

Embedded Cultural Features in the Design of an Accessibility Agent for the Web

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Abstract. This paper presents the Web Navigation Helper (WNH), an interface agent for users with special needs originally developed for Brazilian users. WNH mediates scripted interaction with web sites, by providing alternative dialogs with appropriate style, structure, etc. The paper reports the results of qualitative empirical studies done at the early design stages. In particular, it shows how our design vision changed when findings from initial studies revealed that the technology we were about to develop was implicitly guided by a sociability model that was not prevalent in the Brazilian culture. The main contributions of the paper are to expose the process by which we became aware of cultural factors affecting the design of accessibility agents, and to propose a kind of technology that may be adopted in cultures whose sociability models are based on personal relations with friends and family members.

Keywords: Web Accessibility; User Agents; Computer Mediated Communication; Cultural Issues in HCI Design; Sociability.

1 Introduction

In almost every social setting, when individuals have trouble performing a task that they need to accomplish, there are people available to assist them. As so many activities migrate to computer environments, we need to think of assistants. Help for online activities may be available as information (*e. g.* web sites and public repositories) and as communication – in asynchronous (*e. g.* online discussion lists and blogs) and synchronous (*e. g.* chats) form. It may also come from *user agents*, an alternative that takes much more computational effort to design and develop.

This paper discusses WNH, the Web Navigation Helper [7, 8], which as its name suggests is a user agent for helping users with special needs to navigate the Web. The metaphor underlying WNH is that of an interpreter – a *mediator* that is able to understand different languages and cultures, and can therefore translate material from one into the other in different kinds of situations. Specifically, WNH can translate web site interfaces into specialized interaction dialogs (*e. g.* dialogs appropriate for the elderly, the deaf, the blind, users with literacy deficits, etc.). The translation is not automatic; it is the result of manual interface adaptations by well-informed Web

users, who can use the WNH dialog editor to specify how a given web site's interface can be translated into an appropriate interface for the elderly, for example. This interface, which works truly as a Web Navigation Helper, is then made available for elderly users that need help to do tasks on the Web.

The size and diversity of the user population in need of help are huge, and accessibility solutions are practical only if they can scale up to benefit the largest share of the targeted population. Hence, manually produced help usually fails to make a difference in the accessibility scenario. However, there is a limit to automation when it comes to translating web site's interfaces into more accessible dialogs. If even human translators are known for making regretful context interpretation mistakes, what can we say of automated software and its ability to produce contextually adequate translations? A key element in this context is that the targeted beneficiaries of the translation are individuals with *special* (*i. e.* non-standard) needs.

One way to circumvent the limitations of automated solution, especially with the advent of Web 2.0, is *crowd sourcing*. Now that a large number of individuals can be mobilized, there have already been attempts to use the power of social participation to promote more accessibility on the Web [11]. Thus, WNH was initially conceived as an accessibility tool to be developed counting on large-scale social volunteering. However, as we found out later, the Brazilian culture, for which WNH is primarily targeted, values certain practices and structures that go in a different direction. Therefore, we report empirical research that led us to this realization and discuss what this may mean for promoting accessibility in Brazil and similar family-oriented cultures.

In Section 2, we present a brief overview of WNH. In section 3, we describe three empirical studies carried out to inform the design and evolution of WNH. Then in Section 4, we present our current conclusions and outline the future research work.

