

Analyzing the Importance of Marking Links to Special Targets in Mobile Web

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Abstract

Literature points out the importance of indicating when a link opens a different website in a new window, since this is the default behavior that users expect, but this problem has not been specifically studied in mobile devices yet. This paper explains a study that was carried out with 20 different mobile devices and 19 users. We compared the usability of opening links in the same window or in a new one, informing or not informing the user about the target, as well as the convenience of using icons or text to inform about the target of a link. Results show that 95% of the devices used for the experiment had browser multi-window support, and we conclude that mobile users prefer to be previously informed when a link opens in a new window, and that the preferred method for informing them is using an icon instead of a text.

Keywords: Usability, HCI, Mobile Devices, Mobile Web, Navigation, Empirical Study.

1. Introduction

The affordable access to mobile technology and mobile Internet has contributed to the increase of mobile users and Web traffic through these devices [5]. Therefore, the design of mobile Web content has increasingly gained in importance and mobile usability is of growing relevance, as mobile Web access presents interoperability, accessibility and usability issues due to factors such as small screen size or the way of interacting with the device [10].

Standards and recommendations providing guidance on increasing usability when designing Web user interfaces [13] may not be directly applied to web mobile interfaces because of the different characteristics of these devices [1], [17]. Different initiatives address the issues related to the design of digital content for mobiles in order to establish guidelines and recommendations to generate this content in a usable way for mobile devices [3], [9], [11], [17, 18]. However, there is not a standard yet to follow and Mobile Web Best Practices by W3C “Mobile Web Initiative” [22] may be outdated because they do not consider the advances in mobile technology in the last years. A comprehensive understanding and experimenting with mobiles will help in formulating guidelines and recommendations or even contribute to standardization by migrating solutions from other established standards, by adapting them or by including new ones.

One of the topics considered in Web design are hyperlinks, which allow linking some content with another one, enabling the navigability Web feature. From the point of view of PCs, there have been many efforts to establish guidelines and recommendations (about their size, meaning, etc.) to create these hyperlinks [7], [13]. As mentioned above, many authors stated that traditional usability guidelines may not be applicable to mobile devices. Therefore, in the particular case of guidelines for hyperlinks whose targets open in a new window, they also may not be applicable to the mobile Web, because windows management may be uncomfortable in mobile devices and even sometimes these devices do not support multiple windows, so the user should be warned when a hyperlink opens in a new window [22].

We are interested in determining the effects of warning users about opening new windows when they open links in their mobile device's web browsers. This work tries to answer two questions: (1) are mobile devices able to manage more than a browser window at the same time? and (2) if a hyperlink opens in a new window, is it necessary for the user to be previously warned? To answer these questions, this paper presents a set of experiments carried out with different mobile devices and users with different types of hyperlinks (notifying and not notifying their target). The results will contribute to evolving mobile device usage, as well as mobile web design and development, thus helping both designers and developers to consider this issue in their developments.

Section 2 of this paper shows the related work to this research, Section 3 explains the details of the experiments carried out, Section 4 presents the results, and finally Section 5 discusses the results and concludes the work.

2. Related Work

Warning the users that a link is going to be opened in a new window or tab is a common recommendation in guidelines and standards establishing usability recommendations for hyperlinks in general web pages design [7], [13] and it is an issue addressed in usability of mobile devices [4], [22].

The ISO 9241-151 Ergonomics of human-system interaction – Part 151: Guidance on World Wide Web user interfaces [13], specifically designed for general purpose web pages, provides in guideline 9.4.10 “Marking links opening new windows” that links that open new browser windows or pop-up windows should be clearly marked.

The initiative Usability.gov, Web design and Usability Guidelines by the US Department of Health and Human Services [7], also provides a set of guidelines for general purpose web pages (known as “HHS guidelines”), and guideline 7:1 “Provide Navigational Options” indicates that when a link opens a new browser window the back button is disabled, eliminating the user's past navigation (Back-button problem). This can be confusing to the user because he/she might not know how to get back to the previous pages [15]. Continuing with the HHS guidelines, guidelines 10:12 “Indicate Internal vs. External Links” and 2:1 “Do Not Display Unsolicited Windows or Graphics” discuss distractions and annoyances that a user might perceive when opening a new window, especially if it is an unsolicited pop-up. W3C [22] also supports this idea, since the guideline 13 says that pop-ups or other windows should not appear and should not change the current window without informing the user.

However, when using mobile devices, the user visually interacts with only one application at a time, using just one window [2]. In [4] a set of usability guidelines applicable to mobile devices are proposed, and although they do not recommend any specific guideline for this problem, they comment that working with a single window in mobile devices is uncomfortable and complicated. Furthermore, many devices do not support more than one browser window, so opening a link in a new window may have unpredictable results on a mobile device [22]. This is one of the reasons why traditional usability guidelines may not be appropriate for mobile devices [17] and further research has to be carried out to analyze whether it makes sense to open links in new windows in mobile web.

