

4 The Experiment

This chapter presents tests that were run on the prototypes, which attempt to gauge how users accept and benefit from WNH when navigating the web. The general question asked in this study is: “How does WNH help or not help functionally illiterate and blind users in navigating the web”. In order to answer it, qualitative research methods with exploratory purposes were used.

The purpose of the user study on the WNH prototype was three-fold: first, to find out if WNH can be of any help to functionally illiterate and blind users, or in other words: how does WNH help or not help these users in navigating the web; second, to find out how WNH can be improved or modified to suit their immediately perceived needs more appropriately; finally, how can WNH be used to attend to yet a broader scope of interactive needs faced by these two similar but distinct groups of users.

Two different experiments were run, one for each group of users (i.e., a test for blind users and a different one for functionally illiterate users). Sections 4.1 and 4.2 present the description of these experiments.

4.1. Experiments with Group 1 (alleviating sight problems)

This study has users attempt to use WNH-see to complete one task on the Brazilian Internal Revenue Service (“Receita Federal do Brasil”: <http://www.receita.fazenda.gov.br/>) web site. The reason for choosing a task hosted in this site was that, in contrast to others, this was the only government site that presented *accessible captchas*⁹ for blind users.

⁹ Audio captcha differs from visual captchas in that instead of displaying an image with letters and numbers in a *messy* visual background, it consists of a series of numbers read out loud in the midst of a noisy and clutter background (in order to make more difficult the interpretation by malware robots).

4.1.1. Participants

The study involved 5 blind adults recruited in different contexts (P1-1, P1-2, P1-3, P1-4 and P1-5). One is a former PUC student; three others belong to URECE¹⁰, a non-profit organization to promote sport and culture amongst the blind, and the fifth was a teacher at Benjamin Constant Institute¹¹, a “...*national reference center for the visually-impaired concerns*” (Instituto Benjamin Constant, 2009). Four users were between 25 and 30 years old and one was 70 years old. All of them are male. Three of them were college graduates, among whom two are full-time workers and one is retired. The others are athletes and/or had a range of occupations.

The subjects were all web users, some of them very experienced. They all claimed to use the web at least twice a week, at least 2 to 3 hours each time. None of them, however, had ever accomplished any task similar to the one requested in the scenario on any Brazilian governmental web site. As put by one user, their use is unlimited and independent while the communication between the user and the web site is unidirectional. The moment they need to provide any information, and especially when this information is sensitive (as in the case of id or credit card numbers), they ask for help from someone else sighted.

4.1.2. Preparation

The first two experiments (P1-1 and P1-2) were considered to be pilot-experiments, used in order to fine-tune the system for the other three remaining experiments. During the first two experiments, modifications to WNH-see were allowed and effectively made (described later in this section). After that, during the other three experiments, the software was frozen and no modifications were made.

Each subject sat at a computer loaded with WNH-see, JAWS screen-reader and connected to the Internet. A brief explanation of the purpose of the research was given, and the Consent Term was read to them. They were asked to orally pronounce themselves regarding their acceptance/refusal of the performance of the experiment, and this pronouncement was recorded (instead of a signature). After that, in order to get to know the participants better (e.g., their previous experience with the Internet, with government site navigation, with other sites,

¹⁰ <http://www.urece.org.br>

¹¹ <http://www.ibc.gov.br>

their difficulties), they were asked to answer some questions on a profile questionnaire. Then they were asked to listen to the task scenario and to perform what was requested of them. The browser was already open, and the required web site page was already loaded. The cursor was also already positioned in the URL address bar, which served as a starting point, or a gateway entrance, to WNH (it is noteworthy that: blind navigation makes use of keyboard *tabs*, which moves the cursor to the next page element. WNH is only two *tabs* after the browser address bar).