2 A Brief Overview of WNH

WNH is a Firefox plug-in and currently works in conjunction with CoScripter, a macro recorder for the Web developed by IBM Research Almaden [9]. CoScripter macros automate tasks enabled by a particular Web application whose interaction with users WNH can *mediate*. Macros must be created by *scripters*, typically non-professional Web users with high levels of digital literacy, who will then develop mediating dialogs for each macro step that requires user input. When a macro is created, all interaction with the browser is captured and recorded. Thus, input values that go into textboxes, options that are selected in list boxes and checkboxes, links and buttons that are pressed, all of these are captured for further use in the mediating dialogs. For example, a simple movie search macro recorded on Google Movie Showtimes for Rio de Janeiro might look like this in CoScripter:

1. * go to "http://www.google.com/movies"
2. * enter "Toy Story 3" into the first textbox
3. * click the first "Search Movies" button

The instructions above correspond to recorded input events and values. Note that values and events recorded in lines 1 and 3 can be *reused* if users want information

about movies in Rio de Janeiro. Likewise, we do not know how the actual interface looks like; all we know is that there is a textbox where users can fill in movie titles and a button that launches search. The *scripters'* job is to adjust the macro and create mediating dialogs that may look like in **Fig. 1** (in English only to facilitate reading).

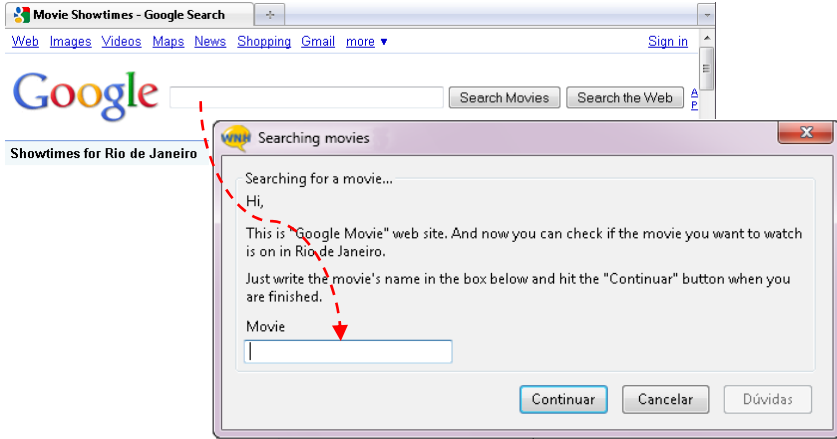


Fig. 1. How WNH mediates Web navigation

In order to allow each user to search for a different movie, *scripters* use an existing CoScripter mechanism to create variables whose values can be filled in during the execution of a CoScript. In the next step, *scripters* use the WNH specialized editor to design small screens like the one shown in **Fig. 1** and then to associate them with instructions where user input is necessary (see instruction 2 in the example above). In **Fig. 2** we show WNH editing screen shots that briefly sketch the flow that culminates in the creation of a mediating dialog, for a registration page. First (1), the *scripter* writes the screen title and the dialog text. Second (2), he sees which instructions will have their input captured in this particular screen. Third (3), the *scripter* chooses which labels and other interface elements will appear on the dialog screen (regardless of the ones used in the original web page). Fourth (4), he indicates the data types for input. Finally (5), the *scripter* can preview the dialog screen.

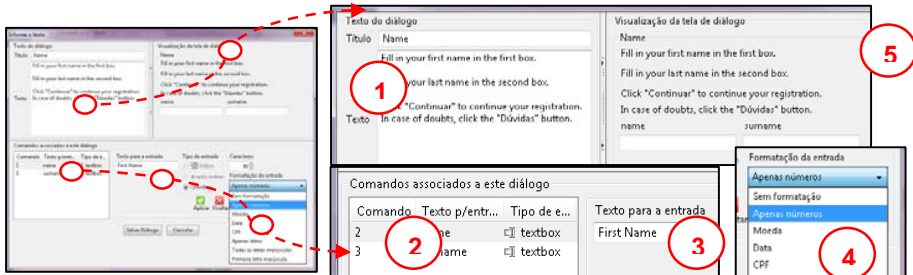


Fig. 2. Creation of a dialog in WNH editor

Scripters can add help information to dialog screens. A special button labeled “Dúvidas” (Doubts), as shown in **Fig. 1**, appears on each screen. When the targeted user presses that button during interaction with WNH, she can resolve doubts about what she must do, the meaning of specific terms, the effects of the task, the overall goal of the web site, and so on. Notice that these doubts must be anticipated by scripters, or else the end user will have no help.

