Tests of Usability Guidelines About Response to User Actions. Importance, Compliance, and Application of the Guidelines

Lucía Alonso-Virgós[1], Jordán Pascual Espada[2], Gustavo Rossi[3] *

[1] Universidad Internacional de La Rioja (Spain)
[2] Universidad de Oviedo (Spain)
[3] Facultad de Informática, UNLP and Facultad de Tecnología Informática, UAI (Argentina)

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Abstract

Usability is a quality that a web page can have due to its simple use. Many recommendations aim to improve the web user experience, but there is no standardization of them. This study is part of a saga, which aims to order existing recommendations and guidelines by analyzing the behavior of 20 Information Technology (IT) developers. This publication analyzes the set of guidelines that determine "user responses" when they interact with a website. It is intended to group these guidelines and obtain data on the application of each of them. The test is carried out with 20 web developers without training or experience in web usability. The objective is to know if there are "user response" guidelines that a developer with no training or usability experience applies innate. Since web developers are also users, it is believed that there may be innate behavior that is not necessarily learned. The purposes of the work are: 1) Enumerate the most forgotten recommendations by web developers. This can help to think about the importance of offering specific training in this field. 2) Know the most important recommendations and guidelines, according to the web developers themselves. The investigation is carried out as follows: First, IT engineers were asked to develop a website; Second, user tests were performed and the most neglected and most applied guidelines were evaluated. The level of compliance was also analyzed, as developers lack experience in web usability and could be applying a guideline, but not correctly; Third, web developers are interviewed to find out what guidelines they consider necessary. The results are intended to help us understand if a web developer without training or experience in web usability can innately apply guidelines on "user responses". The objective of the study is to determine that there are guidelines that are applied intuitively and others that are not, and to know the reason for each situation. The results determine that the guidelines considered essential and those that are most applied innately have something in common. The results reveal that the essential guidelines and those that are most commonly implemented inherently share certain commonalities.

Keywords

Action, Guidelines, Recommendations, Usability, User Response, User Experience, Web.

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I. Introduction

Web usability measures the quality of a user's experience when interacting with a web page. To measure the experience, the relationship between the website and who uses it is analyzed. A web page, or website, refers to the navigation system, its contents, and the functionality it offers.

Thus, web usability aims to facilitate a user to use a website efficiently. This efficiency involves the access of the elements offered on the screen and the fulfillment of the tasks that the user intends. Many suggestions are published that improve the usability of web portals [1]. These "ideas" are classified into recommendations, heuristics, guidelines, etc. [2]. All these concepts are different and, therefore, seek different objectives.

Heuristics are design principles that allow interaction to be facilitated. The most popular ones were published by Jakob Nielsen in his book 10 Heuristics of Usability for User Interface Design (1995) [3]. They are useful, but experts have shown that their approach, mainly theoretical, is not the best answer to specific problems [4].

The guidelines have a similar objective to heuristics [5], [6]. Their foundations do not offer a theoretical framework that is broad enough to determine generality and applying them is more effective in specific cases [6]. So they are not always the best option because they are still too theoretical.

In our previous research, we have proposed to establish usability standards. Usability recommendations are the most useful for this [7].

* Corresponding author.
E-mail addresses: lucia.alonso.virgos@unir.net (L. Alonso Virgós), jordansoy@gmail.com (J. Pascual Espada), gustavo@lifia.info.unlp.edu.ar (G. Rossi).

However, and although many lists of recommendations have been published [7], to date they have not been grouped, classified, or sorted in a standardized manner. Getting recommendations to be grouped, classified, and ordered would be very useful for web developers. This is one of the objectives of our research.

For our research, 103 recommendations were extracted from different sources. Within this selection, usability recommendations for specific domains have been avoided [8]. Next, the 103 recommendations are divided into five groups that offer a classification [8]. Classifying recommendations helps in avoiding repetitions. The proposed groups are:

(1) Recommendations to reduce "noise"

(2) Follow conventions

(3) Provide information quickly and understandably

(4) Efficient and understandable controls for users to enter information

(5) Give descriptive and understandable responses to user actions

After designing this ordered classification of usability recommendations [8], and after evaluating the recommendations of groups (1), (2), and (4), three scientific articles that evaluate these groups of recommendations [8], [9] were published.

This paper aims to evaluate the group (5) "Give descriptive and understandable responses to user actions".

Of the 103 recommendations, there are 4 useful usability recommendations on this group [10]-[20].

It should be noted that the tests and interviews that were conducted during this investigation, involved participants without training or experience in web usability.

The participants are web developers. The idea of asking that these participants be newbies in web usability aims to make the evaluation objective and to be able to measure innate behavior during web development.

The mechanics of our research has been the following.

In addition to offering the above 103 grouped recommendations, participants are selected for tests and interviews. The participants are 20 web developers without training or experience in web usability.

1. Each participant develops a web portal referred to a specific objective, each one chooses their own.
2. Specific training on web usability is offered. This training is also divided into 5 blocks, so the knowledge of each guideline is acquired with precision.
3. When the participants have already received the appropriate training, their web developments are evaluated. This evaluation is made in 5 parts, coinciding with the groups. The application of each of the corresponding group guidelines and their level of compliance is measured.
4. A list of the groups is offered to the participants. They are interviewed to analyze the importance they attach to each of the guidelines. There are 5 interviews, one for each group. In this way, the results are more accurate.
5. Conclusions are drawn in this regard.

