User Trust in eCommerce Services: Perception via Screen Reader

M. Claudia Buzzi, Marina Buzzi,
CNR: ICT Department
IIT
Pisa, Italy
{Claudia, Marina}.Buzzi@iit.cnr.it

Barbara Leporini
CNR: ICT Department
ISTI
Pisa, Italy
Barbara.Leporini@isti.cnr.it

Fahim Akhter
College of Information Technology
Zayed University,
Dubai, U.A.E
Fahim.Akhter@zu.ac.ae

Abstract— **The increasing diffusion of electronic commerce (eCommerce) services is a great opportunity for visually-disabled people, provided that accessible and usable interactive environments are available. Usually e-Commerce sites have complex layouts crowded with elements and are difficult to navigate via screen reader. Another crucial issue concerns consumer trust in security of on-line transactions. In this paper we investigate the interaction of blind users with eBay, a popular eCommerce website, with specific focus on accessibility and usability of secure transactions when navigating via screen reader.**

Trust, e-Commerce, eBay, usability, blind

I. INTRODUCTION

The number of electronic commerce (eCommerce) websites is steadily increasing, attracting more visitors and consumers than ever. Many factors can impact on user experience, such as the time it takes to find the desired information, efficiency and security when carrying out the transaction, reliability of the delivery service behind the website, etc. However two of these are crucial for satisfactory access: service usability and trust in security of on-line transactions.

Internet and the eCommerce services are valuable for everyone but are particularly interesting for the blind, who have mobility problems and depend on others for buying goods and services.

Blind users usually access the Internet (web, email, etc.) using an assistive technology called a screen reader and a voice synthesizer. As the name suggests, the screen reader is a software program that interprets and announces the content being displayed on the screen. Although screen readers are evolving over time and increasing their help features for the blind, interaction is still difficult since websites are becoming more and more dynamic and rich in multimedia content.

When designing for blind users, it is necessary to consider the three main interacting subsystems of the Human Processor Model: the perceptual, motor and cognitive systems [3]. Sightless people perceive page content aurally and navigate via keyboard. This may render the interaction time-consuming, difficult and frustrating, if the contents are not designed with special attention to their needs.

Specifically, interaction via screen reader involves several issues:

1. Information overload. The screen reader reads and interprets the source code of the User Interface (UI) by announcing the contents sequentially, from the first (title) to the last word, losing style, font size and any other visual cues. This means for instance that the menu and navigation bar are repeated on every page, annoying the user and becoming time-consuming. As a consequence, blind users often stop the screen reading at the beginning, and prefer to navigate by Tab Keys from link to link, or explore the content row by row, via arrow keys.
2. Lack of interface overview. Blind persons do not perceive the overall structure of the interface, so they can navigate for a long time without finding the most relevant content.
3. Lack of context. When navigating via Tab and arrow keys the user can access only small portions of text and may lose the overall context of the page; thus it may be necessary to reiterate the reading process.
4. Content and structure mixing. The screen reader announces the most important interface elements such as links, images and window objects as they appear in the code. For the blind user, these elements are important for figuring out the page structure, but require additional cognitive effort to interpret.
5. Tables. If the table's content is organized in columns, the screen reader (which reads by rows) announces the page contents out of order; consequently the information might be confusing or misleading for the user.
6. Difficulty understanding UI elements. Links, content, and button labels should be context-independent and self-explanatory.
7. Difficulty working with form control elements.
8. A blind person is unable to access multimedia content; equivalent alternative descriptions should be provided otherwise the user may miss important content.

In this paper we analyze the usability and perception of trust of on-line services involving commercial transactions.

As a case study we analyze eBay, a popular eCommerce website. Specifically, we show the interaction via screen reader for the task of "buying goods". Section 2 presents related works, Section 3 describes the exploration of eBay via screen reader, highlighting potential problems. Last, we discuss how to facilitate and clarify interaction when performing a secure transaction, and future works are highlighted.