With WNH installed in her Firefox, she can select one from a set of available mediated activities. Once she does it, she begins to interact with WNH. The user’s interaction with WNH guides background navigation controlled by the underlying macro. In this way, the user completes the desired task using an *alternative* style of interaction. For further details on how WNH works, see [7].

3 Empirical Studies Informing the Design of WNH

Our first approach to designing WNH was inspired by crowd sourcing. We hoped to count on volunteers with high levels of digital literacy to create mediating dialogs for users with special needs. They might even do this anonymously, if they wished. We planned to give them dialog *templates*, designed by HCI specialists, to guide their interface mediation. But in order to know what other requirements we would have to meet, we ran two exploratory experiments with participants that viewed themselves as potential WNH volunteers. We used a qualitative methodology, as is often the case with exploratory studies. In the first experiment, we worked with seven IT professionals and in the second with eight experienced Internet users. The groups were intentionally selected with complementary skills. Whereas IT professionals had no particular training in written communication, selected users in the second experiment were well-trained Language students, taking a course in digital narratives and related topics (HCI and Accessibility *excluded* for both groups).

In the first experiment, participants were quickly debriefed about WNH and its purpose. Then they were asked to go through the experiment scenario. The main character in it (whose role they should play) wants to develop mediating dialog screens for an elderly lady who wants to visit a Bus Travel Company web site and look for travel options (date, time, seat, etc.). The CoScript for the task was previously prepared by our team, so all the participants only had to design the dialogs, and make the appropriate associations between them and the CoScript instructions. Because the WNH editor was not fully implemented at that time, we used printed form sheets, which participants filled out with their solutions. At the end of the experiment, each participant had a short interview with us, about the experiment, the technology, and the participant’s perceptions and suggestions regarding WNH.

The results of this experiment gave us much useful information. This group had no difficulty to understand how CoScripter combined with WNH. As a rule, they could indicate, easily and correctly, when their dialogs should appear. They could also easily name and use interaction elements in their dialogs. Interestingly, one participant used a different interface element in his dialogs, clearly *rephrasing* what the original interface was saying. Another participant, at a certain point along the mediated dialog, directed the user to the company’s web site itself in order to select a particular bus service code. This achieved a kind of transition from mediated to non-mediated interaction, which was nice to see.

Only three participants completed all of their dialogs within the time limit for the task, and the others fell short of completing them all by only a few screens. All participants thought of questions and answers (Q&A's) to go in the "Doubts" section. The number of Q&A's elaborated by participants ranged from 3 to 7. Five participants created Q&A's for all dialogs where user input was required. The style of communication in all dialogs included various instances of technical jargon like "procedure", "this script is optimized", "valid date on dd/mm/yyyy format", and the like. In some cases, the participants even spoke for the bus travel company, saying things like: "Unfortunately, it's possible that your city isn't served by our company."; "We apologize, but apparently this city isn't served by Viação Cometa"; "Contact Customer Service at..."; "Bear in mind that we cover the largest number of routes...".

The most relevant results of this experiment with IT experts were that the styles of mediating dialogs varied considerably from one participant to the other, even though their professional profile was homogeneous. Participants expressed their difficulty to communicate appropriately with the targeted user. Clearly, participants were unsure about how much explanation was necessary. None of them really knew how to deal with the stereotyped user depicted in the test scenario. So, in spite of having initially said they would be glad to act as volunteers to develop WNH dialogs, at the end of the experiment they were faced with unanticipated difficulties and were no longer sure that they had the necessary knowledge to achieve the task. Three participants explicitly suggested that companies and commercial businesses operating in the Web should be interested in creating the dialogs themselves. One of them explained that companies might use this to publicize their concern with users with special needs.