Though web developers have enough skills to develop websites, the purpose of this research is to assess if these skills (together with intuition) are sufficient to create usable Web sites and to measure objectively the deviation from this objective.

That is, what we intend to know is if a web developer intuitively applies web usability recommendations. And if compliance with the recommendation is correct. Or if, on the contrary, an IT engineer needs specific training on web usability, in addition to the acquisition of web development skills.

The research is divided into two objectives:

- Objective 1 is intended to determine the degree of application and the level of compliance with each of the fifth Group's guidelines "Give descriptive and understandable responses to user actions", by IT engineers with no training or experience in web usability.
- Objective 2 aims to know the importance that web developers give to each recommendation, after understanding its purpose. That is, after receiving training in web usability.

This article is organized as follows. In Section II we present some background on usability evaluation. In Section III heuristics and recommendations are extracted and grouped. In Section IV the research design is described. In Section V, results for each of the recommendations are presented and in Section VI we evaluate these results. In Section VII we discuss these results presenting the best and worst recommendations as valued by volunteers. In Section VIII we present our conclusions and suggest some topics for further research.

II. Background

A. Usability Evaluation

Web usability not only measures the ease with which you browse a Web site, but also the effectiveness and efficiency with which it is done [10]. Many methods measure this.

There are three broad ways to measure usability:

(i) Usability inspections. These inspections are abstract concepts that are supported by expert studies or observations. The most common are heuristic evaluations, cognitive patterns, and checklists [6], [11], [12]. Their purpose is to evaluate specific actions or problems [13], [14], [15].

(ii) User-centered methods. Unlike the previous ones (i), users participate in these tests. This means that they are more practical than theoretical. They are tests, physiological measurements, or interviews [16], [17], [18]. Web usability is measured by looking for potential problems, mainly. Through the interviews, you can know the opinions of the users. In this case, several questions are asked about their behavior, attitude, thoughts, and feelings during web browsing. Through physiological measurements or monitoring, physiological responses are obtained from users to a website. For example, a physiological measurement is to use eye-tracking to measure the movement of the retina and know which areas of the interface are the ones that stand out, and which ones go unnoticed. Through the tests, it is possible to measure the efficiency in the interaction of the user with the computer. For example, you can measure the memory capacity that a user has while browsing the web on a website that he had not visited for a while. It is also possible to assess satisfaction by analyzing the facial expressions of users [19].

(iii) There is a third method of website evaluation: an automatic evaluation. Since experts in the field of web usability recommend that measurements be made by people, in this work this method is not considered. This statement is justified because the evaluation aims to discover the ease of use of a website. And the ease of use comes from the intuition of the user (as a person). The great advantage of automatisms is that they are objective in their evaluation. However, if the evaluation is carried out by two people, they may offer different results due to subjectivity [32]-[35]. For research, we start from the fact that evaluations must be carried out by a person, and not by automatisms [20].

The proposals of this project are evaluated through interviews answered by web developers, without experience in usability, who also think like users, and through expert analysis.

B. Heuristics, Guidelines, and Recommendations

As stated earlier, the heuristic method aims to discover and improve human-computer interaction. Nielsen [21], [22] stands out in this field, although other proposals designed for specific domains [23], [24] [25], [26] are also useful. The intention of these proposal is to detect existing problems and create a theoretical action plan that avoids errors [27]. As they are planned for specific domains, they are not useful for evaluating general web design problems [4].

An example of heuristics would be: "This (concrete) website must differentiate text links" or "Single-column paragraphs are read faster than multiple column paragraphs" [6], [28]. The solutions are given for specific websites and may or may not be useful for other websites. Besides, there is no standard to follow [6], [29], [30].

It has already been mentioned that this research aims to select the most important general guidelines. Bibliography used to extract these guidelines [6], [11], [27], [28], [30], [31], [32], [33] includes 103 generic recommendations [8], [28], [33] that are useful for any domain. These recommendations were extracted and analyzed for the purpose of this study.

An IT engineer is technically trained to develop a website but does not always seem trained in human-computer interactions. When it is not, its developments may not meet the needs of users [34] or even the specific needs of a domain [35], [36]. This "ignorance" or lack of training in human-computer interactions causes the application of web usability guidelines to be useless [37]. For all this, our project aims to discover if there is intuition during the application of the usability guidelines and if this application is fulfilled correctly. It is intended to demonstrate that there are recommendations for web usability that are intuitively applied and others that are not used, and the reason for each situation.

III. Recommendations

This publication focuses on the recommendations group (5) "Give answers descriptive and understandable to the actions of the users". We aim to analyze these four useful recommendations with the assistance of 20 graduate students specializing in web engineering. The purpose is to know if these recommendations are applied innately and compliance is correct without the need for training. We also discover the importance that these IT engineers give to each recommendation once they understand their purpose.

A. Classification of Recommendations

The 103 recommendations were extracted from different sources [6], [11], [42], [43] and divided into groups by our teammate Jordán Espada, who analyzed the 103 recommendations and their objectives and looked for similarities to be able to group them. He found five viable similarities, differentiated by their purpose, and created the 5 groups.