II. Related Work

Computing enables new ways of working by simplifying processes and increasing efficiency -- but what about user satisfaction, fears, and doubts? User acceptance, in addition to economic impact, plays a critical role in widespread adoption of eCommerce applications, so it is important that users interact with eCommerce usable, secure and trustworthy websites.

Many user studies suggest that the totally blind encounter more difficulty than those with other sensorial disabilities (such as low vision, motor or hearing impairments) when executing specific tasks [5], [11], [16]. Petrie et al. [16] presented the results of accessibility testing of 100 websites with users with visual, motor and perceptual disabilities, showing that websites that are accessible for differently-abled users can also be visually pleasing. Specifically, 100 websites spread out over five sectors were tested with automated verification and user testing, involving 51 differently-abled users, including 10 totally blind users. Results showed a mean task success rate of 76% that fell to 53% if considering only the totally blind (the lowest score of all user categories). Likewise, regarding user satisfaction, the authors recorded that the blind encountered more difficulty than other differently-abled users (4.2 on a 1-7 Likert scale, the lowest score of all the user categories). Researchers at Manchester Metropolitan University [5] highlighted issues of non-visual access by studying a sample of blind and visually-impaired users who performed four information-seeking tasks, including the use of search engines. Visually-impaired users searching the Web for a specific piece of information took an average of 2.5 times longer than sighted users. The efficiency gap was further quantified by Ivory et al. [11]; when blind subjects executed a set of tasks, they took twice as long as sighted users to explore search results and three times as long to explore the corresponding web pages.

E-commerce systems pose new challenges, since user interfaces are crowded with elements, many of them active, and offer several functions including secure transaction (secure http sessions). As highlighted by Kubilus, "usability considerations should be of prime importance in the design of an electronic commerce web site" [12].

Accessibility is a basic pre-requisite for allowing users to explore web page content, while usability provides online users with simple, efficient, and satisfying navigation and interaction. Navigation is vital for special-needs people, and especially for the blind, since it is crucial for them to be aware of their current location on the webpage and how to return to the beginning, or how to reach a certain point in the material [6].

Various studies investigate the usability of e-Commerce systems and include a general discussion on accessibility and usability, but to our knowledge only a few focus on totally blind individuals [1], [9], [15]. Petrie and al. [15] investigate conformance of a set of e-commerce and financial websites to "accessibility logos", verifying that the level of conformance to the Web Content Accessibility Guidelines (WCAG) version 1.0 was overestimated in 30% of the analyzed sites. Organizing a page in logical sections enhances the experience of the blind user when navigating a page in two ways: it provides a page overview and permits jumping from section to section. Specifically, heading levels may improve navigation since screen readers have special commands for moving from one heading to another. Brudvik et al. [1] present an interesting study on how sighted users associate headings with a web page, observing very different results depending on factors such as whether the page has a hierarchic structure, how users identify sections, etc. Furthermore authors applied techniques of information retrieval (i.e. training data and a classifier), developing a system for automatically inferring from the context (font, size, color, surrounding text, etc.) whether a phrase "works semantically" (and may function) as a heading, and dynamically adds the heading level using Javascript. The system called HeadingHunter was evaluated using human-labeled headings gathered from the study and showed high precision (0.92 with 1 the max). Most common website usability factors involve meeting business objectives while providing a satisfying user experience. Therefore, accessibility should be seen as a challenge to designers and implementers rather than as a constraint. To share best practices in designing for the blind, in [9] authors describe their experience developing the on-line shop of the Royal National Institute of Blind People (RNIB) which enhances user experience by means of a natural language interface.