Before we ran the second experiment, we interviewed the instructor of an Internet course for the elderly offered by the Rio de Janeiro State administration, and attended some of the classes to observe how they went, especially as the elderly learners practiced their lessons in the computer. Our goal was to put together some guidelines that the next participants would be able to use while developing their mediating dialogs for a similar test scenario.

The second experiment was run for the same purpose as the first: to investigate what kind of support WNH volunteers needed in order to design good mediating dialogs. Participants were non-experts in IT, but had advanced skills in written communication. Although the experiment scenario was similar to the one used with the first group (this time they should help an elderly lady create a web mail account), the experiment procedure was different. Instead of running individual sessions with each participant, we used a class situation, with the whole group. They all saw the same introductory presentation, telling them about WNH, CoScripter, and our goal with the technology. We emphasized the case of elderly users. Then each participant received sheets of paper with their task description, the paper forms for the dialogs, and a summary of guidelines and facts about computer interfaces for elderly users. This step was done individually, by each participant. At the end of the experiment, we brought all participants together for a focus group session to discuss the experiment.

The group as a whole needed more time than the first group to achieve the task. Five of the eight participants understood how CoScripter and WNH worked together. The other three were confused when associating dialogs with CoScript instructions. Only two of the eight participants had no problems with naming interactive elements. The other six experienced a variety of breakdowns. For example, they talked about

'icons' when none were involved in the interaction, or referred to radio buttons as *circles*. Three participants gave us evidence that they did not really understand how CoScripter automated script execution. For example, they created a dialog for commands where no user data was necessary. Unlike the first group, this group generated very few Q&A's for the "Doubts" section. To our surprise, most participants *did not* consult the list of guidelines and information about elderly users' needs. Regarding the content and style of dialogs, as a rule, this group's dialogs were very informative. All the participants embedded useful explanations in a number of dialogs, providing detailed explanations about how to use interface controls, for example (which explains the scarcity of Q&A's).

The focus group session raised a number of relevant points. One participant said he believed that the less technical the information, the *closer* the elderly would feel to the technology, and the more comfortable with it. Some of the participants manifested having difficulty to explain *the basics of interaction* (like what 'to click' means, what a 'cursor' is, etc.). One participant said that he was worried that the language and style he used would not sound childish to the elderly. One participant said that as she listened to the oral presentation he thought everything was easy and obvious, but when it came to actually writing down the mediating dialogs, it became difficult (which echoes the results of the first experiment).

Interestingly, one participant said that he was rather pessimistic about Brazilians engaging in this sort of social volunteering online. He did not see "people helping other people *at large*", he said. This statement started a lively discussion about when and if Brazilians were likely to *help* others, rather than 'be selfish' (this expression was explicitly used in the discussion). There was a consensus in the group that everybody in this culture would be happy to help *their grandmother and grandfather*, or some other elderly person in their *family*. These were people they *knew*, and not – as one participant put it – "the whole wide world". It thus became clear that the point of the discussion was the reach of one's initiative online, which extended far beyond the limited context that necessarily informed what one was doing when trying to *help someone with a special need*. In other words, *helping their grandmother* was as far as they were willing (or able) to go, because they felt they needed to *know* the person they were trying to help. Helping *unknown* people, which was the context of WNH we presented to them, was something about which a number of participants said they were rather *pessimistic*. However, all agreed that once they developed a script for somebody they knew well, there would probably be no problem whatsoever with *sharing it* with other people that they knew. Notice that this keeps the decision about sharing or not sharing scripts would be then made on a case-by-case basis, not escaping human *control* (as would probably happen in a crowd-sourcing context).

The two experiments gave us much valuable input for the design of WNH. However, one finding had much deeper consequences than all others did. The focus group discussion in the second experiment taught us that we had tacitly accepted the fact that crowd sourcing was *the* alternative for having contextually well-adapted dialogs for users with special needs. The pressure for scalable accessibility solutions led us to aim at *users at large*. The reaction of one of the participants in the second experiment showed us that we were unconsciously expecting WNH *scripts* to work for stereotyped beneficiaries, running the risk of missing precisely those *special* contextual elements that distinguish this user population from other users that can deal with standard interfaces.