(1) Recommendations to reduce "noise"

(2) Follow conventions

(3) Give information quickly and comprehensibly

(4) Efficient and understandable controls for users to enter information

(5) Give answers descriptive and understandable to the actions of the users

This grouping proposal has been designed and serves as didactic material in the Master in Web Engineering of the University of Oviedo.

Fig. 1 shows the grouping of web usability recommendations [38]. The 103 recommendations taken from different sources are ordered and reduced to 69. As indicated in Fig. 1, repeated or overly specific recommendations are eliminated. They are divided into 5 groups, of 16, 8, 24, 17, and 4 recommendations.

Given that groups 1-4 have already been published, this article presents the recommendations from Group (5) - Provide clear and understandable responses to user actions.

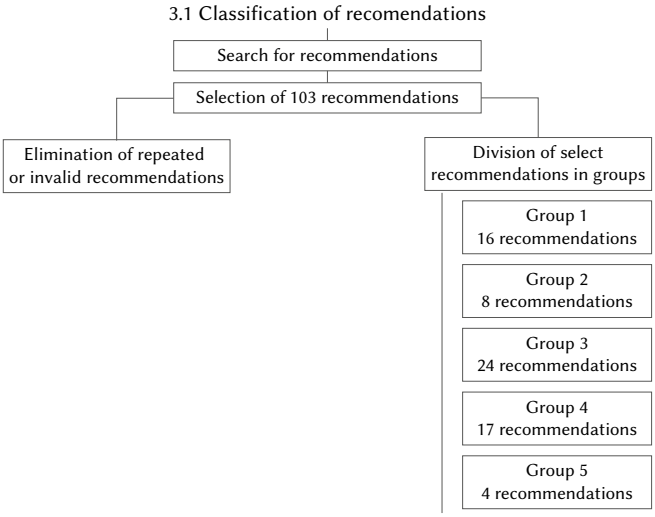


Fig. 1. Classification of recommendations.

1. Recommendation A: Being Able to Easily Identify Items Seen or Visited

This recommendation focuses on the website recognizing those elements that were visited or selected.

For example, in a specific search of the web browser the websites in which the user has previously entered are presented in purple. The rest of the websites that you have not visited yet appear in blue. The elements that must be recognized are those on which the user applied actions of importance [39].

In Fig. 2 the second search result is represented in purple because it has been visited before. In this way, it alerts the user that this site is already "read".



Fig. 2. Identify viewed or selected items. Google.

Fig. 3 identifies unread emails (with white background), emails already read (gray background). This is very useful for the user to quickly locate those emails that are unopened.

2. Recommendation B: Notice of Response to Actions

This recommendation intends that all user actions have outstanding notifications. For example, using color codes and standardized icons to represent the type of notification. These notifications can be errors, successes, warnings, etc. [40]-[41].

In Fig. 4, a notification is presented for a product that has been added to the shopping basket. Alongside the notification, additional options are available, such as editing the basket or proceeding to checkout. However, the importance of this recommendation is underscored by the clear notification of a new item being added to the basket.

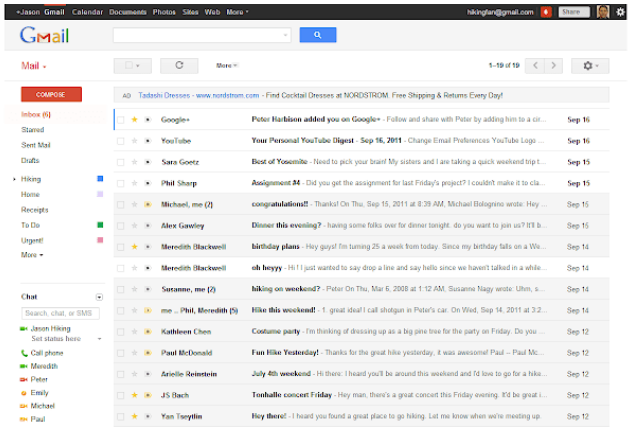


Fig. 3. Identify viewed or selected items. Gmail https://chrome.google.com/webstore/detail/gmail/pjkljhegncpnkpknbcohdijeoejaedia?hl=es-419.

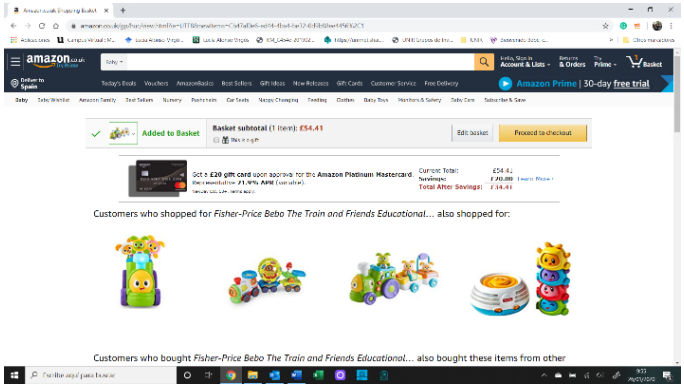


Fig. 4. Identify added to basket. Amazon.

A notification is sent in Fig. 5 that warns that a conversation has just been deleted to the recycle bin. With this notice, the user can be satisfied knowing that he or she has deleted the conversation if that was his or her intention, or the user can rectify (Recommendation C) if the deletion of the conversation is a mistake.