Opening links automatically in a new window is both confusing and disruptive for some users, as they are likely to expect the new webpage will load in the current window. Furthermore, it breaks one of the fundamental principles of the user interface design, that is,

users should always be in control of the interface they are interacting with [14], [19]. Nielsen [16] commented that, in exceptional circumstances, non-Web documents could be opened in a new window, but users should be warned in advance that a new window would appear. We can find studies for web browsing in PCs, pointing out the importance of indicating when a link opens a different (external) website from which the users are visiting [20], [23] or the navigation difficulties when popup windows appear [21] but, as far as we know, this issue has not been investigated thoroughly in the specific case of mobile web browsing.

3. Research Methodology

The experiment comprised two parts: first, an analysis on different mobile devices was carried out to check whether they were able to manage multiple browser windows. As results showed that most mobile devices could work with them, the second part was performed, which aimed to study the importance of informing the user when opening links in a new browser window.

3.1. Part 1: Experiment With Mobile Devices

The first part of the experiment addressed the question: “Do mobile devices support multiple browser windows?”. In order to answer it, a simple web page was designed that contained only two links: one that opened the target in the same window and another one that opened the target in a new window. Then, the behavior of both links was tested on a set of twenty mobile devices of various makes and models, with different operating systems, interaction methods (touchscreen, keyboard, and stylus) and screen sizes.

3.2. Part 2: Experiment With Users

The guideline to be tested is 9.4.10 “Marking links opening new windows”, included in ISO 9241-151 [13]. Therefore, the null hypothesis adapted to mobile devices would be “Links that open new browser windows or pop-up windows should be clearly marked on mobile devices”.

The experiment compared the performance of users when web pages included or lacked notifications about opening links in new windows. To analyze the usability, metrics for effectiveness, efficiency and satisfaction factors were considered [12].

Two web pages were designed, each of which contained only a series of links (there was no more text on the web page). The targets of the links in the first web page were not indicated. The second web page had two different types of notification (with text or with icon), because there could be a significant difference depending on the method used [24]. The icon may also have an influence [6], so we chose the icon used by the official Transport for London web page¹, because a previous study demonstrated this is a usable web page [8].

Subjects

Nineteen subjects participated in the experiment (13 male, 6 female). Regarding the age distribution, 47.37% was between 18 and 24 years, 36.84% was between 25 and 34 years, and 15.79% was older than 35 years. As to the subjects' self-rating on their experience in using mobile devices, 42.11% were experts, 47.37% were intermediate, and 10.53% were novice.

Apparatus

To carry out the experiment, six mobile devices of different makes were used, with various operating systems and different interaction methods². In all cases the default web browser of

¹Transport for London. <http://www.tfl.gov.uk/>.

²Specifically, the devices used were an Apple iPhone 4 (with iOS 4.3.3), a Samsung Omnia W (with Windows Phone 7.5), a Sony Xperia U (with Android 2.3.7), a BlackBerry Curve 9360 (with RIM 7.0), a BlackBerry Torch 9860 (with RIM 7.0 and touchscreen) and a Nokia Asha 302 (with Symbian S40).

the device was used and no additional software was installed. A custom-made support held a webcam to record the mobile's screen and the user's interaction (Fig. 1).



Fig. 1. Custom-made device used to record user interactions.

Design and Tasks

A within-subject design experiment was used. The task was to ask the users to open a requested link in the same window or in a new one. The metrics to measure for *effectiveness* were the number of errors made and whether the user was able to correctly finish the task or not. The number of errors was the number of times the link was opened in a destination other than the requested. To measure *efficiency*, the time users took to successfully open each link was recorded, and if a user failed, the time was measured until he/she gave up. Finally, after performing the experiment, users filled out a *satisfaction* survey where the comfort was assessed for each mobile device for opening links in new windows.

Procedure

The treatments of the experiment were randomly assigned to each user, so that it could mitigate the possible biases introduced by other factors. All subjects were tested individually in a quiet research lab, being conducted by the experimenter, who told them what link had to open and where in each case. All users performed the experiment once with each configuration (i.e., links without informing about their target and links informing about it) and each mobile device (six different devices). For each of these cases, all possible combinations were tested: on the one hand, a link that opens by default in the same window had to be opened (1) in the same window and (2) in a new window; and on the other hand, a link that by default opens in a new window also had to be opened (3) in the same window and (4) in a new window. That is, 48 videos ($2 \times 6 \times 4 = 48$) were taken in total for each user, and later analyzed. After the experiment, each user answered the satisfaction survey.

4. Results

The results obtained are presented below for each part of the experiment.