The nature of eCommerce applications requires knowledge of user preferences and data in order to automatically carry out tasks efficiently. A large-scale use of intelligent services requires user data to be transmitted and stored in different places, thus posing serious privacy issues. Security and privacy issues are widely addressed in numerous studies and surveys [4], [7], [8], [19]. Regarding user perception of security, some consumers are not completely comfortable with eCommerce because of concerns about the security of their transaction [17]. Customers are often uncertain about the full consequences when transacting online [19] and think that they take greater risks in the online market because the desired product usually cannot be physically examined before the payment has been received [20]. In online commercial transaction consumers are vulnerable to specific trust violations: loss of money and loss of privacy ([8], [19]). For instance, phishing is a worrying phenomenon that is flooding the Internet with electronic fraud, damaging the unskilled user. This increases the fear of the network and may induce people to limit their use of eCommerce applications.

Customers' lack of trust has repeatedly been identified as one of the main barriers to the development of eCommerce [4], [7], [8], [19]. This is more relevant for blind users who

cannot see the screen and who interact via screen reader, having to manage a further level of difficulty, since for them an eCommerce transaction requires additional effort (both physical and cognitive) compared to sighted users. Thus, especially for them, security and trust assurance are fundamental to favor eCommerce services utilization.

III. EXPLORING E-BAY VIA SCREEN READER

For this study, eBay.com was selected to evaluate usability of eCommerce websites and specifically the perception of security features when interacting via screen reader. We chose eBay.com as a case study since it is one of the most reputable websites in the online auction business. The richness of functions and services is the strength of an eCommerce website, but the graphical user interface's complexity can create difficulties when interacting via screen reader.

A. 3.1. Evaluation Methodology

For testing the eBay ("sign-in" and "review your purchase") pages we used the screen reader JAWS for Windows (http://www.freedomscientific.com) v. 10 and the Mozilla Firefox version 3.0.5 browser.

The test was carried out by all the authors independently; afterwards, outcomes were compared and integrated. One author has been totally blind since childhood and is proficient at using JAWS (i.e she knows advanced commands very well). However, by analyzing the test results we noticed that in spite of her great expertise using JAWS, she was unable to perceive the exact structure of the graphical page layout. The sighted authors carried out the same test using only JAWS basic commands. Thus, integrating both these outcomes led to a more accurate analysis, covering a variety of screen reader interaction modalities: i.e. basic commands, simulating the level of novice users, and advanced functions for experienced users.

B. Interacting with eBay

In order to evaluate how the blind user may perform a secure web session to buy an item on eBay, we started the interaction from the home page (even if today it is more common to start with a Google search). However, since it takes at least eight steps for the user to complete an on-line transaction, we only analyze the last two pages: i.e. "sign-in" and "review your purchase", shown in Figs. 1 and 2. This high number of steps is uncomfortable for a blind person interacting via screen reader.

The eBay website allows one to make an initial purchase as a guest shopper, in order to try out their services. As an example, let us use the guest login and navigate Ebay to buy an mp3 reader (the IPod shuffle).

Starting with the Ebay home page, we select the "electronics" category and then proceed by selecting each appropriate link to catch on the page where the product can be bought. To reach this page, 6 steps – i.e. loaded pages– are needed: too many steps for a beginner user (Electronics-> ipod -> shuffle->buy it now only-> choose the model->

product page). As soon as the object to purchase is displayed, we click on the button "Buy it now".