Scenario:

The scenario suggests that the participant is about to submit a loan request for buying a home to the Brazilian Federal Loan and Saving Bank (“Caixa Econômica Federal”). In order to do that, he/she is asked to retrieve a specific document from the Brazilian Internal Revenue Service (“Receita Federal do Brasil”: <http://www.receita.fazenda.gov.br/>) web site which attests he/she has no debts to any Brazilian governmental institution (“Certidão Negativa de Débitos”).

The participant is oriented to navigate using the new tool called WNH already installed in the Firefox Browser, instead of browsing the web site itself. He/she is told to take 20 minutes at most, by the end of which, if no success is achieved, the participant might call a fictitious friend who shall help in accomplishing the task.

Risks:

This experiment involved some risks:

- 1) Sites could suddenly change during an experiment or between two experiments. The “Receita Federal do Brasil” site actually was modified in the night before the first experiment, which required a few modifications in the script;
- 2) Sites can be temporarily down;
- 3) CoScripter server-side can be temporarily down. This did occur during one experiment, and the solution found was to set a new appointment date for the experiment;

Modifications to WNH and to other experiments as a result of the first two experiments (P1-1 and P1-2):

After the first experiment took place, it was noted that P1-1 presented difficulties in situating himself in the process. Although a non-blind user would have noticed that the process was in course (through the visual elements used by CoScripter when coloring web page elements, or when the web page is changed), blind users only had access to what was orally mentioned. In order to tackle this problem, a *guidance* window with a message informing that “x steps out of y have been concluded” was popped-up whenever a new step was concluded, as shown in Figure 18. This information would be read out-loud by the screen reader whenever available.

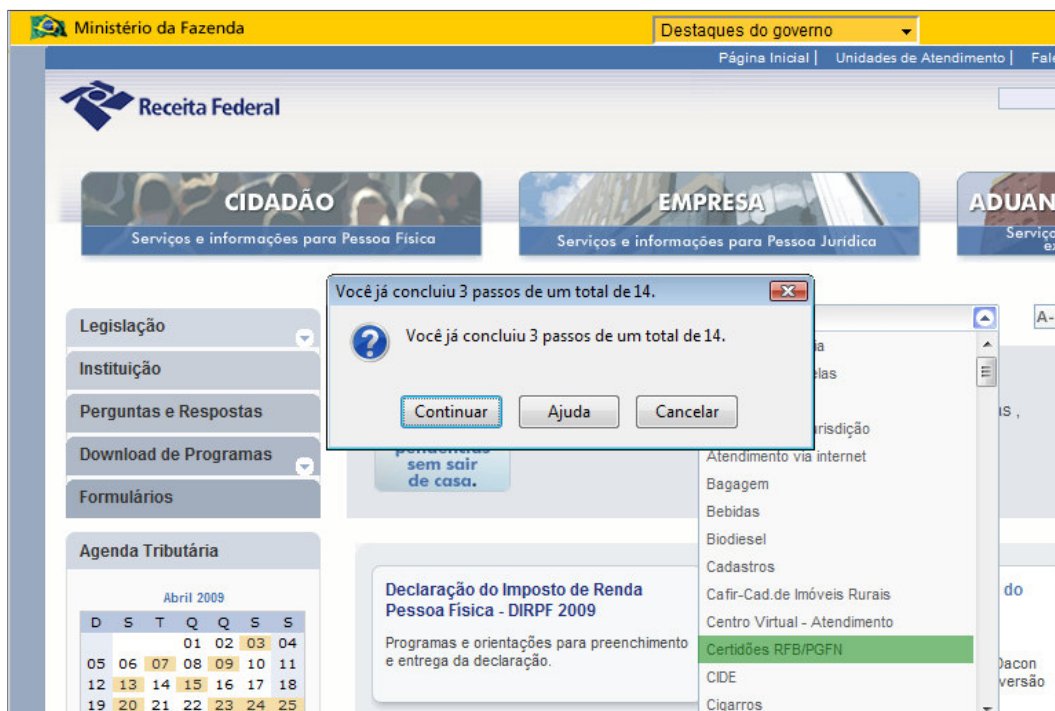


Figure 18: WNH guidance pop-up window

Still during the first experiment, besides the *guidance* tip previously mentioned, it was found of utmost importance to allow users, whenever desired, to restart the whole process or to look for a new process to run. A new button called “Help” was added to the pop-up *guidance* window. By pressing the new “Help” button, users are requested to specify the action to be taken: whether to restart the current process, or to start a new process, or to cancel the help and get back to the ongoing process, to the point it was when it was suspended by help. Figure 19 shows this interaction.