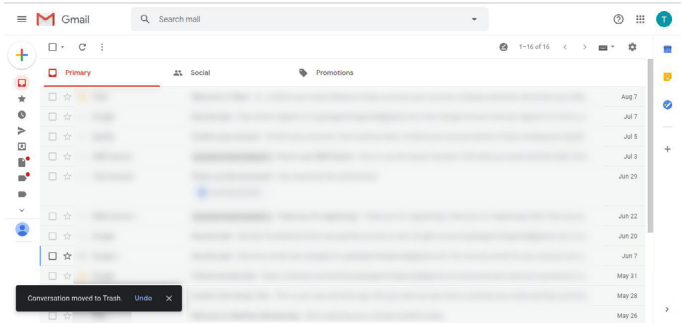


Fig. 5. Notice of response to actions. Gmail.

3. Recommendation C: "Undo" to Go Back on Tasks Sensitive

This recommendation allows user error tolerance. For example, requiring confirmation on some important tasks, such as a purchase. Although, sometimes, it is more efficient to use Undo than to request confirmation [42].

The purpose is to ensure that the user did not act by mistake.

As shown in Fig. 5, in addition to notifying the action that the user has just performed (delete a conversation), the user can go back by clicking on the "Undo" text link.

4. Recommendation D: Descriptive Information About Errors

This recommendation is intended to provide detailed information about an error, for example, why it occurred.

Sometimes you need to know if the error was made by the user or the system, or if there are problems with the information entered (for example, if unsolicited content has been sent as an unsupported symbol, if expected content is absent, if there is blank or invalid size/format content, or if there is content not validated by business logic). Fig. 6 shows an example of descriptive information about errors in Dropbox application, when entering an email in use [43].

When this happens, it should be clear:

- What error has occurred
- Where has it happened?
- How can it be solved

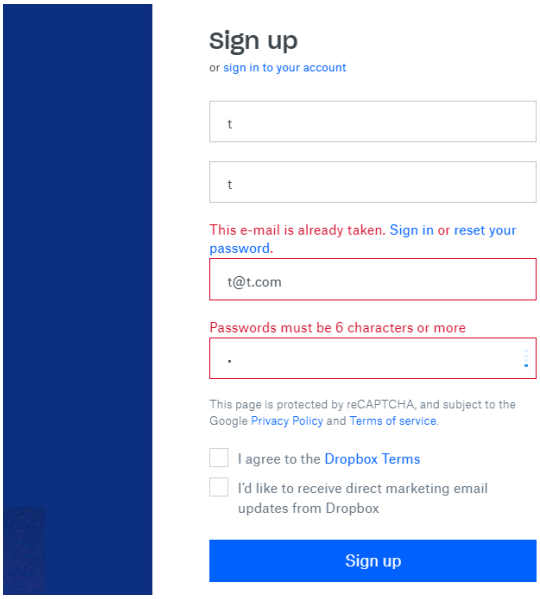


Fig. 6. Sing up in Dropbox. Dropbox.

IV. Research Design

This project studies the behavior of 20 Spanish computer engineers. The purpose is to discover if a web developer with no experience in web usability applies a useful recommendation intuitively because the intuition factor is relevant. If the existing recommendations are not applied intuitively, it can be deduced that IT engineers need to be trained in web usability.

Of the 20 students, 15 are men and 5 are women and have an average age of 23 years. They are students of the Master in Computer Engineering at the University of Oviedo. Everyone has a degree in Web Engineering, so everyone has the technical capacity to develop a website. However, none have experience in web usability. Web usability is a block of didactic content that will be taught in the Master in Computer Engineering at the University of Oviedo after the experiment described in this article.

As no participant formally knows web usability, despite having a high level of knowledge in web development, our team wants to know if an IT developer of these characteristics can innately apply any of the recommendations of web usability. This hypothesis is based on the basis that states that web usability is easily detectable by a user, and IT developers are users in addition to web developers.

It is also intended to measure the level of compliance with the recommendations that have been applied. Besides, finally, it is expected to know the importance that the web developers themselves give to each recommendation after training in usability.

For the experiment, a subject is assigned to each student (banking, restaurants, etc.). From this topic, they should design a website.

Therefore, 20 different websites are created by IT engineers who ignore web usability. After receiving training, participants are trained to evaluate their web designs. In this particular case, students receive training on the 4 recommendations collected and grouped in Group (5).

The purpose is to know the importance that a web developer recently trained in web usability attributes to each of the group's recommendations, and if any of the developers apply the usability recommendations innately and correctly (see Fig. 7).

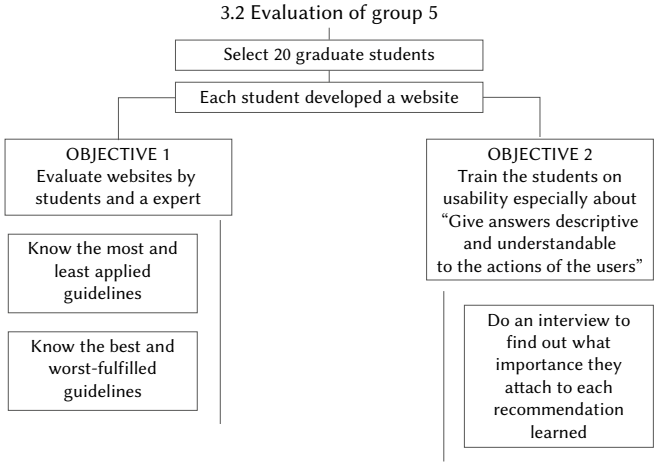


Fig. 7. Evaluation of group 5. Objective 1 and Objective 2.