4.1. Part 1 of the Experiment: Experiment With Devices

The results of the first part of the experiment was that 19 out of 20 mobiles (95%) used in the test supported multiple browser windows. This contradicts the W3C indications [22], because mobile devices have been evolving in recent years, by adding new functionalities.

4.2. Part 2 of the Experiment: Experiment With Users

In the following lines, the measurements taken for each usability factor will be discussed. Please note that in the results analysis, statistical significance refers to $p < 0.05$.

Effectiveness and Efficiency

Effectiveness and efficiency was measured considering: (1) task completion, (2) number of errors and (3) the time taken to perform the task in the following cases:

- Open in the same window a link that by default opens in the same window (to simplify, from now on this operation will be named “Same-same”).
- Open in a new window a link that by default opens in the same window (“New-same”).
- Open in the same window a link that by default opens in a new window (“Same-new”).
- Open in a new window a link that opens by default in a new window (“New-new”).

In addition, for the cases in which a link opened by default in a new window (last and penultimate cases), the difference between informing with a text and informing with an icon was also studied. Below are the results for each of the cases above.

Results on Task Completion

In the “Same-same” case, 100% of the tasks were fully completed, both when informing about the target of the link and when not informing. In the “New-same” case, 82% were fully performed when informing about the target of the link, and 79.65% when not informing about it. In the “Same-new” case, 65.48% of the tasks were fully completed when the target of the link was not notified, whereas 77.68% of the tasks were fully completed when the target was notified. Finally, in the “New-new” case, 80.70% of the tasks were fully completed when the target was not indicated and 82.46% when it was.

Although there was not statistical significance in “Same-same”, “New-same” and “New-new” cases, the statistical analysis indicates that there is statistical significance in the case “Same-new” ($\chi^2=7.891$, $df=3$, $p=0.048$), so it suggests that marking the target of links affects positively in opening links in the same window when they open by default in a new one.

Results About the Number of Errors

The basic statistics about the number of errors in the tasks are summarized in Table 1. The analysis shows a statistical significance in the cases “New-same” ($z=-2.07$, $p=0.04$) and “Same-new” ($z=-5.11$, $p=0.00$). In these cases, informing about the target of the link reduces the number of errors. This was not found to be significant in the case “New-new” ($z=-1.76$, $p=0.08$) and no analysis could be performed in the case “Same-same” because data were zero in all cases, so we assume that there is no statistical difference in that case.

Table 1. Basic statistics of the number of errors when opening links.

	Not informing about the target			Informing about the target		
	Average	SD	Median	Average	SD	Median
Same-same	0.000	0.000	0.000	0.000	0.000	0.000
New-same	0.540	0.780	0.000	0.366	0.569	0.000
Same-new	1.221	1.223	1.000	0.696	0.909	0.000
New-new	0.237	0.537	0.000	0.307	0.500	0.000

Results About the Time

Table 2. Basic statistics of the efficiency (time in seconds) when opening links.

	Not informing about the target			Informing about the target		
	Average	SD	Median	Average	SD	Median
Same-same	5.386	9.720	3.000	4.065	3.828	3.000
New-same	15.640	20.630	7.000	6.960	3.201	6.000
Same-new	27.600	25.940	23.000	18.500	17.150	12.500
New-new	9.180	14.050	5.000	5.860	7.093	4.000

Table 2 summarizes the results of the task completion time when informing or not about the target of the link. The average time was always lower when informing about the target, but no significance difference was found in the case “Same-same” ($z=-0.41$, $p=0.68$). In the remaining cases there was statistical significance: in “New-same” ($z=-2.25$, $p=0.02$), “Same-new” ($z=-4.07$, $p=0.00$) and “New-new” ($z=-3.09$, $p=0.00$). So, informing about the target of the link is advisable in the last cases, as it reduces the task completion time.

Results About the Type of Notice (Icon or Text)

To analyze which type of notice is more appropriate to inform users about the target of the link, only the cases with links opening their targets in new windows were considered (“Same-new” and “New-new”). All targets were indicated with a text or an icon and the task completeness, number of errors and task completion time was measured.

In the case “Same-new”, 68.75% of the tasks were fully completed using text and 89.58% using an icon. The difference was significant ($\chi^2=7.894$, $df=1$, $p=0.005$), so using icons to indicate the target of links is preferred instead of text. In the case “New-new”, 81.63% of the tasks were successfully completed when the notice was a text, and 83.07% when it was an icon; but there was no statistical significance between text and icon ($\chi^2=0.04$, $df=1$, $p=0.841$).

