Reprojecting a Fitness App Regarding Retention and Usability Using Nielsen's Heuristics

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Abstract. The increasing use of wearable devices, associated with sports practices, served as a motivation for the researchers of this work analyzed the app called Fitness, developed for iOS platform. The choice for iOS was due to the fact that Apple Watch is considered the best selling smartwatch in the world. Besides that, during their physical activities Apple watch users have the possibility to have their data captured by the biosensors in the watch. Such data can be transferred to the iPhone, processed and the result presented to the user to a structured report. However, it was identified serious problems of design in the generated report, probably because it disregards the user's context. Thus, the objective of this research is to identify the existing limitations in Fitness using the evaluation heuristic, in addition to proposing solutions to the referred problems identified through the restructuring of the application interface based on Nielsen's heuristics. To the identification of the limitations and the consequent restructuring of the interface, the research used qualitative and quantitative methods. The results showed a great improvement in usability, with more than 20 points on the SUS scale. In addition, it was noted that heuristics minimize user memory loads, shortcuts and speak the user's language were those that most brought benefits to the interface.

Keywords: Fitness app · Nielsen heuristics · Usability improvement

1 Introduction

Health, exercise and well-being are getting more relevant issues for the mobile app development market, in [1] it is evident a high growth of those applications. These data have relationship with new wearable technologies evolution that has an important role because of their biosensors which are able to precisely measure data from the body [2].

Thus, the most purchased smartwatch in the world is the Apple Watch, with 4 million new active owners in just the first 4 months of 2020 [4]. This gadget has a very close integration with Apple smartphone and with many applications developed by Apple. One of these applications is the Fitness, an app exclusively

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designed for sports and physical fitness. This application stores data during exercise in the biosensors of the watch. The data is transferred to the mobile and then, processed in order to show a report to the user.

However, the report generated by the app has visible design drawbacks. For example, as repeating totally or partially the data layout to all available sports, the user context might not have been considered [12]. Besides that, different visual elements from the interface are too close; making the user believes that they form information from the same group [6] and making the search for any specific element more difficult. These problems may negatively affect the application retention, and this as it was previously seen in [1] is one of the greatest challenges found in the health apps. Therefore, this factor is highly relevant for the context of this work.

As an evidence, an experiment carried out by Tison, Hsu et al. [10] has shown that when three design techniques in an Apple Watch app are applied the retention grows significantly. These techniques were: feedback – warn about changes; efficiency – raise the daily frequency of the data updating; and minimalism – simplification of the interface in order to make visualization of the tendencies easier. Such techniques are notable shown in the heuristics done by Nielsen [7]. However, would it be possible to use this and other heuristics to find out new drawbacks and enhance the application interface?

Thus, this work aims to identify problems in Fitness application and how to solve them in order to enhance its usability and retention through heuristics shown by Nielsen.

2 Related Works

Taking into account that one of the pillars of this research is related to the user engagement factor in wearable devices, this section aims to present other works that seek to identify that factors that favor the engagement or disengagement of the user when using the app and the device, regardless the area.

In this sense, Keseberg [15] developed a research in which he sought to understand what favored user engagement with the health app. In it, the definition of engagement adopted was smartwatch Kim, Y. H., Kim, D. J., Wachter, K. [16] who says that engagement is expressed by the user through satisfaction, intention and a perceived value. It was also mentioned that engagement was related to three types of motivation, where the first would be of a utilitarian nature, which can be understood as the ability to complete a task, the second of a hedonic nature, which refers to "feeling entertained" and finally, the third refers to a social order that corresponds to "connecting with others".

In this research, personal and technological factors that favored engagement were identified. Regarding those of a personal nature, it is possible to mention: intrinsic motivation, bond and personal adjustment. Regarding the technological ones, what stood out the most was monitoring, through reminders, goals, among others.

However, another highlight in Keseberg's research is related to identifying the factors that contributed to the user's disengagement in an application. Among

them, lack of perception and reliability were mentioned as factors that served as a stimulus for discontinuing the use of the application or wearable. This is because of the perception, regarding the understanding in the form of the functions or understanding of the measures, was not clear.

It was also perceived as important, on a technological level, the presence of factors that make people feel engaged, both in the app and in the wearable. In this sense, the most cited factor is the function of monitoring one's behavior. This is experienced as a motivator, as people are continually encouraged to achieve their goals and thus adjust their behavior.