When loading the sign-in page (Page A), the screen reader automatically announces only the message "Sign in or register to continue", which is the title of the page. At this point a sequential reading is needed to explore the page content.
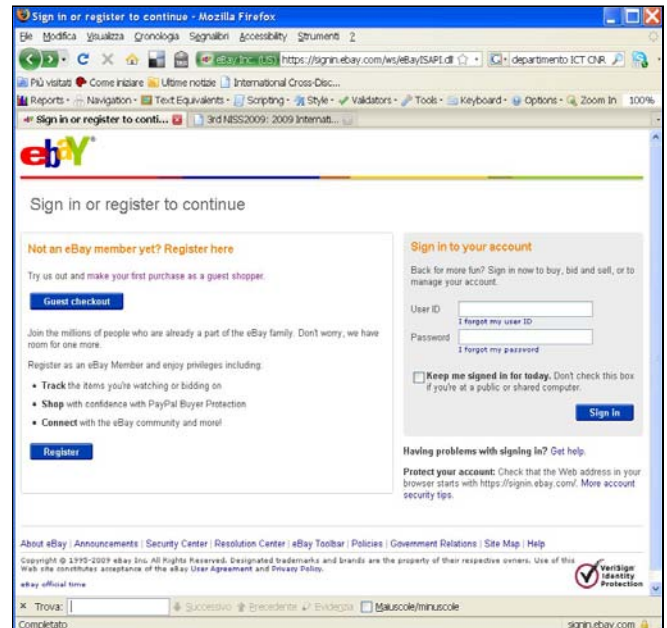

Figure 1. eBay "Sign in or register" page

Navigating this page with JAWS, some usability issues are observed:

- No heading is used to structure the page content. Consequently, to get an overview of the content a blind user must read all the content sequentially. This process can require a lot of user effort and time. To overcome problems of navigation via screen reader and interaction via keyboard, the Web Accessibility Initiative (WAI) group of the World Wide Web Consortium developed ARIA, the Accessible Rich Internet Applications (WAI-ARIA) Suite, which enhances usability and accessibility for the blind. ARIA makes dynamic content such as AJAX (Asynchronous JavaScript and XML), (X)HTML and related technologies more accessible to the disabled, especially people interacting via screen reader and keyboard [18]. The use of ARIA regions for structuring content offer the user a page overview, allowing one to move rapidly from one region to another, and limit the reading to the regions chose by the user.

- A layout table is used for formatting the login form. Layout tables should not be used for rendering purpose, but if they are applied, an appropriate summary should be assigned, such as "Sign in" in this case. Jaws in fact allows one to move to the next table by pressing the letter "t". In this way the virtual

cursor (the Jaws exploring focus for navigating Web pages) skips directly on that table. This is useful when a user is experienced in accessing this UI: by clicking "t" he/she can reach the login form immediately.

- The links "Verisign seal" and "ssl-certificate" are available just at the end of the page (see Fig.2). In addition to those links, the screen reader reads the hidden block appearing when clicking on the link "Verisign seal". This means that the user is not sufficiently informed about the security level, unless he/she reads all the page content reaching the end of the page. In pages like these – when the user can make a transaction – clear feedback should be provided to reassure the user about the trust of the on-line transaction and increase user awareness.

Figure 2 shows as this page is announced by Jaws when exploring the content sequentially.

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Sign in or register to continue

Link graphic From collectibles to cars, buy and sell all …

Sign in or register to continue
Not an eBay member yet? Register here

Try us out and
Link make your first purchase as a guest shopper.

Guest checkout Button

Join the millions of people who are already a part of the ….

Register as an eBay Member and enjoy privileges including:

list of 3 items
bullet Track the items you're watching or bidding on
bullet Shop with confidence with PayPal Buyer Protection
bullet Connect with the eBay community and more!
list end

Register Button

Sign in to your account
…

table with 2 columns and 7 rows
User ID
Edit
Link I forgot my user ID
Password
…
table end

Checkbox not checked
Keep me signed in for today. **Don't check this box if you're at a public or shared computer**.
Sign in Button

Having problems with signing in?
Link Get help.

Protect your account: Check that the Web address in your browser starts

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with https://signin.ebay.com/.
More account security tips.

Link About eBay |
Link Announcements |
Link Security Center |
Link Resolution Center |
Link eBay Toolbar |
Link Policies |
Link Government Relations |
Link Site Map |
Link Help
Copyright © 1995-2009 eBay Inc. All Rights Reserved…
constitutes acceptance of the eBay
Link User Agreement
 and
Link Privacy Policy.
Link eBay official time

Link Verisign Seal

Link ssl-certificate

VeriSign Identity Protection

The VeriSign Identity Protection (VIP) Network offers an extra layer of security when you log in to Web Sites with a PayPal Security Key. To learn more
or to order a Security Key, log in to PayPal and click the Profile tab.

