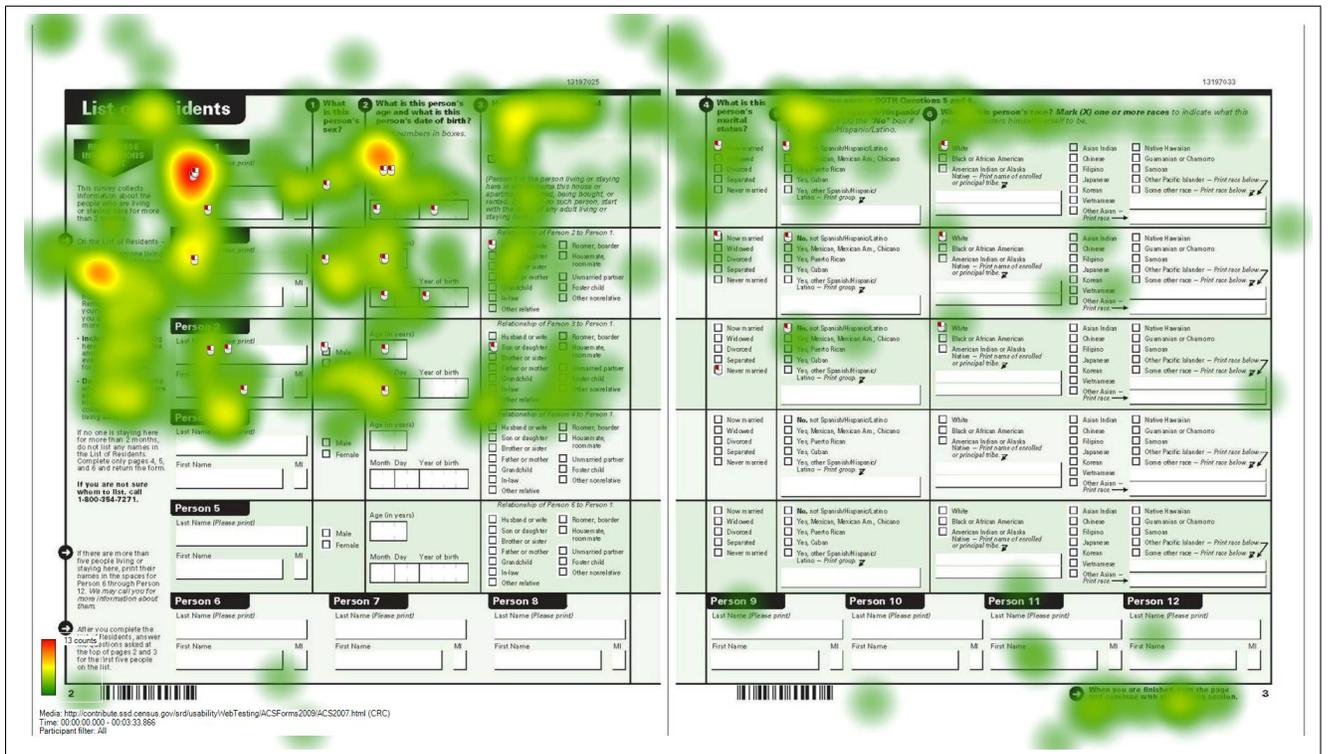


Figure 41. 2007 ACS Mail Form Heat Map: Participant 8



Figure 42. 2007 ACS Mail Form Heat Map: Participant 10



Figure 43. 2007 ACS Mail Form Heat Map: Participant 12