In the same direction, Asimakopoulos, Asimakopoulos and Spillers [3] conducted a survey with wearables to understand the factors that contributed to motivate and, consequently, engage users, in an application. The research isolated inherent motivational and engagement factors with fitness tracking participants, over time, in an attempt to investigate the reasons for abandonment and, consequently, the barriers outlined for engagement.

One of the barriers identified was related to the lack of application customization. Thus, some declared the need for applications to balance autonomy with the creation of more self-directed goals to support their engagement.

In this sense, the results revealed three main areas of UX that directly impact the motivation and effectiveness of users: data, gamification and content. With this result, it was possible to propose a set of heuristics focused on mobile health, which included a strategy of challenges and tests to motivate the user to interact with their device.

However, just engaging is not enough, what interests us is a cycle that was described by O'Brien and Toms [8], which starts with a phase of interests, which remains and ends, and it can return to the starting point depending on certain factors.

Therefore, the following section will present the problem and the proposal for this research.

3 Methodology

In order to assess the level of commitment of users with the Fitness app, this research made use of a qualitative method and it was organized in three main stages, namely: heuristic assessment, redesign of the application and usability assessment. Next, each of the steps mentioned will be described.

3.1 Heuristic Evaluation

In the first part of the research, a bibliographic survey was made in order to identify works with similar objectives to this research. One of them was the research by Tison, Hsu et al. [10], where they applied techniques related to a series of positive characteristics contained in [7]. Such characteristics were mapped and organized in ten heuristics, which are guidelines that contain desired characteristics in the interaction and in the interface of an application.

Knowing these rules, it is possible to inspect if a certain application contains interaction problems. This inspection method is called heuristic evaluation. Taking into account the context of the researchers, the main reasons for choosing this methodology were due to low cost, agility in data collection, in addition to being used by [10] and showing good results.

After the assessment was made, the results found were organized into three categories. They are: Not applicable, needs investigation with users, detected failures. All categories mentioned here will be detailed in the result section. However, it is important to explain that the heuristics classified as "needs researches with users" were those in which the researchers were unable to identify the presence or absence of each heuristic in the application without the prior help of the users. For this reason, an auxiliary questionnaire for heuristic evaluation was developed to be applied to an audience to be defined later in order to evaluate information found in the application interface.

In the following subsection, the questionnaire will be detailed.

Auxiliary Questionnaire for Heuristic Assessment. The development and application of a questionnaire with users was necessary to confirm whether some heuristics were consistent with the metrics raised by Nielsen [7]. For a better understanding, it is possible to cite as an example, the equivalence between a data presented by the Fitness app, in the swimming activity, called "Average rhythm per stroke" and how a real user uses it in their daily lives. For the results not be mistaken, a specific target audience was defined, which in this case were characterized by people who swim.

The first part of the questionnaire asked for authorization on the use of participants' anonymous responses, followed by questions that assessed the user's profile such as, "how long have you been swimming?", "Do you have an Apple Watch?" among others. The purpose of this first part of the questionnaire was to understand how familiar the user was with the sport and the app.

The second part is related to the evaluation of the information itself. For that, each data that existed on the Fitness app screen was separated into an image. Each image had the same task as in this case, to evaluate the relevance of this information for monitoring its results during training. The respondent then had five options, based on the likert scale [13] and to extra to assess whether the user understood the meaning of the information.

With the results extracted with the aid of the questionnaire, it was possible to proceed to the next step, which in this case was the second and was related to the redesign of the interface. About this redesign it is possible to obtain more details in the following subsection.

3.2 Redesign of the Interface

With the results of the heuristic evaluation stage, it was possible to start the application redesign. The changes were evaluated in order to add the missing characteristics discovered by the user in the previous step. In addition, the interface of other sports applications was taken into account, such as: *Runstatic*,

Nike run club and *My Swimming Pro*. Associated with such sports applications, other applications were considered, but of a non-sports nature, such as *Telegram*, *Reminders*, *Settings and Notes*, present in the cell-phone, so that the result was friendly for iPhone users.

In view of the above, a prototype was developed using the *Figma* digital design platform, but it was found that the result would not be interactive enough. For this reason, a new prototype was developed using the Swift language, which is a small application containing only the redesigned screen, with static data. This new application was inserted in the official Apple testing service, *Testflight*, for the exclusive use of the research participants, needing a code to be made available, by the researchers involved in this work, to download and, consequently, its use.