Figure 2. eBay page for the guest account read by JAWS

Let us now analyze what appends when clicking the button "Guest check out". A new page (Page B) is loaded. The main issues observed can be summarised as follows:

- Jaws does not read anything automatically; to know whether the page has been loaded, the user has to check the status bar continually until the message "loading the http...." disappears.
- The sequence of steps to follow (CHECKOUT, 1. REVIEW, 2. PAYMENT, 3. CONFIRM) to buy the product (visible in the upper left-hand corner of the UI) is not implemented appropriately. First, it is not clear (1) which is the current step and (2) which steps have already been completed; indeed, visually they are highlighted with a different style (color, bold) but it is not accessible via screen reader.
  Secondly, these steps are structured through a bullet list (i.e. tag); additionally the four items are numbered with "1.", "2.", etc. (see Fig. 5). This might make the reading by Jaws more annoying ("bullet 1 Checkout guest", and so on). The screen reader announces both unnumbered and numbered modalities. Using only a numbered list (i.e. with <ol> tag) might be appropriate. Furthermore a label would be added before the list to indicate the meaning (e.g. steps for buying).
- Headings are not appropriately applied to logically structure the content. Just one heading is used for the title of the page "Review your purchase". Since this page contains two main areas (highlighted by two colored boxes) for "Shipping address" and "Order

details", two headings should be assigned to these subtitles to have a similar aural perception.

Figure 3.   eBay "Review your purchase" page (top)

Figure 4.   eBay "Review your purchase" page (bottom)

- When filling out the form "Shipping address", the four edit fields used for telephone data are somewhat confusing. Moreover, they are grouped by using a list of two elements. This is not clear at all. Just one edit field should be more than enough.
- The data related to the "Order details" are not appropriately structured. In the visual rendering it seems that a table has been used to format all information. When reading those data via screen reader, the content is not well sequentialized. This means that the user might be confused in reading all data (see Fig. 5). The content of this "like-table" should be read by colons rather than by rows (e.g. by exploiting the CSS float: left property to make blocks close like columns in the visual layout).
- Regarding the table used for rendering the subtotal data, the reading is fine, but the button "update subtotal" is not accessible since no alternative description is assigned to the graphical button.

- Last, there is a consistency issue in providing buttons for the actions. In order to continue it is necessary to click on "Continue", which visually appears like a button. But in the code – as it is read by jaws - it is a link. In this way, for a user who prefers to skip button by button, it is not possible to reach this element using the special command "b" (to navigate between page buttons).
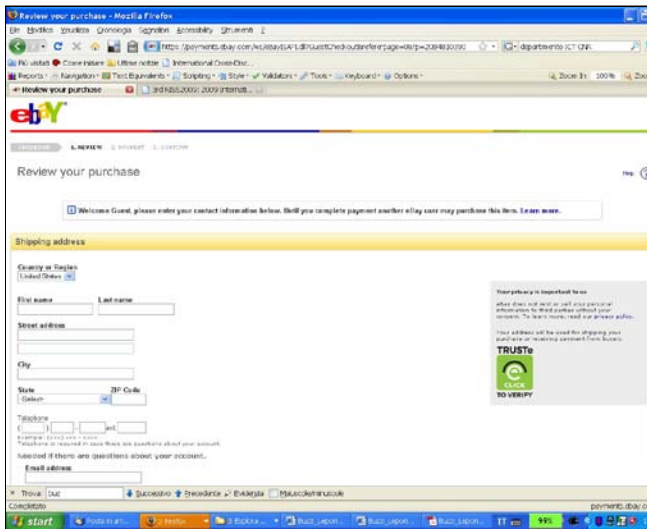