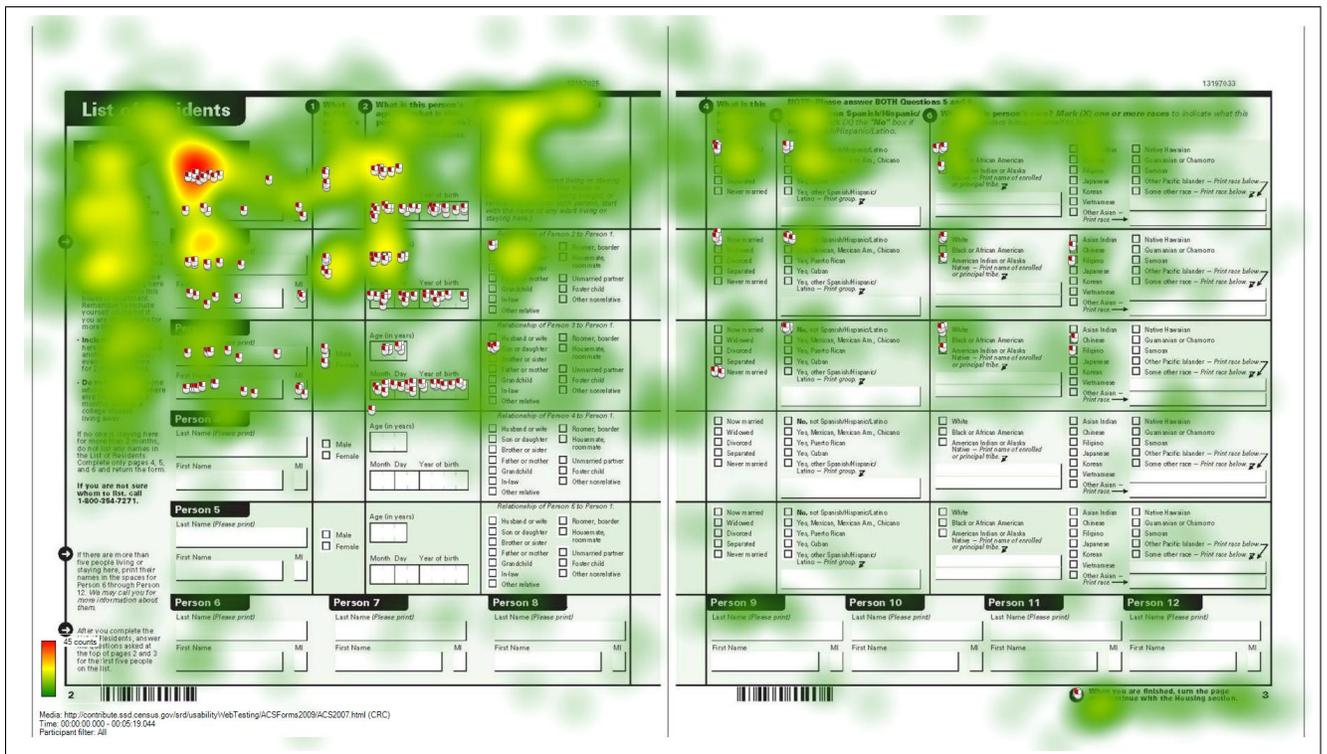


Figure 44. 2007 ACS Mail Form Heat Map: All Participants Together

13.2 Heat Maps for the 2008 ACS Mail Form



Figure 45. 2008 ACS Mail Form Heat Map: Participant 1