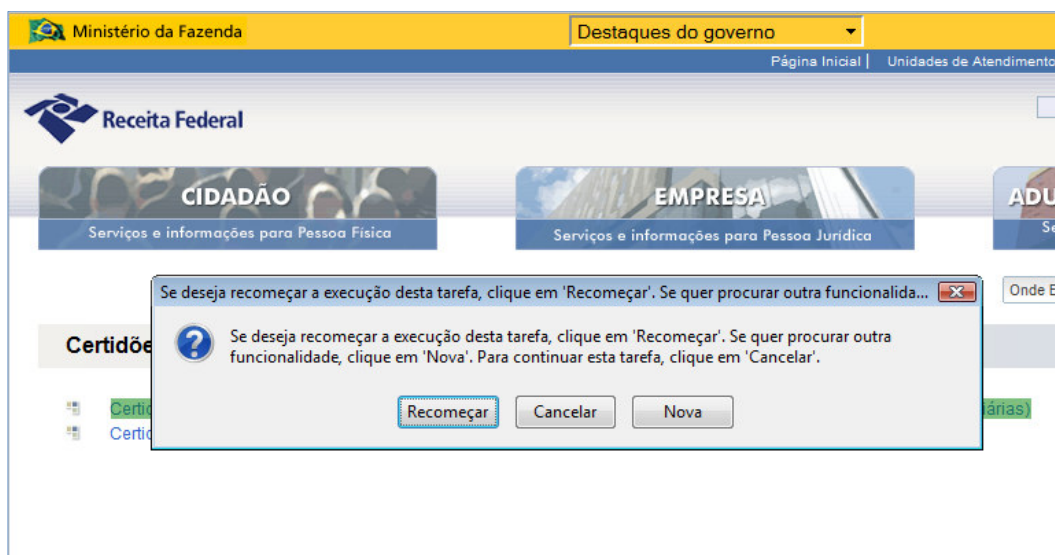


Figure 19: Restarting the process or starting a new one

Other interesting findings were seen in P1-1 and P1-2 that required changes. Nevertheless, although important, due to time limits these changes were left to posterior versions. One change worth citing is: once in WNH interface, users should be audibly notified whether and when navigating out of WNH. In the current version, if users keep pressing Tab to proceed to the next element, at some point they reach the end of WNH and enter the main web page without even noticing this passage. While sighted users have natural and implicit information about the limits of WNH by only watching the screen, blind users need to be audibly informed of these limits.

4.1.3. Results

Here the results of the experiments with five blind participants are presented. Several relevant characteristics of their profiles are also shown.

P1-1

Profile: the user lost his vision at the age of 22, and now, at the age of 28, he distinguishes light only. He has been accessing the Internet every day, for 10 years already, on an average of 10 hours a week. Sites like Google, Gmail are the most visited. He is American, therefore not very familiar with Portuguese formal terms (e.g., from Brazilian government sites).

Results: the user was lost concerning where and in which phase of the process he was. Also, he didn't know how to restart the process. He had difficulties in comprehending the Portuguese read by the screen reader, and also with using Jaws for Windows.

P1-2:

Profile: P1-2 is 26 years old and has been blind since the age of 6. He remembers colors. He has been using the Internet since 2001, and accesses sites through DosVox¹² almost every day, for 8 hours a day. Although an experienced user, he practically had never accessed a Brazilian governmental site.