About the number of errors, in the “Same-new” case the average was 0.794 ($SD=0.970$) for text, while it was 0.571 ($SD=0.816$) for icons. In the case “New-new”, the average for text was 0.449 ($SD=0.5796$) and 0.200 ($SD=0.4031$) for icons. The statistical analysis suggested that there is statistical significance between using text or icons to indicate the target of links when they are opened in a new window ($z=-2.50$, $p=0.0125$); but not when they are opened in the same window ($z=-1.28$, $p=0.2034$).

Finally, there was no statistical difference between using text or icons in the task completion time, nor in the “Same-new” case ($z=-0.50$, $p=0.6178$) or in the “New-new” case ($z=-0.62$, $p=0.5389$); although the average time was lower for icons in the “New-new” case than for text (4.508 vs 7.650 seconds), and the time for text was slightly lower in the “Same-new” case than for icons (17.73 vs 19.49 seconds).

Satisfaction

The subjects were asked the following questions in the survey after the experiment:

1. Knowing that the target of a link will be opened in a new window, when would you click on it?
2. Would you like to be previously informed when the target of a link opens in a new window when clicking on the link?
3. How would you prefer to be informed when the target of a link opens in a new window when clicking on the link?

The answers to the first three questions were quantitatively measured with predefined answers. An additional open question was added about the general opinion of users about informing or not informing when a link opens its target in a new window on a mobile device.

The average results to question 1 for all devices were: 64.91% answered “Only if I was interested in the link”, 30.70% answered “Only if strictly necessary” and 4.39% answered “Otherwise”. For question 2, 15.79% answered “Never”, 73.69% answered “Always” and 10.52% answered “Otherwise”. On the other hand, answers to question 3 were: 100% said that they preferred to be informed by an icon for all mobile operating systems except Symbian, where 84.21% of the users preferred to be informed by an icon and 15.79% otherwise (not text). In average (for all operating systems, including Symbian), 97.37% preferred to be informed by an icon and 2.63% otherwise (nor icons or text).

Regarding the open question, 47.37% answered that users should be informed when a link opens its target in a new window, because otherwise they may be confused on those devices that do not clearly show the number of open windows, inasmuch as opening a link in a new window is not the default behavior or because the user may not want to open many windows.

This makes navigation more comfortable, especially on mobile devices as users may not know exactly where they are and windows management is more difficult.

5. Discussion and Conclusions

Most mobile devices currently available in the market (in the experiment, in particular, was 95%) support multi-window. Therefore, it makes sense to analyze the usability of different issues of mobile web browsing. In this work we were interested in experimenting whether links that open new browser windows should be clearly marked on mobile devices.

Results showed that task completion was higher when informing about the target of the link, and the difference was significant when a link that by default opens in a new window is opened in the same window. There was also statistical significance in the number of errors and/or efficiency when a link opens in a new window (either opening it in the same window or in a new one), so we can say that in mobile devices it is preferable to inform when a link opens by default in a new window. Furthermore, this is reinforced by the results of the satisfaction survey, of which we obtained (question 2) that users (73.69% of average) prefer to be always previously informed when they are using a mobile device and a link opens by default in a new window.

There was statistical significance between using icons or text to inform about the target of a link in task completion (case “Same-new”) and in the number of errors (case “New-new”), always in favor to icons. Therefore, in mobile devices it would be advisable to use an icon instead of a text to inform about the target of a link when it opens a new window. It is important to highlight that the icon used should be easy-to-understand.

The analysis of effectiveness, efficiency and satisfaction showed that it is always better to inform previously about the target of the link and also users clearly prefer to be informed when they are using mobile devices and they are going to open a link whose target opens in a new window. Therefore, we can confirm the initial hypothesis: “Links that open new browser windows or pop-up windows should be clearly marked on mobile devices”.

Our results are consistent with the web guidelines 9.4.10 of ISO 9241-151 [13] and 2:1 of HHS Guidelines [7], which means that this guideline (marking links opening new windows) is also applicable to mobile devices, and not only for PC websites. This can be due to the mobile devices evolution and the inclusion of multiple window support, which contradicts recommendations given by Ballard [2] and W3C [22]. Although commonly only one window occupies the whole screen of a mobile device, the behavior is similar to multi-window in PC, because most mobile web browsers make users aware of the number of windows opened. On the other hand, our results support guideline 13 of the Mobile Web Best Practices [22], suggesting that usability of opening links in mobile devices has not changed in recent years, likewise it does not change with respect to PCs. Therefore, we could conclude that links opening new windows should always be marked, regardless of the device used, as it seems to be a guideline that remains over time.

The main limitations of the study are the lack of results segmented by operating system due to the number of devices used and the age of participants is not balanced. Therefore, further experiments with more participants and mobile devices will be conducted to segment the results for each operating system and age groups.

As every day more and more people use the Internet, and also mobile devices, the work presented here has a special relevance for making easier the task of mobile web browsing. To do this, web designers and developers should take into account the recommendations presented in this paper.

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