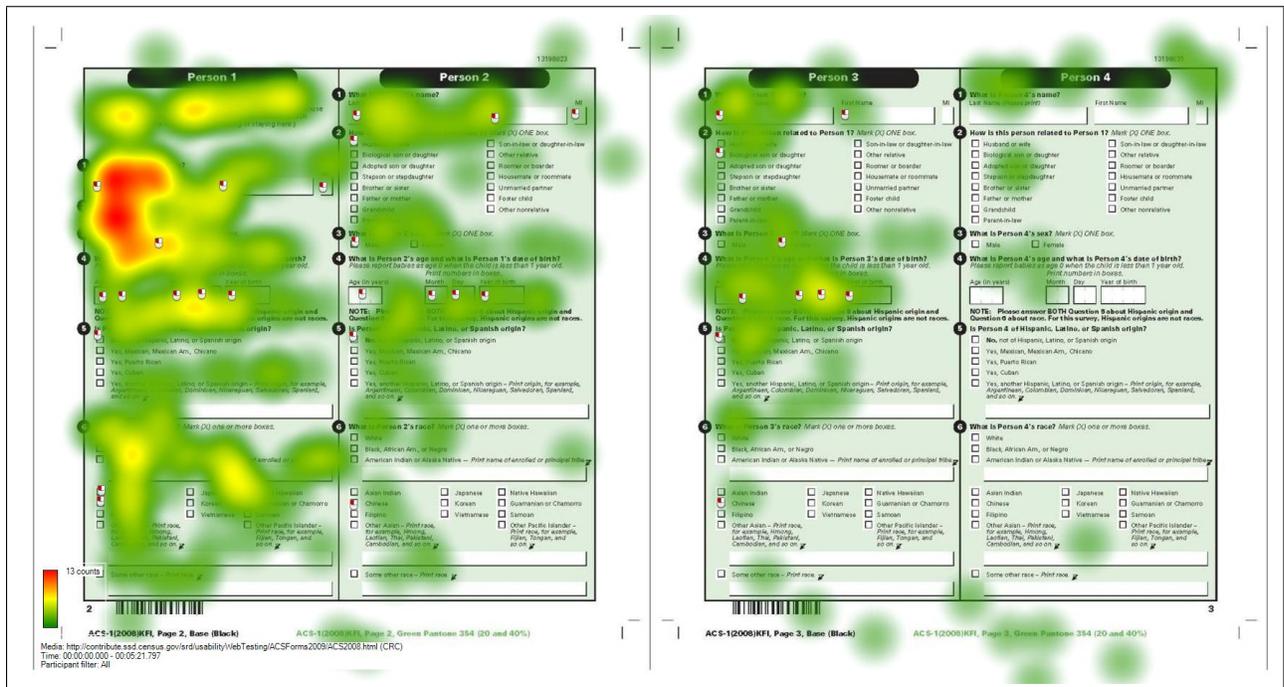


Figure 46. 2008 ACS Mail Form Heat Map: Participant 3



Figure 47. 2008 ACS Mail Form Heat Map: Participant 5

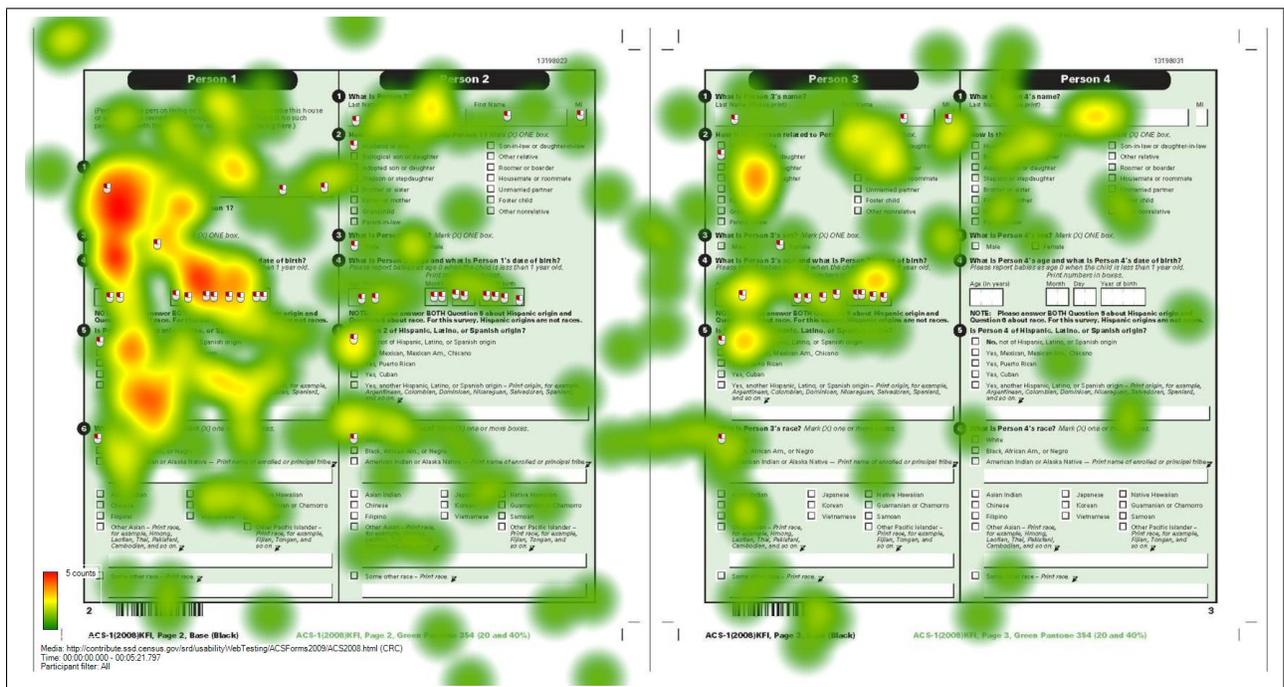