Results: the user had difficulties in triggering the script. He browsed all scripts. Once he finally managed to start the process, he followed the WNH guidance. He said: "I only need to press the continue button? There is nothing else to do?". He managed to fill in the requested information (CPF id and captcha), but still couldn't successfully complete the process. The reason is that the government web site in which the process takes place sets a very strict expiration time limit for captchas pages. In other words, the user took longer than the site allows, and in such cases the site generates a new captcha and requests users to fill in again the new generated value.

P1-3:

Profile: P1-3 is 28 years old and has been blind since the age of one year and a half. Although he has around 10% percent vision in the left eye, he can't see details and navigates the web with the aid of screen readers. He works in an institution for the blind, is studying to enter the university, and is an athlete. He is not a frequent user of computers and the Internet: he uses it once or twice a week, for 2 hours each time. He has been using the Internet since the year of 2008, and visits mostly email and music download sites. He practically had never accessed a Brazilian governmental site.

Results: since the user was not used to notebook keyboards, it took him a few minutes to familiarize himself with it. He showed difficulties in using the notebook

¹² DosVox is a tool that combines a number of its own solutions for blind computer users, amongst them a browser and a screen reader - <http://intervox.nce.ufjf.br/dosvox/>

keys. As he didn't know how to locate WNH from the browser address bar, it took him some time to get into it. He chose to click the button that shows the available tasks "Ver Tarefas Disponíveis" after browsing several of the elements of WNH. The user said he had difficulties in understanding the Portuguese with English accent of the JAWS screen reader. When required to fill in his CPF Id, he asked the experiment instructor if he could already start filling it in (he was not sure whether the software was ready to capture his input). The user could not fill in the audio captcha, since he missed some numbers. The process was not successfully completed since the captcha was wrong.

P1-4:

Profile: P1-4 is 24 years old. He lost his vision when he was 7 years old. A Braille reviser and an athlete, he has used the Internet since 2003, every day, many hours each time. He uses DosVox and Jaws screen readers to navigate. The sites most visited by him are webmail, music download and Google (for search) sites.

Results: the user asked about the name of the tool. He showed difficulties in locating WNH tool. He pressed a combination of keys that jumps to the web page, and because of that the experiment had to be restarted. For an unknown reason, the process navigation was interrupted and the new web page was not loaded after clicking on the button to continue the process. The user clicked the INSERT key, a shortcut key used by JAWS to read out loud the current position of the cursor, which did not help him. After clicking a combination of keys, he was redirected to the browser address bar, from where he quickly restarted the experiment and entered back WNH sidebar. As soon as he heard the "Execute" button, he clicked on it, and the process continued from the point it was first interrupted. The user showed difficulties with the notebook keyboard when asked to fill in the CPF Id. When asked to fill in the audio captcha that was meant to be read out loud, the user kept browsing the elements of the pop-up message, and clicked the OK button before the captcha was said. This triggered back the WNH process, as this step was successfully concluded. When the audio captcha was finally said, not even the capture pop-up box was not available anymore (which caused the user not to be able to fill it in), but the screen reader was reading something else related to the WNH process itself (which caused overlapping and undistinguishable sounds).

P1-5:

Profile: P1-5 is 70 years old, and was born blind. He is a retired teacher in an institution for the blind. He has used computers and the Internet since 1994, once every two to three days, for two to three hours each time. He uses Webvox as the navigation browser, and for those sites that it doesn't work with, he uses JAWS screen reader and another regular browser. The sites most visited by him are webmail, news and Google (for search) sites. He considers his navigation (when visiting known sites) to be efficient.

Results: the user didn't know how to find the requested tool. He heard the "Execute" button and clicked on it, which did nothing. He tried again, and heard the "Restart" button. It restarted the last executed procedure, which luckily was the desired one. The user was misled by one of the oral messages of the screen reader: JAWS kept saying during the whole execution process percentage numbers (which the experiment researcher could not identify or suppress). In one of the cases, the screen reader said "100%", and P1-5 thought for a moment that the process was concluded. He hit the Help button, and then clicked on the Restart button. The whole process was then restarted. The user could not follow the audio captcha read. The process was not successfully completed since the audio captcha was not filled up.

