

Effects of Increasing Users' Attention on Cost in Software Download Interfaces on the Internet

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Abstract. *In this paper we analyze how users behave on the Internet while dealing with software download. We present the results of a usability test performed comparing the Internet Explorer SP-1 software download interface with a wizard-based interface. Experimental results show that our 3-step wizard is effective in increasing users' attention level and is almost error free.*

Keywords. Usability, trust, authentication, software download.

1. Introduction

User interfaces in Internet authentication procedures are the front-end of software publishers towards remote users. In such context, the design of these interfaces is critical for both users and publishers. In fact, users can draw unaware or wrong decisions if interfaces are hard to learn and to use [1, 6]. On the other side, publishers can become unable to distribute their products on the Internet, if hard tasks and tricky interfaces reduce users' trust.

In our previous work [2], we published results of a user test with the Microsoft Authenticode “Security Warning dialog box” (SWDB) (figure 1). We observed that changing the usual image with an impressive one has no effect on users' attention. In addition, we noted that if the SWDB included a link conveying to software details in an external web page, users almost never used such link. This means that if software details were accessible via the link, users behaved without being aware of them, basing their behavior on their preconceptions in the software publisher. In sum, users accepted download if the software publisher was well-known (or one believed so). In this sense, the SWDB is not fully usable, little respecting the usability principle

“ensure recognition rather than recall”. We concluded our analyses suggesting that a wizard asking feedback from the user could be effective in increasing the users' attention on actual software properties, reducing the influence of the publisher name.

In this work, we designed and tested a novel interface, comparing it with the Authenticode one. Our novel interface is a 3-step wizard (3SW) designed to make users focus on cost aspects. Experimental results prove that the 3SW is effective in increasing user attention on software features (in our tests cost), reducing errors, when the user has to decide whether to accept a software download or not.

2. Experiment

We conducted a user test on a classical user interface for software download, and we compared it with an innovative one by means of user tests. The adopted classical interface was the Microsoft Authenticode version released with Internet Explorer 6 SP-1 (figure 1). We chose such an interface due to its wide diffusion (93.9% of market share [7]).

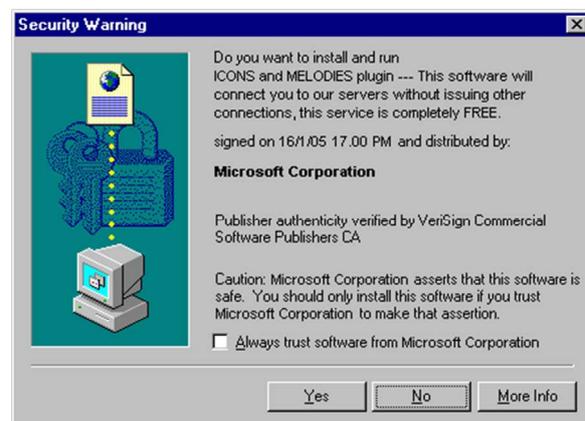


Figure 1. The Security Warning dialog box. This is a layout without link.