Figure 48. 2008 ACS Mail Form Heat Map: Participant 7

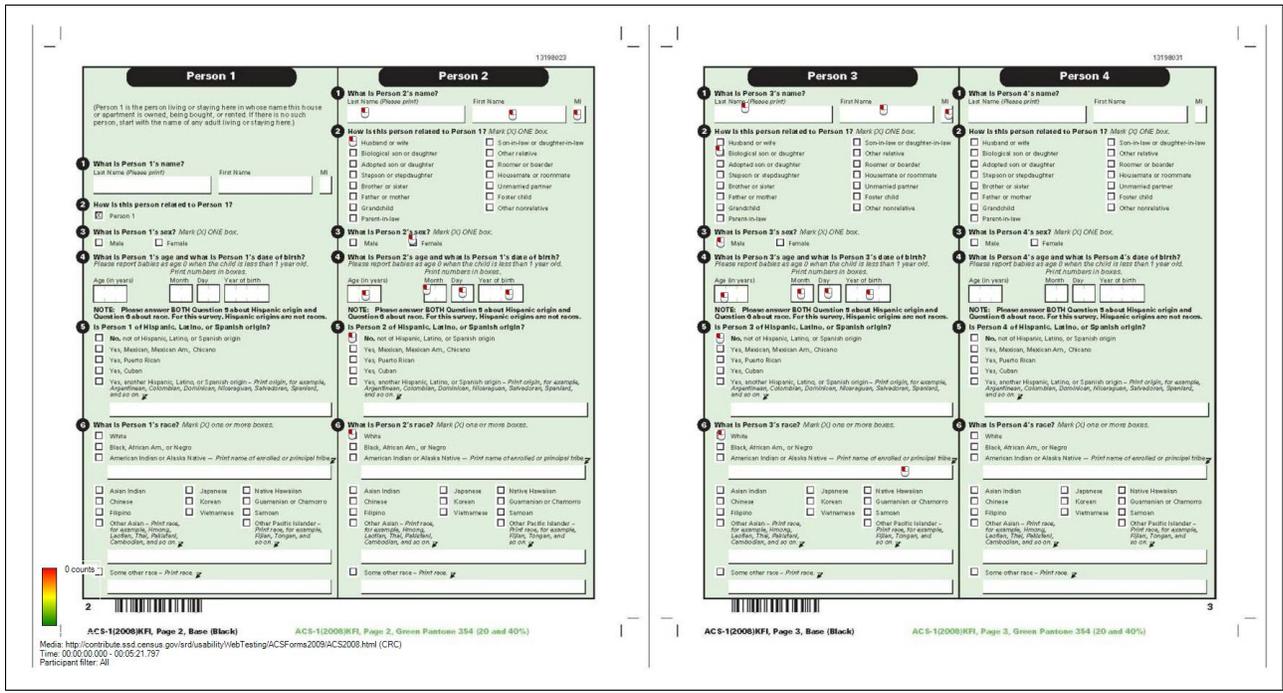


Figure 49. 2008 ACS Mail Form Heat Map: Participant 9 (Mouse Click Data Only - No eye-tracking data)