To analyze the importance that each IT gives to each recommendation of the Group (5), surveys are carried out, (see Fig. 7, left side). The level of importance is measured with a score of 0-10 (Objective 1). As indicated above, the survey is conducted after web usability training to ensure that participants respond with knowledge. The measurement results are shown in Section V.

Next, each website is tested. The tests are carried out by the same participants, but this time assisted by an expert supervisor in web usability.

Website measurements are scored always following the same criteria. An applied recommendation is scored with 1, and an unapplied recommendation is scored with 0. The application measures the participant's intention to develop based on web usability. These results can provide useful information on whether web usability recommendations are innately used by inexperienced developers.

The degree of compliance is also measured with values from 0 to 5. 0 means that the recommendation is not properly fulfilled. 5 means that the recommendation is met successfully. It may be the case where a recommendation has a value of 1 in application and 0 in compliance. This means that the recommendation is applied innately because it is considered useful even without notions in web usability, but it is applied incorrectly (Objective 2). The results of the tests performed can be found in Section V of this article.

The summary of the process is:

1. Postgraduate students, already experienced web developers, were tasked with creating websites on assigned topics.
2. The students underwent training in usability, specifically focusing on the guidelines presented in this document (OBJ 1).
3. A survey was conducted to gather the students' perceptions regarding the application, fulfillment, and importance of the guidelines after the usability training (OBJ 2).
4. Each website was assessed by a usability expert to determine which guidelines were applied intuitively, which were not, and how this relates to the opinions expressed by each participant.

This comprehensive approach aims to understand the intuitive application of usability guidelines by inexperienced developers and how this aligns with their perceptions and usability training.

V. Results of the Experiment

This section includes the results of tests a) and b) both with the 4 recommendations previously seen.

A. OBJECTIVE 1. Test A) "Innate" Use of Usability Guidelines by Developers

The first part of the experiment consists in that web developers create a website. After the development task, they are trained in web usability, particularly in the Group's recommendations (5). Once web developers have been trained in web usability, they attach importance to each of the guidelines, according to their criteria. With well-established knowledge, they evaluate their websites and measure the degree of application and the level of compliance in each of the 4 guidelines of this group. This step is taken with the help of an expert.

The application of a guideline is scored with a 1. The non-application of a guideline is scored with a 0. This non-application means that the guideline should have been used but was not used. On some occasions, the guidelines were used, value 1, but were not met properly. For this reason, compliance is studied in the following section of the paper.

Fig. 8 indicates that most applied guidelines belong to type B (Notice of response to actions) and D (Descriptive information about errors). 90% of the participants applied them. The least applied guideline is A (Identify viewed or selected items). In this case, 60% of web developers applied it. Guideline C ("Undo" to return to sensitive tasks) was applied by 75% of IT developers.

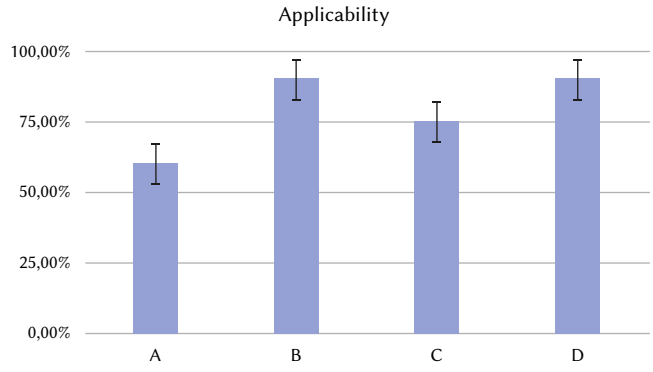


Fig. 8. Results of applicability.

Fig. 9 indicates that the major guideline complied with is D (Descriptive information about errors), with 78.5% compliance; then, the B (Notice of response to actions), with 77% compliance; these guidelines are applied in 90% of cases and three-fourths of the time were correctly applied. The worst compliments are the A (Identify viewed or selected items) and the C ("Undo" to go back on sensitive tasks), with 12% compliance. Guideline A stands out for properly fulfilling only 6% of the occasions. This recommendation is applied more than half of the time (60% of the time) and is incorrectly applied almost always.

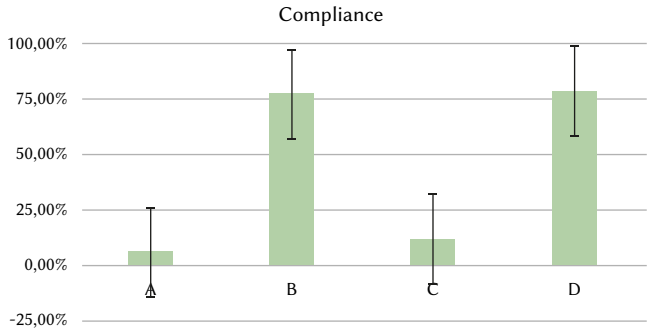


Fig. 9. Results of compliance.