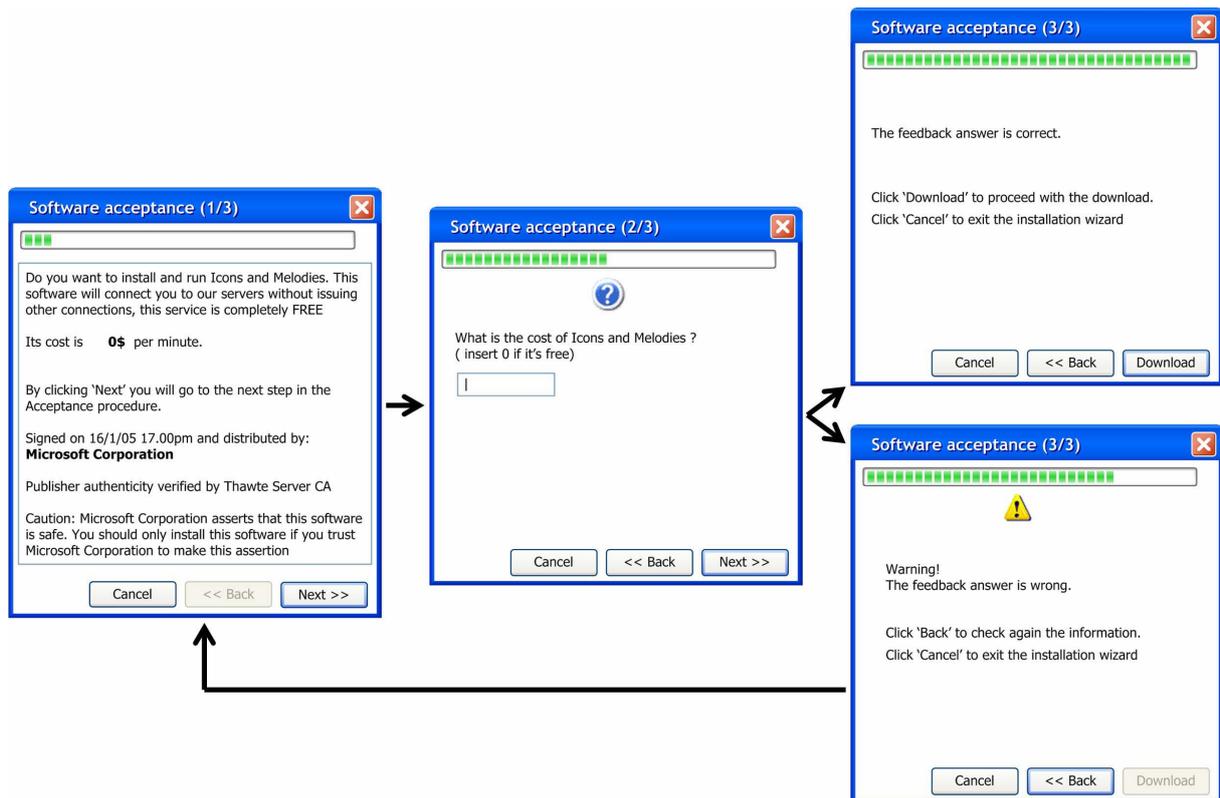


Figure 2 . The 3SW download interface, built up of 3 steps.

In contrast, the novel interface is a three-step wizard (3SW), whose design was driven by our previous study [2]. 3SW can be navigated backward and forward (figure 2).

The first step presents the same information shown by the SWDB. In the second step the 3SW asks for user feedback. In order to check if the user understood the information presented in the first step, the user must insert the software cost (0 if it is free). The third step, in case of correct answer, permits to download the software, or, in the case of wrong answer, allows the user to go back and check the software properties. The feedback was always the software cost, as in [2] we observed that users did not pay much attention to it.

Since we performed a differential analysis, final users' interactions with the SWDB and with the 3SW were compared while dealing with the same software to download. The validity of the obtained results will be shown in the 'Discussion' paragraph.

2.1 Variables and procedure

In order to test the influence of each independent variable and make a comparison between SWDB and 3SW we arranged a set of Internet pages with SWDB (or 3SW) dialog boxes. Software publishers were varied

according to the following: well-known software publishers (WK), common name publishers (CN), companies whose name was deceptive (DN), and names of companies that provide adult contents (AC). Software cost was varied among *free* and *costly*. Only for the SWDB we added two more variables: the presence of either code information or a link to an external web page conveying that information, and the type of image (the usual one or an impressive one). The link presence variable was included to better reproduce every day navigation scenarios.

We designed a double-session experiment. In the first session we assessed users' interactions with the SWDB. In the second session participants interacted with the 3SW.

Each participant had to complete two test sessions, for a total of 40 test cases of software download. We prepared 32 test cases in the first session, since we proposed to each participant a complete permutation of the independent variables ($4 \times 2 \times 2 \times 2$), and 8 test cases in the second session (4×2). A test case, as shown in Figure 3, consists of a web page with software to download, the relative SWDB (or the 3SW) interface and the *motivation window*. A user, following his decision of code acceptance or code refusal, must choose, with a radio-button, the *major motivation* that drove his decision.