4.1.4. Discussion

Most users presented difficulties in understanding and handling captchas. Only one of them managed to hear the numbers and type them correctly in the data input box, and the others said they barely grasp this information the first time around, so a second chance is of utmost importance.

All users also showed some difficulty in using the laptop keyboard, which is different from the one they are used to. Actually, this was a technical problem during the experiments realization, which could be prevented if there were better infra-structure conditions for this research. Nevertheless, it did not put into jeopardy the gathering of important indicators that contributed to noteworthy results.

P1-3 and P1-5 were misled by some of WNH pop-up messages that informed them that the step was completed, although there were errors in that same interaction.

P1-1 was the one that presented most difficulties in interacting with WNH. He not only was the first one to test WNH, but also presented other personal difficulties. Being American, English is his mother-tongue, and his understanding of some of the screen reader spoken words in Portuguese was far from fluent. Besides, he was not familiar with terms used in the “Receita Federal” site, such as “Pessoa Física”, “Pessoa Jurídica”, etc. At last, he claimed lack of confidence in using Jaws in Windows, since he is a Macintosh user. The other participants also claimed lack of confidence in using Jaws, but only because they are used to other screen readers.

P1-2 presented a behavior that might repeat itself in the future, or might be a common behavior among the blind. The same way non-blind users pass the eyes over a page in order to get an overview of it, P1-2 moved too quickly between the elements of the page, when he was looking for a script that performed the desired task, and ended up by skipping the desired one. This caused him to reach the web page itself, and he couldn't get back to the start point.

4.2. Experiments with Group 2 (alleviating reading problems)

In this study users attempt to use WNH-read to complete one task in the Transit Department of Rio de Janeiro State (“DETRAN-RJ – Departamento de Trânsito do Rio de Janeiro”: <http://www.detran.rj.gov.br/>) web site. The tasks for groups 1 and 2 were constructed to be equivalent in difficulty and nature.

4.2.1. Participants

The study involved 5 adults recruited in different contexts (P2-1, P2-2, P2-3, P2-4 and P2-5), four of them students with at least 6 and at most 12 years of study, and with minimum Internet experience, one of them not studying anymore. Their ages ranged from 24 to 63. Two of them (P2-1 and P2-2), female, worked as domestic servants in houses of friends/families, two of them (P2-3 and P2-4) are male students in an Adult Education Nucleus (NEAD – Núcleo de Educação de Adultos), a social project supported by PUC-RJ to promote literacy instruction and basic schooling improvement for adults (NEAd, 2009), and the last, P2-5, works as a building gatekeeper. P2-3 has no other formal occupation besides NEAD, and P2-4 works as a wall painter at PUC-RJ.

Three of the subjects were all very basic web users, claiming to have used it a few times only. Two others proved to be more familiar with the Internet, continuously using it for at least 6 months before the experiment. None of them, however, had ever entered any Brazilian governmental web site.

4.2.2. Preparation

Both P2-1 and P2-2 experiments were considered to be pilot experiments, used in order to fine-tune the system for the other three remaining experiments. During these first two experiments, modifications to WNH-read were allowed and effectively made (described later in this section). After that, during the other three experiments, the software was frozen and no modifications were made.

Each subject sat at a computer loaded with WNH-read and connected to the Internet. A brief explanation of the purpose of the research was given, and a short version of the Consent Term was given to them. They were asked to sign it, showing their acceptance/refusal of the performance of the experiment. After that, in order to get to know the participants better (e.g., their previous experience with Internet, with government sites navigation, with other sites, their difficulties), they were asked to answer some questions on a profile questionnaire. The written scenario was then given to them, and after reading it, a brief discussion of what they understood took place. The scenario reading and the posterior discussion were used to have a glimpse, although in a superficial way, of the level of functional literacy of the participants. After that, they were asked (except for P2-1, since it was created after and as a result of her experiment) to watch a tutorial demo that exemplifies how WNH works. After reading the scenario and watching the demo, they were allowed to start the experiment. Firefox browser was already open, and the required web site page (Detran-RJ) was already loaded.