B. OBJECTIVE 2. Test B) "Importance" Use of Usability Guidelines by Developers

Fig. 10 represents the degree of importance that web developers attach to each recommendation. We have already published three groups before this, and we know that the levels of importance granted are usually high. In the case of this experiment, the recommendation considered the most important is C ("Undo" to go back on tasks sensitive), with 85%. Then the A (Identify viewed or selected items) with 82.5%. It is followed by recommendation B (Notice of response to actions) with 81%. Finally, the recommendation considered less important is the D (Descriptive information about errors) with 67%. Curiously, recommendation A has been considered one of the most important, having received training in web usability, and yet only 60% of IT developers have applied it (in an innate form). Besides, this application has been quite wrong, with only 6% compliance. A similar case occurs with recommendation C, the most important with 85% and, although 75% of IT developers have applied it (in an innate way), only 12% have complied properly.

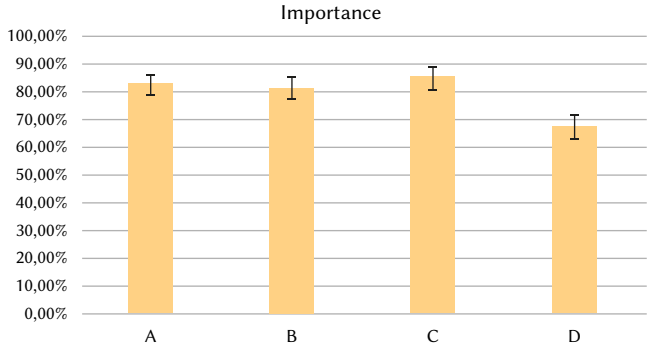


Fig. 10. Results of importance.

Fig. 11 compares the degree of importance given to each recommendation and the result of the Pearson coefficient of applicability.

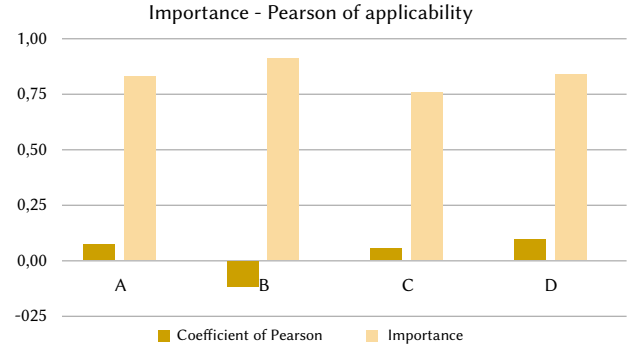


Fig. 11. Statistical analysis of the importance - Pearson of applicability.

Our research only publishes the scatter plots of those recommendations whose relationship is moderate, with a value -0.40> or <0.40, or high, with a value -0.60> or <0.60. In this case, there is no objective relationship in any of the recommendations.

Fig. 9 establishes that the recommendations closest to a relationship of variables are the B: (Notice of response to actions) and the D: (Descriptive information about errors). But in none, there is a considerable relationship. That is, it can be concluded that all recommendations seem to contradict the theory of relationships, with the variables studied in this analysis of Importance.

The objective is to determine if a higher Importance causes a higher Applicability rate. That is if the guideline that is most applied is also considered the most important and vice versa.

Unlike Covariance, Pearson's Correlation is independent of the scale of measurement of the variables. We use Pearson because the study aims to obtain the same index in all recommendations.

To interpret the results in detail, the dispersion diagram should be consulted. This diagram is used to analyze the strength and direction of the relationship between the variables. Although there have been no relationships in this analysis, the process is explained. The value of the correlation coefficient can vary from −1 to +1. The higher the absolute value of the coefficient, the stronger the relationship between the variables. An absolute value of 1 indicates a perfect linear relationship. A correlation close to 0 indicates that there is no linear relationship between the variables. In the analysis, the ratios obtained are: 0.07, -0.12, 0.05 and 0.10, values too low to interpret that there is a relationship.

The sign of the coefficient indicates the direction of the relationship. If both variables tend to increase or decrease at the same time, the coefficient is positive and the line representing the correlation forms an upward slope. This occurs with guidelines A: (Identify viewed or selected items), C: ("Undo" to go back on tasks, and D: (Descriptive information about errors), whose results are positive (> 0).

If one variable tends to increase while the other decreases, the coefficient is negative and the line representing the correlation forms a downward slope. This happens with guideline B: (Notice of response to actions), whose result is negative (< 0).

C. Analysis of the IMPORTANCE – Pearson of COMPLIANCE

The relationship pattern between the Pearson coefficient of Compliance and Importance variables is analyzed. Conclusions are drawn about the relationship between their variables.

As with the previous analysis, there are no moderate or strong relationships in any of the guidelines. This means that no conclusions can be drawn about the relationship between variables or that said relationship is not decisive (see Fig. 12).

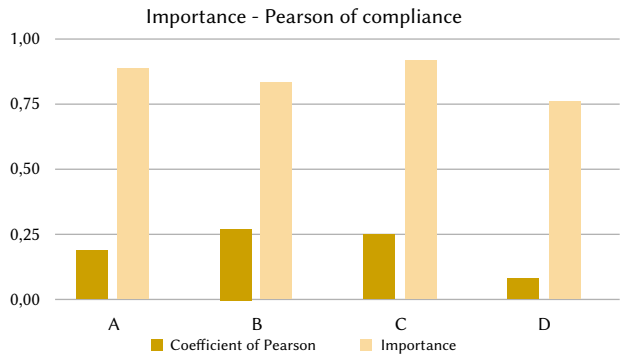


Fig. 12. Statistical analysis of the importance - Pearson of compliance.

n the study of these variables all possible relationships are positive, which would mean that if there was a relationship, it would be direct.