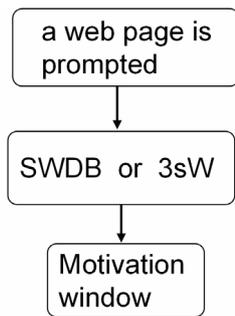


Figure 3. A single test case.

The motivation window presents a set of options for participants to choose; the content of such window is described in Table 1 (column *Motivation*). The given motivations helped us to identify which reasons drove users' decisions. Motivations were also used to identify correct and wrong behaviors by participants. A participant makes an error if he gives an incoherent motivation for his action. In Table 1, column *Errors* shows the behaviors that were considered errors. Given that each user had to complete 40 test cases, we minimized learning effects by not giving participants a feedback on their actions during the whole experiment.

In the end of the 40 test cases, participants answered a multiple-choice questionnaire, with questions on the two interfaces under test.

The dependent variables were the acceptance or refusal of the proposed software, and the

awareness level, which we derived from the users' motivations given in each test case.

Our methodology is similar to other usability studies [3, 4].

2.2 Participants

The tests were performed by undergraduate students at our Department, and by already working people. The participants were 40, with ages ranging from 23 to 35 years (mean age 28). The group was gender balanced. Participants were not rewarded for their time, but they were told that "they were participating to the design of the next user interface for e-government web sites". Actually, this study is in the framework of the Easy.Gov project: which aims to improve the user experience of Italian local Public Administration web sites.

At the beginning of the test session, in the tutorial each participant was told: "... you will navigate through a predefined set of web pages, and you will be prompted to download various software. Behave as if you were using your laptop".

2.3 Data analysis

The results of the tests have been logged on a database for subsequent analyses. Results are given reporting percentages data and statistical analyses (ANOVA and Chi-Square).

Decision	Motivation	Label	Errors (if combined with)
Acceptance	I was very interested in it	I	
	My interest was not high, but I trust the code publisher	T	<i>a deceptive publisher name</i>
	My interest was not high, but the cost was fine	O	<i>a free code</i>
	My interest was not high, but it was free	F	<i>a costly code</i>
	I didn't want to accept it	O	<i>wrong</i>
	Other motivations	O	
Refusal	I was not interested in it at all	NI	
	I could be interested, but I didn't trust the code publisher	DT	
	I could be interested, but the cost was high	C	<i>free code</i>
	I could be interested, even if it was free	O	<i>a costly code</i>
	I didn't want to refuse it	O	<i>wrong</i>
	Other motivations	O	

Table 1. Motivation options to be chosen in each test case, and related errors. Labels identify specific motivation options, those labeled with O were chosen in minor quantity by participants. All labels are cited in following paragraphs.

Interface →	SWDB				3SW			
	Acceptances (%)		Refusals (%)		Acceptances (%)		Refusals (%)	
Code type →	Free	Costly	Free	Costly	Free	Costly	Free	Costly
WK	36.6	20.3	13.4	29.7	36.2	5	13.8	45
CN	27.5	8.4	22.5	41.6	37.5	1.3	12.5	48.7
DN	23.4	9.7	26.6	40.3	27.5	5	22.5	45
AC	6.6	5.3	43.4	44.7	8.8	1.3	41.2	48.7
Average	23.5	10.9	26.5	39	27.5	3.2	22.5	46.9

Table 2. Acceptance and refusal rates. Results are given for each code publisher name type.

Decision	Interface →	Interface							
		SWDB				3-step Wizard (3SW)			
Accept	Motivation →	I	T	F	Os	I	T	F	Os
	WK	61%	19%	18%	2%	33%	9%	58%	0%
	CN	37%	7%	34%	22%	23%	0%	77%	0%
	DN	38%	9%	38%	15%	31%	0%	61%	8%
	AC	34%	8%	32%	26%	25%	0%	75%	0%
	Average	42.5%	10.8%	30.5%	16.3%	28%	2.3%	67.6%	2%
Refuse	Motivation →	NI	DT	C	Os	NI	DT	C	Os
	WK	61%	6%	24%	9%	51%	6%	32%	11%
	CN	58%	25%	12%	5%	49%	8%	39%	4%
	DN	38%	41%	14%	7%	30%	43%	24%	3%
	AC	54%	34%	6%	6%	68%	14%	15%	3%
	Average	52.8%	26.5%	14%	6.6%	49.5%	17.8%	27.6%	5.3%

Table 3. Motivations for acceptance or refusal for code downloading. Motivation labels: I (interest), T (trust), F (free code), NI (no interest), DT (distrust), C (costly code), Os (other reasons). These labels are mapped more precisely in table 1.