We then reframed WNH and began to think of it more clearly as an end-user development tool to create software agents that can achieve what Clayton Lewis refers to as “*human companionship and support*” [10]. This new design conception opened a new way of computer-mediated *social* participation, although it did not impose to *scripters* (and WNH beneficiaries) a networked sociability model [3] as our previous design did [7, 8].

We ran a third experiment to explore the new design concept. It was structured in three subsequent phases, which shared the same scenario setting and involved two different participant roles: WNH *scripters* and WNH *end users*. We recruited four participants to play the *scripter* role (two HCI students doing research with elderly users, and two teachers working with digital inclusion programs for the elderly in the State of Rio de Janeiro). For the *end user* role, we recruited six users (aged 55-82) that had just started learning how to use computers and the Internet.

In the first phase, *scripters* were asked to produce verbal descriptions of interaction involved in the experiment scenario to two different listeners. In one case, they would be talking over the phone to a *colleague* (with the same level of expertise as the *scripter*). In the second, they would be talking face-to-face to an elderly family member or friend (both listener roles were played by a research team member). The participant’s job was to explain orally to the other person how to use an online mortgage calculator made available by a Brazilian public bank. In the second phase, *scripters* listened to a brief description of our project and were introduced to the WNH Editor. Then they were asked to use the editor to create mediating dialogs for the web site they had just described and explained. Their targeted user should be the elderly person they were addressing themselves to in the first phase. In the last phase, participants matching most of the ‘digitally illiterate elderly person’ profile were asked to use the mediating dialogs created by *scripters*. The group was divided in two: three participants used dialogs created by one of the HCI researchers and the other three used those created by one of the teachers. At the end of experiment sessions, we had a short interview with the participants.

This experiment was used for triangulation with previous experiments in the sense that the tasks and activities that *scripters* had to do were very similar to the ones we had before. The design vision and context this time was, however, substantially different: we moved from online volunteering to family help, and from paper forms to the real WNH editor. Moreover, we did an internal triangulation in the third experiment, by having *end users* actually using the dialogs produced by the *scripters*.

We collected considerable evidence that the new design perspective we adopted is more naturally understood by participants, who can easily engage in the proposed scenarios. During the interviews, all *scripter* participants, without exception, told some story about relatives (parents, grandparents, elderly in-laws) that had problems with computers and asked them to help (which they all did). All agreed that WNH could be effectively used to create mediating dialogs, especially to facilitate frequent tasks done by relatives with lower levels of digital literacy. They also said that they would like to start using WNH as soon as it became publicly available.

Some participants explicitly said that WNH gave them an opportunity to help their friends and family in a much more practical way. The teachers, in particular, said that WNH would be useful at home, with their relatives, and with the elderly students in the Digital Inclusion program. The more experienced of the two teachers even said

that if he had more time, he could do “air-tight dialogs”, with which it would be almost impossible for the end user to make mistakes during the navigation. When asked who would benefit from WNH, most participants answered that all lay users and the elderly, in particular, would. Some of them said they also thought that blind and deaf users, as well as users with literacy deficits, could also be helped with WNH.

The end user group of participants (most of them over 60 years of age) showed real interest in WNH. All of them said that they would like have WNH installed in their personal computers to help them do most frequent tasks. We observed that successful navigation with WNH had mostly to do with breaking interaction into a series of small dialogs (a stepwise interaction style). This, in itself, circumvents a number of problems having to do with ‘what to do next’ confusion. We also observed that once users knew how to use an interface control element (*e. g.* a textbox), they did not care to read short instructions and tips on how to use them that *scripters* had included in their dialogs. They jumped right into interaction, which was a small but noticeable gain in efficiency. In some cases, when skipping the reading led to mistakes, the end users were warned by WNH that something had gone wrong. This situation gave us the opportunity to see the importance of anticipating errors and doubts when creating WNH dialogs. In all cases where these were available, end users eventually corrected the problem and went on to next steps.