Scenario:

The scenario suggests that the participant lost his/her Brazilian ID Card, and a friend told him/her to check on the DETRAN-RJ web site if it had been found (although this is a transport department, it also handles this type of service). This same friend also comments that there is a quick way of accomplishing this task through a new tool, positioned in the left side of the screen, which should be used by the participant instead of the DETRAN-RJ web page itself.

The participants are told to take 20 minutes at most, by the end of which, if no success was achieved, they might call a fictitious friend who shall help in accomplishing the task.

Risks:

This experiment involved the same risks specified in Section 4.1: Experiments with Group 1 (alleviating sight problems).

Modifications to WNH and to other experiments as a result of first two experiments (P2-1 and P2-2):

During the first experiment, it was noted that the script actions exhibited in the WNH sidebar panel were unnecessary to the task execution, and, worse, could be confusing to the participant. It was decided to suppress this information, as shown in Figure 20.

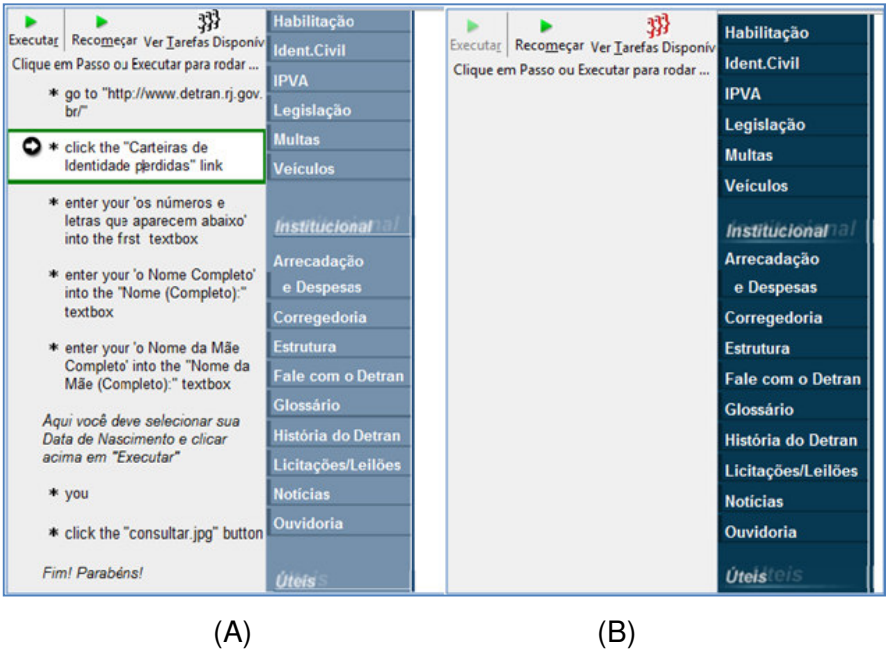


Figure 20: WNH before (A) and after (B) left sidebar information was omitted.

Also in the first experiment, the button which triggers the list of functionalities called “Ver Tarefas Disponíveis” was changed to a blinking button, in order to be easily seen by users.

P2-1 had difficulties in understanding where WNH is located, and how to use it. After this experiment, it was decided to show them a tutorial demo that presents a brief overview of how it can be used and how to trigger scripts.