Interface →	Errors		LACA
	SWDB	3SW	SWDB
WK	6.3%	0%	43.1%
CN	7.8%	0%	43.1%
DN	11.3%	2%	41.6%
AC	6.1%	0%	44.7%

Table 4. Errors made, and low aware correct actions (LACA).

3. Results

3.1 SWDB specific results

Out of the four independent variables tested in the first session, only the image type had no effect (ANOVA F(1,40): $p > 0.05$).

Link is almost never used (37 times out of 416). If a link in a SWDB is present, then code details are all in the external web page. We define as a *low aware correct action* a decision taken by a user interacting with the SWDB with link.

3.2 Errors and low aware actions

Table 4 shows the errors made with the SWDB and the 3SW, and the low aware actions with the SWDB. Errors are wrong behaviors, which were identified from given motivations, as shown in Table 1. The SWDB suffers from higher error rates than the 3SW. Besides, we observed that all participants always answered correctly to the cost question in the 3SW. Concerning the *low aware correct actions* (LACA in Table 4), they identify behaviors not resulting to be errors in our classification. The LACAs were present only in the SWDB, given that we designed the 3SW without links conveying to external web pages.

3.3 Acceptance/refusal analysis

Table 2 shows the acceptance and refusal rates for each publisher type and code type, both for the SWDB and the 3SW approach. Table 2 shows how users behaved while dealing with free or costly software.

With the 3SW there is a steep reduction in accepted costly software ($\chi^2(1,40)$: $p < 0.01$), and an increase in accepted free software by non-WK

publishers (χ^2 (1,40): $p=0.04$). With the 3SW, common name (CN) publishers have an increase in free software acceptances (χ^2 (1,40): $p=0.03$). CN publishers behave similarly to WK ones, both for acceptances and refusals. The 3SW keeps free software acceptances stable, but causes a reduction of accepted costly code (on average from 10.9% to 3.2%).

3.4 Motivations analysis

Table 3 shows which major motivations were given by participants who accepted or refused the download. The table compares the SWDB with the 3SW. The SWDB and the 3SW behave differently. In the following, we first present acceptance motivations, then we present those for refusal.

The SWDB interface causes acceptance motivations for well-known (WK) publishers to differ from the other publisher names. WK publishers have peaks of motivation of 61% and 19% in *interest* (I) and *trust* (T), respectively. Non-WK publishers (CN, DN, AC) have highly correlated motivations: on average *interest* (I) was about 36%, *trust* (T) about 8%, and *free cost* (F) about 36%.

Interestingly, the 3SW interface causes a shift in acceptance motivations. All of the four types of publishers have as their higher motivation the *free cost* (F) of software, always followed by *interest* (I). In contrast to the previous case, the comparison between WK publishers and non-WK ones presents many similarities: *interest* 33% for WK, 23% for CN; *free cost* 58% for WK, 77% for CN.

The second part of table 3 shows which motivations were given by participants who refused software downloads. The *no interest* (NI) represents a peak in almost every case both for the SWDB and the 3SW. With the SWDB interface, well-known (WK) publishers have a *distrust* (DT) motivation (6%) rate much lower than in the other types of publishers (CN: 25%, DN: 41%, AC: 34%). Non-WK publishers have high *distrust* (DT) motivations rates, while WK publishers present higher *cost details* (C) motivation rate (24%).