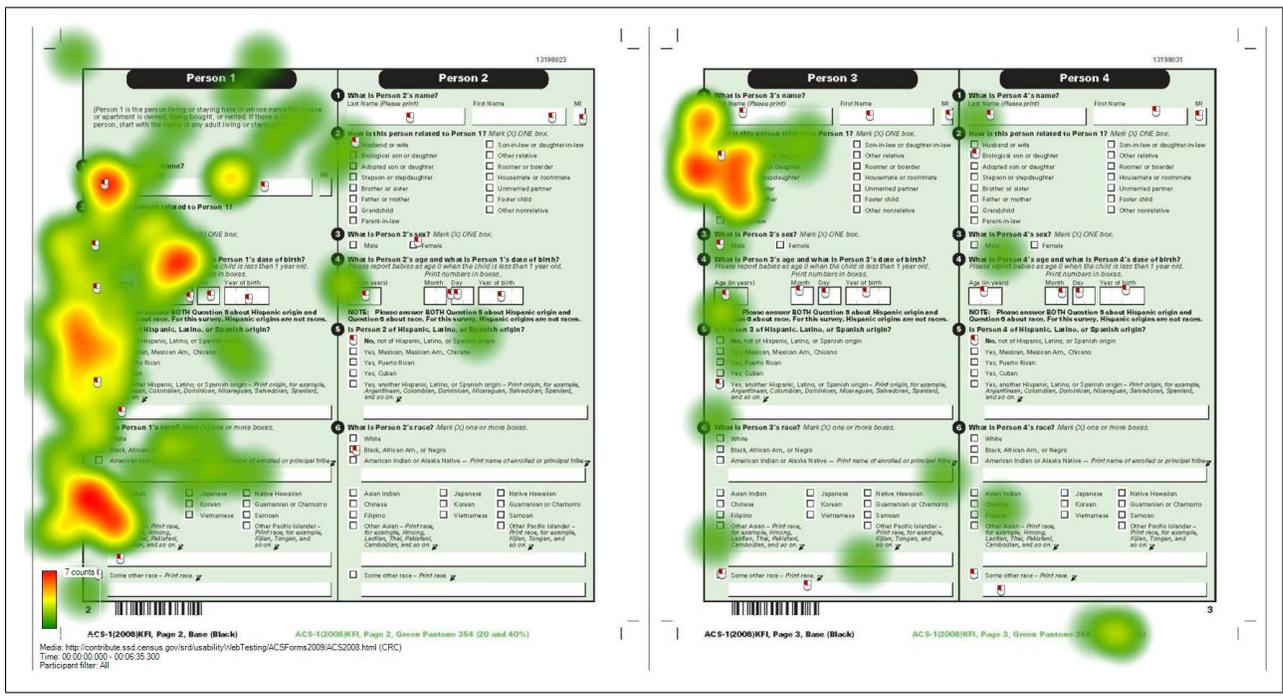


Figure 50. 2008 ACS Mail Form Heat Map: Participant 11

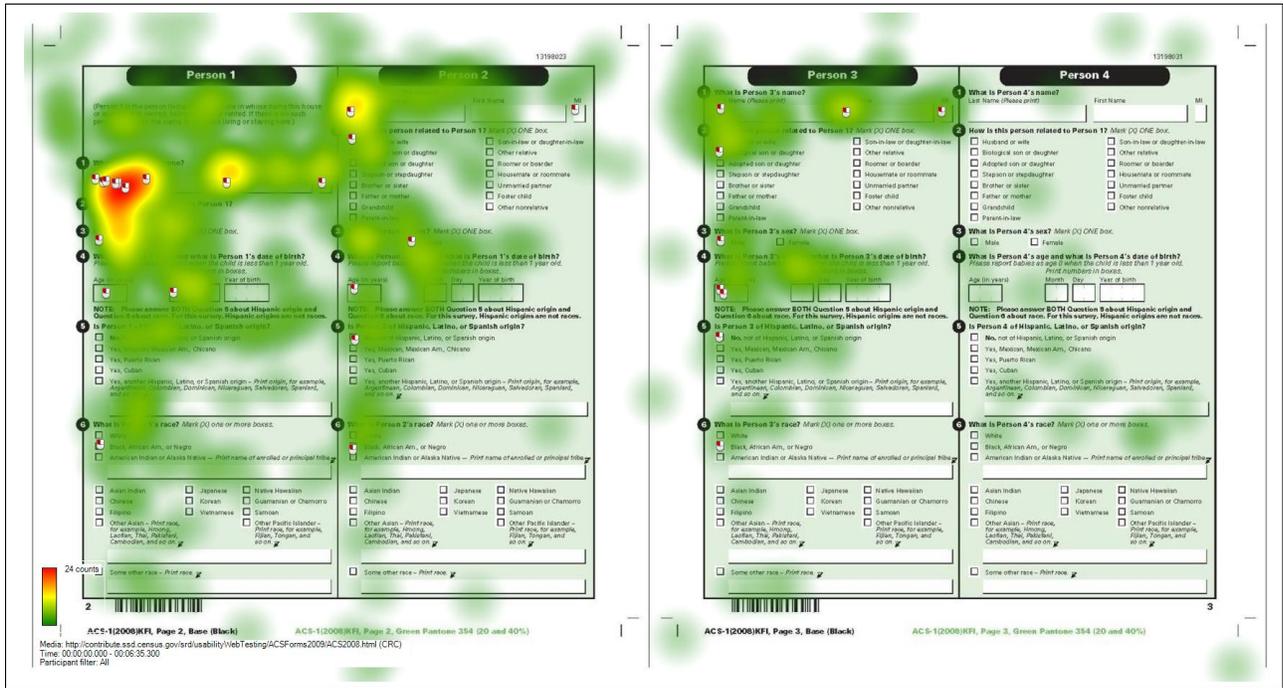