Review your purchase

Link graphic From collectibles to cars, buy and sell all kinds …

list of 4 items
bullet CHECKOUT
bullet 1. REVIEW
bullet 2. PAYMENT
bullet 3. CONFIRM
list end

Heading level 1 Review your purchase

Link Help

Welcome Guest, please enter your contact information below …
…
Shipping address
…
First name
Edit
…
Telephone
list of 2 items
(
Edit
)
 Edit
 -
 Edit
ext:
Edit
Example: (xxx) xxx - xxxx.
….
Your privacy is important to us
….
Order details

Item title
Shipping & handling
Quantity
Price

Seller:

Link quickshipelectronics
 (Link 55784
Graphic Feedback score is 50,000 to 99,999
)
Link Member is a PowerSeller
Link eBay Store

Link APPLE iPod 1GB SILVER SHUFFLE 2nd Generation MP3 Player

110362873126 - Price: US $34.99

Standard Flat Rate Shipping: Calculated from Shipping Address

```
┌─────────────────────────────────────┐
│                                     │
│  Combobox 1   1 of 84               │
│                                     │
│  US $34.99                          │
│                                     │
│  Message to quickshipelectronics …  │
│                                     │
│  Redeem a gift card, certificate, or …│
│  …                                  │
│  table with 2 columns and 4 rows    │
│  Subtotal:                          │
│                                     │
│  US $34.99                          │
│                                     │
│  Total:                             │
│                                     │
│  US $34.99                          │
│  table end                          │
│  ….                                 │
│  By clicking Continue you agree to the eBay│
│  ….                                 │
│  Link Continue                      │
│                                     │
│  …                                  │
└─────────────────────────────────────┘
```
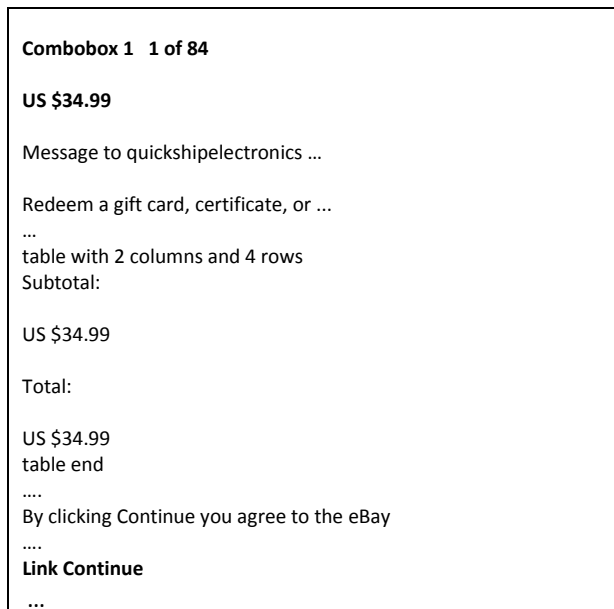
Figure 5.   eBay page as read by JAWS.

IV. DISCUSSION

In this paper we showed how a blind user interacts with an eCommerce website to perform a commercial transaction involving the on-line communication of sensitive data such as credit card numbers and personal info including name, surname, surface and email addresses. Privacy is a great concern of interaction in the Web. Consumers in general and blind users in particular need to have a positive feeling about security features applied by the providers. Clearer, non-technical information on how the secure transaction is made would be useful for anyone. Since blind users are unable to interpret visual clues, it is crucial to provide equivalent information that can be explored early in the interaction via screen reader.

Furthermore it is fundamental to position the security description in the main part of the UI so the user may find it quickly. Other ways to simplify interaction via screen reader are the use of hidden labels to orient the user (for instance, numbering good items) and the improved organization of table content which may provide more control over what is happening in the commercial session. Examples of how apply this suggestion are included in [2], [13].

In future research we plan to implement a modified eBay UI in order to reduce usability issues and allow users to have control of the situation. Then, user testing with totally blind users will verify any improvement.

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