Other interesting findings seen in P2-1 and P2-2 required changes. Nevertheless, although important, due to time limits these changes were left to posterior versions. They are:

- 1) Data input from the participant should be concentrated in the beginning of the execution. The reason for doing this is due to session time constraints imposed by the governmental sites: a process that takes more than five minutes requires a new captcha code generation;
- 2) Some of the data users need to provide is required by means of a dialog box pop-up, which should be filled in by the user. This is true for data of text type, whose correspondent in the html page is a “<input>” tag, and in the WNH script is a “Enter your” action. Other types of data, such as those users select from a list of possible values (like a month in a combo-box), whose representation in WNH script is a “Select” action, are still not captured by WNH. Instead, they should be selected on the web page itself. In other words, WNH is not intermediating this request. The reason for not having done that yet is because this type of action requires a parsing of the html page to collect the possible values and to present this information to the user. Due to the amount of time available to implement it in WNH, it was decided to leave it for future versions. An alternative implementation would be, instead of opening a pop-up window containing a combo-box for data selection, to have WNH make use of the combo-box already present in the web page, and highlight it whenever it should be selected.

4.2.3. Results

The details of the experiments are presented below.

P2-1:

Profile: the user is in the 6th year of Brazilian studies (5th grade of Elementary School), is 23 years old, and was evaluated as roughly/basically-literate. She took a long time to read the scenario, and didn't seem to have comprehended it fully. She had accessed the Internet very few times, only to study, and had not used it freely before;

Results: the user showed difficulty in distinguishing between a button and a label, and many times she tried to click a label expecting it to produce an action. The user took a long time to input data that required typing (because of the functional illiteracy problem). Because of that, every procedure took a long time, even longer than expected, and as a consequence the execution on the Detran web site had its session expired. P2-1 could not successfully conclude the process. The user also showed difficulty in scrolling the combo box to select the year of birth. The last WNH instruction presented in a pop-up dialog was not read by the user, so she was not able to get back to script execution. She continued interacting directly with the web site.

P2-2:

Profile: the user is in the 7th year of Brazilian studies (6th grade of Elementary School), is 24 years old, and was evaluated as basically-literate. She took an average amount of time to read the scenario, and seemed to have comprehended it well. She had accessed the web a few times by the time of the experiment, mostly Orkut, children sites and singers' personal web pages.

Results: the user presented difficulties when asked to fill in her date of birth in the combo-box. She was not sure of where and how to fill it in, but managed to find out with no major effort. Nevertheless, since she also didn't read the instructions in the pop-up message with the necessary attention to remember it later, she didn't know how to trigger back the script execution. She then read the instructions and clicked on the submit button in the web page itself, and the process was concluded.

P2-3:

Profile: the user is in the 10th year of Brazilian studies (1th grade of Middle School), is 32 years old, and was evaluated as basically/fully-literate. He took less than average time to read the scenario, and seemed to have comprehended it fully. He had been using the Internet since 2005, almost every day, and lately had stopped accessing it. He used to access sites as YouTube and Orkut.

Results: the user quickly found out how to trigger the correct script, and filled out the required data pretty easily. After filling out his date of birth in the combo-box, he read the web page explanation and immediately clicked on the submit button. Even though he didn't complete the process through WNH, it helped him reach a

point from which its continuation was easy to find. Since this experiment took less than five minutes, the session had not expired and the user could successfully conclude the whole execution. At the end, the user said “Very easy”.

P2-4:

Profile: the user is 63 years old, had concluded the 12 years of Brazilian studies and had had little contact with the Internet by the time of the experiment.

Although he considers it important to know how to navigate the web, he is not very enthusiastic about learning and practicing it.

Results: P2-4 was evaluated to be basically-literate despite having concluded the 12-years studies: he took an average amount of time to read the scenario, but didn't seem to have comprehended it well. Also after watching the tutorial demo, he was about to interact with the web page and not with WNH, despite the instructions. The user showed difficulty in identifying clickable html elements. After a few times of clicking on pure text, he was told that he can only click on elements over which the mouse cursor appears as a hand. Then, he finally succeeded in clicking on the link that triggers the process. After starting the process, he asked if he should always expect to see a hand cursor in order to interact, even if the required action was text data filling. When asked to fill out the captcha letters and numbers, he said: “I see no letter”. Then he clicked the OK button to proceed with the execution without this information. He presented many difficulties in finding the letters on the keyboard when asked to fill out his and his mother's full name. The user interacted with both the pop-up dialog box and the web page at the same time. Although the dialog box requesting his mother's full name was still open, he was already reading the next item on the form, the date of birth, on the web page. For a moment he was confused if the data requested was his or his mother's date of birth. This caused him to digit the day of his birthday on the still open dialog box. After that, he clicked on the OK button. When the instruction message to fill out the date of birth popped-up, he quickly read it and clicked on OK. He took long time reading the instructions on the web page, up to the point where he said “Now I'm stuck, can't go on”. He kept reading for a while, tried asking the experiment instructor what he should do, and repeated “I'm stuck”. The experiment was then concluded.