Figure 51. 2008 ACS Mail Form Heat Map: Participant 13

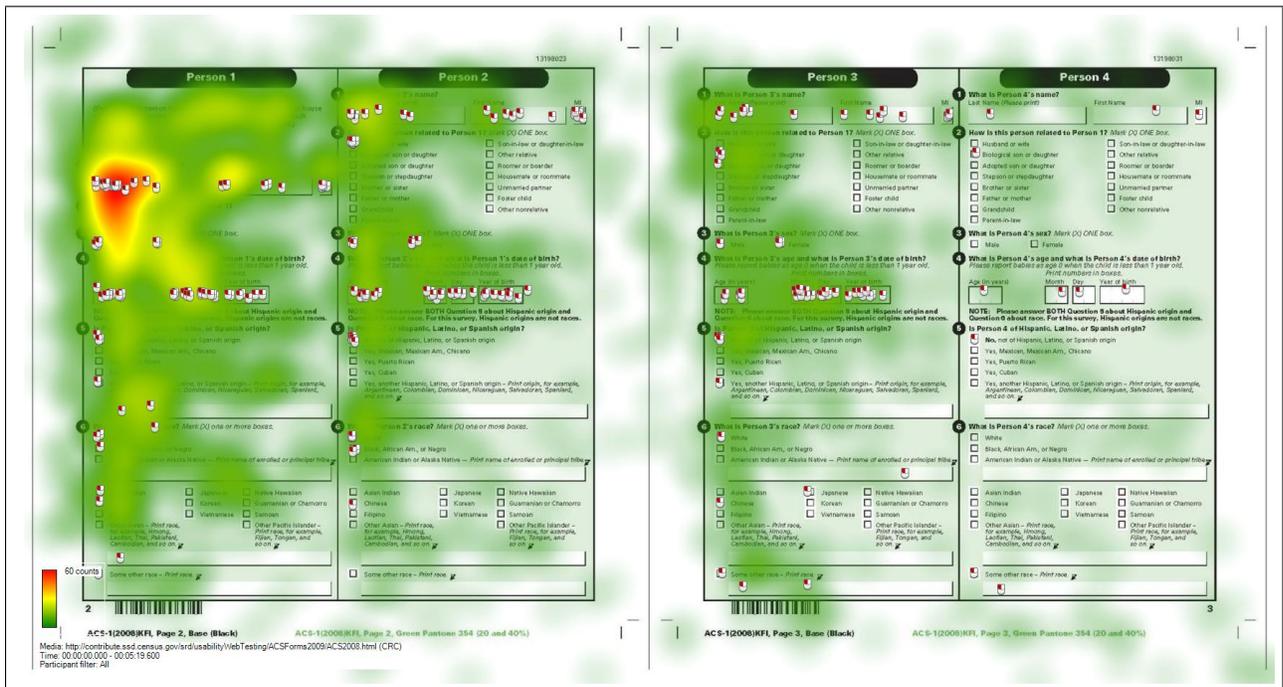


Figure 52. 2008 ACS Mail Form Heat Map: All Participants Together