WK publishers have similar refusal motivations with the SWDB and the 3SW. With 3SW, the CN and AC publishers reduce *distrust* (DT) and increase *cost details* (C) motivation rates. These shifts in motivations are particularly significant in common name (CN) publishers: DT goes from 25% to 8%, C goes

from 12% to 39%. Actually, CN publishers present refusal motivations very similar to WK publishers. An interesting, and desirable, effect can be seen in the *distrust* (DT) motivations related to deceptive publishers (DN): they are the only DT rates that remain high from the SWDB (41%) to the 3SW (43%).

In sum, we observed shifts in motivations with users dealing with the 3SW approach. If participants accepted the software download, the 3SW interface shifted motivations from *trust* and *interest* to *free cost* (F). Refusal motivation rates remain high for *no interest* (NI), but the motivation of *distrust* significantly decreases in favor of *cost details*.

3.5 Questionnaire

Answering the questionnaire, participants preferred the 3SW instead of the SWDB, on average at 4.1 on a five-point Likert scale. They also feel safer with the 3SW than with the SWDB at 3.8 on the same scale. Finally, participants agree (on average at 3.9) to be more protected with the 3SW than with the SWDB. The 3SW design was clear and easy to use, as users used the backward button only 14 times.

4. Discussion and Results Validity

Our results show that, when users have to think explicitly about cost details (as it happens with the 3SW), cost becomes the driving factor for software acceptance/refusal. In fact, with the 3SW users prefer to download free software, and to download costly software only if they are very interested in it. The results analyses of the 3SW compared to the SWDB show these trends: a global reduction of accepted costly software, and particularly for WK software producers (Table 2). With the 3SW, the acceptance ratios of CN publishers become similar to WK ones, showing that users do not base their decisions on previous beliefs (on publishers names) but on actual software cost details. Furthermore, if users

Interface	Costly acceptance motivations				
	SWDB %				3SW %
Motivation	I	T	F	Os	I
WK	58	20	17	5	100
CN	44	11	19	26	100
DN	45	3	29	23	100
AC	35	12	12	41	100

Table 5. Acceptance motivations of costly software

accept to download costly software, they do it only because of a strong interest (Table 5).

This proves that, when users understand and know cost details (this happens for sure with the 3SW), it is hard to have costly software accepted. However, given that Internet has also to be a mean to download software, giving further pieces of information to increase software downloads could be a valid approach. With the purpose to increase software download acceptances and better trust aspects management, in our future work we want to assess how a reputation system [8] is effective in modifying users' decisions and trust motivations.

Concerning the validity of the obtained results, each experiment was built up of two sessions, and it was conducted with a laptop from our lab (thus with no real risks for the users). The two sessions could have caused a learning effect in the users. We tried to minimize such risk by not giving to the users a feedback on the test cases (ie.: correct/wrong decisions, incoherent motivations). Utilizing a laptop from our lab, we observed that the actions taken by the users with the 3SW were very conservative: they tried to minimize the possible risks (even if they were not working on their own PCs). Thus, we believe that such issue had little impact in our results. Considering the fact that the 3SW could have caused only a memorization task, our results show that there has been a more complex cognitive process in the users; otherwise the users' decisions and motivations would have not changed. It means that the explicit feedback on cost in the 3SW causes the users to behave differently than with the SWDB.

5. Conclusions

We performed a usability test to compare how users behave with the usual Authenticode security warning (SWDB) interface and with a 3-step wizard (3SW) we designed to increase users' attention on cost.

When the user has to think explicitly about cost aspects, his behavior changes significantly, accepting costly software only if really interested. Thus, the 3SW is an improvement over the SWDB, because the former interface lets users make safer decisions about software downloads (note that in our experiment accepting costly software is the only possible risk). With the 3SW users behave more safely, and affirm to be more protected.

However, the 3SW can result to be too severe

for those who need to have their software delivered (both for well-known and for common name publishers, as shown in Table 2). We believe that adding a reputation system in download interfaces could increase software acceptances (as well as modify acceptance/refusal motivations), and we are currently working on this aspect.

6. Acknowledgments

This work was partially supported by "Fondazione Cassa di Risparmio di Pisa", under the Easy.Gov project. Authors thank the anonymous reviewers for their suggestions.

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