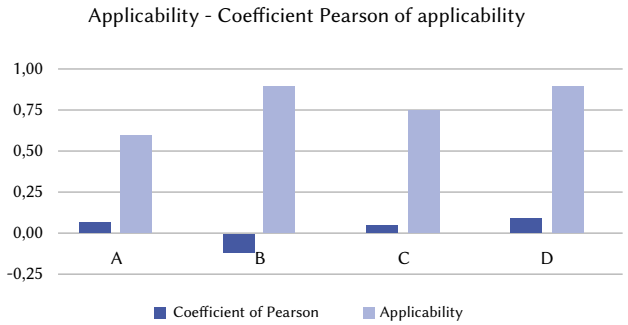


Fig. 13. Statistical applicability – coefficient Pearson of applicability.

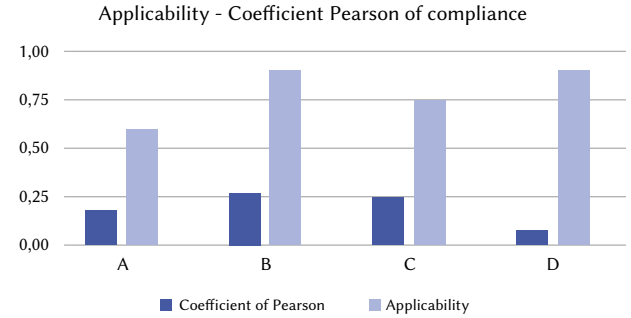


Fig. 14. Statistical applicability – coefficient Pearson of compliance.

That is, the greater the degree of importance attached to the guideline, there would be greater compliance. It should be remembered that compliance can only occur if the guideline has been applied. There are applied guidelines that have not been met, but not vice versa.

The most prominent relationship is that of guideline B: (Notice of response to actions). The previous analysis concluded that the more important, the less application. Now it is determined that the more important, the better compliance.

On the other hand, it was previously demonstrated that this is a very applied guideline, and it was also concluded that the importance was not very decisive in the comparison because there were generally high scores.

This could mean that although there is no relationship between variables, it is a well-applied and well-fulfilled guideline. In this example, importance is not decisive.

D. Analysis of the APPLICABILITY and COMPLIANCE

The relationship pattern between the *Pearson coefficient of applicability/compliance* and *Applicability* variables and *Pearson coefficient of applicability/compliance* and *Compliance* variables is analyzed. Conclusions are drawn about the relationship between their variables.

The basis of the Pearson coefficient is that the more intense the concordance (in the direct or inverse sense), the product gets more value. It measures the statistical relationship between two continuous variables. If the association between the elements is not linear, then the coefficient is not represented. This is the case of the relationships in this study. It has already been shown that there is no relationship between the variables (neither in applicability nor in compliance). Therefore, we cannot offer useful dispersion diagrams nor will the relationships be explained again in the following analyzes. However, we offer the graphs that compare the results of these coefficients with the Applicability and Compliance results of the previous point, Fig. 13-16.

It is necessary to emphasize that to obtain the Pearson coefficient results, the Importance variable was always analyzed, and it was compared alternately with the variable Application or Compliance.

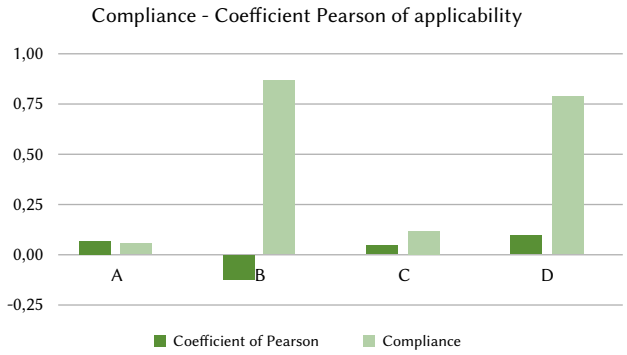


Fig. 15. Statistical compliance – coefficient Pearson of applicability.

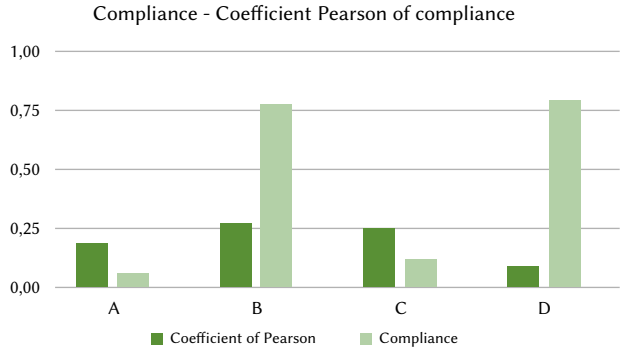


Fig. 16. Statistical compliance – coefficient Pearson of compliance.

This means that these figures represent on the one hand the relationship between variables, and on the other, the result of Applicability or Compliance. What is intended is that, although there is no relationship between the variables studied, useful conclusions can be drawn from this experiment.