We asked to the end user group if they thought that, after using WNH dialogs repeatedly to do the same task, they would stop using mediation and go directly to the web site original interface. All of them agreed that the dialogs actually help them learn to navigate the web site directly. However, half of them said that they would prefer the easier way, which would probably be to continue using WNH. The other half said that, after some time practicing with WNH, they would surely want to migrate to the web site original interface. We welcomed this result since it tells us that WNH is perceived by some as a *scaffold* in the path of digital literacy acquisition.

4 Conclusions and Future Work

Designing tools for accessibility is more than a technological matter. The research described in this paper illustrates some of the benefits of qualitative methods in research, since they allow us to go deep into explicit and implicit meanings manifested by participants in the course of empirical studies. Likewise, we, as designers, in the process, are naturally led to question our own explicit and implicit meanings regarding the (kind of) technology we are proposing to users. Results in this kind of research setting can be very surprising and entail radical changes.

Our study gave us a window onto Brazilian sociability, which is considerably influenced by a different sociability model than the one embedded in accessibility technologies proposed elsewhere (*e. g.* [1, 11]). In sensitive issues like dealing with users with special needs, Brazilian sociability is closer to a community model [5] than a networked model [3]. In communities, individuals experience strong personal relations and intimacy. An individual’s identity is built and sustained by such relations and collective values. “Others” are not unknown, faceless individuals; they can always be chartered in a space of inter-personal relations, because of their ties with people one personally knows. The third experiment showed us how deeply true

this is, since all participants (*scripters* and end users) told us stories of elderly users that were (nearly) “digitally illiterate” and how family members or friends were there to help them in various kinds of situations.

We believe that the crowd-sourcing model may not work for technologies like WNH in the Brazil (and probably neither in similar cultures). Accessibility issues are sometimes related to a “universe of one” [2]. The needs are so special, so specific, that it is difficult solve problems by automating generic solutions. Having someone who is not personally involved with the user generating solutions may also lead to missing many relevant aspects of the user’s special context. The new design vision for WNH brings together both *universe of one* and *community-oriented sociability* perspectives. We believe that this new vision somehow introduces a new type of technology in our country. We are talking about *family-oriented IT*, as an additional alternative to assistive technologies. This technology is strongly related to end user development alternatives, as is the case with technologies produced in the context of the CLever project, at Colorado University [4]. WNH is thus an alternative technology. It can promote and reap the benefits of inter-personal relationships in computer-mediated environments and activities. Besides, end users know whom they must talk to if they have further needs or if (as is often the case) scripts and dialogs stop running because of a change in the website that they refer to. This kind of maintenance task can be costly for larger social volunteering initiatives.

Another lesson we learned was that the mediated interaction supported by WNH could be used for other purposes. For example, it can be useful for teaching and learning activities, or for expressing one’s version of the interactive potential supported by web sites and services (that can be shared with others for various reasons), or even for exploring design or redesign activities (as different mediating dialogs can be created by designers themselves and then be exposed to user evaluation).

We still have a long way to go. Our next steps involve reviewing and fixing some usability problems we discovered with the experiments. We would also like to do more experiments to evaluate the further uses of WNH. On a more theoretical note, and in tune with previous research of ours in Semiotic Engineering [6], we would like to explore how WNH can be used to study different metacommunication strategies and styles, towards a *rhetoric* of HCI. In particular, when running new experiments to observe the use of WNH in family contexts, we might have a glimpse of affective dimensions of metacommunication that we have never explored before. Paying closer attention to cultural issues silently lying beneath technologies opens different avenues for research. Not because this will necessarily lead to inventing new technologies, but perhaps (and more importantly) because it can show us how and why to combine existing technologies and then deploy them in different completely cultural settings.

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