P2-5:

Profile: P2-5 had concluded the 7th year of Brazilian studies (6th grade of Elementary School), is 31 years old, and was evaluated as basically-literate. He took an average amount of time to read the scenario, and seemed to have comprehended it well. He has been using the internet for more than 5 years, twice a day. The sites mostly visited by him are Orkut and airline companies (to buy airline tickets).

Results: the user interacted with WNH only in the very beginning of the experiment: he clicked the “Functionalities” button and, then, chose to interact directly on the web page itself. He filled in the name of his mother where his own name should have been placed. Later he fixed it. He filled in the date of birth of his mother instead of his (this is because the date of birth combo box appears right below the “Name of the mother” field). He showed fluency in typing the letters and numbers on the keyboard. After each step concluded, he returned to the web page instructions to check what was to be done next. He followed the instructions with no major problems. He knew how to choose the date in the combo box, and didn’t conclude the experiment successfully since the session expired (it took longer than 5 minutes).

4.2.4. Discussion

More than the obstacles imposed by each web site, the functionally-illiterate had difficulties inherent to their condition of usually being inexperienced with the Internet and of having difficulties in reading explanations (both from the WNH and from the web page itself).

The difficulty presented by P2-1, i.e. continuing to interact with the web page itself at some point of WNH execution, leads to two conclusions:

1) Even if WNH doesn’t solve all problems, at least it can be used to accelerate its users’ navigation by shortcutting part of it;

2) WNH needs to offer users a better recovery way than expecting them to remember what is to be done. WNH should inform users where they are right now, and let them retrieve help when needed.

P2-2 also demonstrated difficulties in this same part of the script execution, as stated in her description. Even though both P2-1 and P2-2 presented difficulties with this issue, due to time restrictions it was decided not to change the script or WNH behavior for further experiments. However, future versions need to be more helpful or think up other ways of handling this type of problem.

P2-2 was the first user to watch the tutorial demo, and she seemed to have benefited a lot from it. After watching it, she easily identified the correct script and executed it. Yet, it should be taken into account that this participant seemed to have a higher literacy level and to be much more familiar with computers than others.

4.3. Difficulties evidenced during the experiments

This section summarizes some of the lessons learnt from the experiments undertaken in this research.

- 1) Recruiting volunteers - finding 5 blind internet users that agreed and had time to participate in these experiments was not an easy task. The experiment instructor collected a list of several distinct institutions for the blind in the city of Rio de Janeiro and contacted their spokesperson by email or telephone, presenting an overview of the research and the need of volunteers for the research. Fortunately, some of them answered back positively;
- 2) The place – once the blind participants were recruited, running the experiments with them were also not immediate. Not every place was of easy physical access to them, and the experiment instructor had to meet them at their place of work or at their home. This evidenced another difficulty, which was the need of Internet access for the experiments. As expected, not every place had public Internet access, and in order to overcome these challenges the instructor carried with her a laptop with Internet mobile access.
- 3) Equipment – reproducing the ideal conditions for the experiments, in which the used hardware and software and physical conditions are those of the users' preference, is of high importance, and should be pursued whenever possible. Every different artifact inserts a new variable that can negatively influence the results of the experiments. Nevertheless, applying this to every participant would involve too much effort, if not impossible at sometimes; therefore, in this research it was chosen to work with a constant set of these artifacts (computer, browser and screen reader) for all participants