VI. Discussion

Fig. 17 presents the relationship between the results of the variables. The most applied recommendations are B: (Notice of response to actions) and D: (Descriptive information about errors). A: (Identify viewed or selected items) is the worst applied. The best complied with recommendations are also B: (Notice of response to actions) and D: (Descriptive information about errors). It could say that these two guidelines are innately applied because even their compliance is adequate. The worst complied with recommendations are A: (Identify viewed or selected items) and C: ("Undo" to go back on tasks sensitive). Curiously, C: ("Undo" to go back on tasks sensitive) is applied spontaneously by 75% of users. However, almost all comply with some errors.

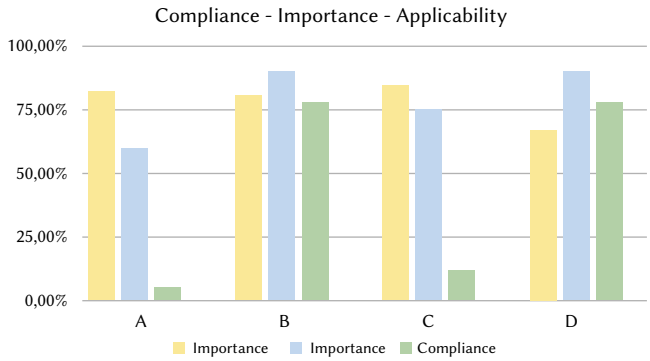


Fig. 17. Importance-compliance-applicability.

A. Best Rated Guidelines

The best-applied guideline is D: (Descriptive information about errors), with 90% application. The best-complied guideline is D: (Descriptive information about errors), with 78.5% compliance. It could be said that this recommendation is not a "necessary" reason for learning, because it seems to belong to the nature of web development.

The same could be said of recommendation B: (Notice of response to actions). It has 90% applicability and 77% compliance.

Although it is determined that the importance factor does not provide too much information for offering such high values, recommendation B: (Notice of response to actions) is considered very important. However, D: (Descriptive information about errors) is the least important recommendation, with 67%.

B. Worst Rated Guidelines

The worst applied guideline is A: (Identify viewed or selected items), with a 60% application. The worst complied guideline is A: (Identify viewed or selected items), with 6% compliance. This guideline needs, on the one hand, to be taught in usability agendas. Because it is the most unknown of the recommendations. Besides, on the other hand, it needs a lot of practice in training, because indeed all web developers have problems with errors. When web developers receive usability training, they give it 82% importance.

The next worst-performing address is C: ("Undo" to go back on tasks sensitive), with 12%. Unlike the A: (Identify viewed or selected items), the C: ("Undo" to go back on tasks sensitive) is applied by 75% of the participants. It could be said that this address, rather than being known, needs to be practiced by web developers.

VII. Conclusions

Our work aims to discover which usability guidelines related to "Responding to user actions" are considered more and less important for web developers, and also which are applied more and less. We tried to discover if there is a relationship between importance and application in these kind of web usability guidelines.

To meet this research objectives, we designed two experiments. First, a team of 20 web developers without knowledge of web usability designed 20 websites. All web developers were unaware of the web usability recommendations that would be analyzed later. The goal was to find out if the application of any of these guidelines is innate or should be learned. Second, web developers trained in web usability, specifically in guidelines related to "Responding to user actions", and responded to two surveys: 1) It aimed to know the level of importance that web developers give to each of the guidelines, once studied. 2) It aimed to evaluate the websites to know the level of compliance with these guidelines.

Data analysed in this research work suggest that there is no relationship between importance and application in this kind of web usability guidelines. Web developers without usability training habitually made mistakes related to A: (Identity viewed or selected items), For instance, in the user interface, include an "Undo" option to allow users to revert sensitive actions or tasks. They made few mistakes related to B (Notice of response to actions). Instead, once they have training in usability, they consider very important C ("Undo" to return to sensitive tasks) just one of the guidelines that they least applied on their websites. The guideline as less important was D (Descriptive information about errors) which is the second most used guideline on their websites.

VIII. Future Research Lines

We have published the research carried out about the Recommendations Group 1, 2, 3, 4 [8]-[10], [16] and this is the research of Group 5.

The next thing will be to test these results with more participants, including other questions of interest, for example, if there are patterns of behaviour while the web development and if this affects web usability, or if the application of the guidelines also depends on the area to which the website is intended.

We also seek to validate the improvement of each guideline in the user experience. This is interesting to support this saga of papers that we have already published. At this moment we are working on the development of a validation tool.

And we also want to compare the improvement offered by each guideline depending on the level of experience the user has.

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Lucía Alonso Virgós

Lucía Alonso Virgós is a computer scientist with interest in web usability. Professor and Director of Industrial and Electronic Area of de International University of La Rioja.



Jordán Pascual Espada

Jordán Pascual Espada is a computer scientist with an interest in web usability; he is a Deputy Director of the Engineering School of University of Oviedo.



Gustavo Rossi

Ph.D. from PUC-RIO Brazil University. Full professor at the Computer Science College at Plata National University and head of the LIFIA research group. Visiting professor at the Universities of Lyon and Montpellier in France, received the Habilitation pour Diriger Recherches (HDR) at INSA-Lyon. Part of the PC committee of many significant conferences like ACM WWW, ICWE, and ACM Hypertext. He has published more than 200 research papers, most of them in the field of modeling and design issues for advanced Web Applications, particularly those that involve context-aware behaviors.