The results of using the new prototype were analyzed in the third and last stage of the methodology, which in this case is the usability evaluation of the redesign detailed in Subsect. 3.3.

3.3 Evaluation of the Redesign

The objective of this phase is to evaluate, with real users, the original Apple application and the redesign proposed during the research. The evaluation phase is essential to understand whether users are able to carry out the proposed interactions and correctly understand the information passed by applications.

The first step was to seek evaluation methods that would meet the demands of the search. Considering that usability is the main metric of the research, it was chosen the use of the System Usability Scale (SUS) system [14], as it is a simple and well-known. However, this method is ideally quantitative and to obtain more information about the results. A previous step was added to the questionnaire: an evaluation communicability.

The communicability assessment, as described in Barbosa [11], is a method that assesses the quality of the interface communication. Thus, users are invited to perform a set of tasks within the application, while evaluators pay attention to how the participant feels when interpreting the information. With this type of methodology, it is possible to observe points of doubt. If the user takes a long time to find any information, and also the opposite, when information is easily found.

Thus, the participant first performed the communicability assessment and, after completing it, answered a questionnaire based on the SUS system, with answers in Likert [11]. Besides that, subjective responses were added to the questionnaire, so that the user could highlight points he liked and disliked within the application. Each step was performed in the original application and redesigned application. The results section provides, in detail, the explanation how the usability test was applied.

4 Results

Likewise the methodology section, this section will be divided into three other ones: heuristic evaluation, application redesign and usability evaluation. At the end, an overview of the result as a whole will be presented.

4.1 Heuristic Evaluation

When doing the heuristic evaluation, each studied point was classified as one of the three options: absent, it can affect the system and the others were not applicable in that context. The heuristics, classifications and justifications are listed below.

For better visualizing the interface problems, an example of the application, which swimming was selected as a sport, will be used as shown in Fig. 1.

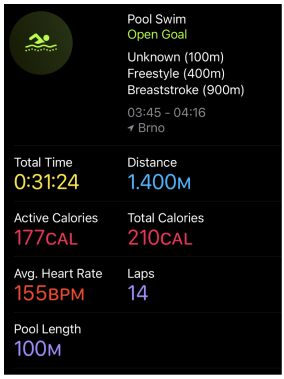

Fig. 1. Evaluated Screen interface using swimming as the sport.

Feedback. This heuristic is about keeping users informed about what is happening through feedback. However, as the interface has data that has already been registered, this heuristic is not applicable in this research.

Speak the User Language. According to Nielsen, the terminology of the interface needs to be based on the terms used by the user. In other words, the system needs to use words that are easy to understand. For example, see in image 1 that some terms may not be understandable to the user, such as total active calories or average pace. However, there is no way to be sure of this, as the heuristic evaluation was carried out with two researchers who are not frequent practitioners of the sport and thus do not know the terms. That is why this heuristic was classified as "needs investigation".

Clearly Mark Exits. The interface must have emergency exits to leave the unwanted state without having to go through an extensive dialogue. In addition, the interface needs to allow the user to undo and redo their actions. However, the interface has no interaction that makes the user undo his actions and for this reason it was classified as "not applicable".

Consistency. We can divide the concept of consistency into actions and appearance of the interface, both are related to what the user is used to do. For example, in Apple's standard interfaces, tabulated information usually appears organized as in Fig. 2.

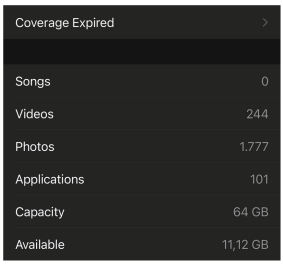

Fig. 2. Detail of a common table, inside Apple's Settings App

Usually, the information is presented in a row, divided into two columns. For example, the title "Videos" appears in the left column and the information contained in it "244" appears on the right. In addition, the lines occupy the entire horizontal extent of the screen.

However, in the application interface, as seen in Fig. 3, the information is not divided in the standard way of the platform. If we look at one of them, for example, the title "*Tempo total*" is located in the second column of a line, dividing space with "*Distância*", the information "0:31:24" is in another line.

In addition, the lines do not use the full length of the screen, causing very large titles to join with others, such as, "*Batimentos médios*" and "*Voltas*" (this occurs only when platform is in Portuguese language). As a consequence, there is a difficulty for users to find the information they want, considering that the platform layout makes them search for the title on the left and the content on the right.

Minimize User Memory Loads. This heuristic deals with the ease of memorizing elements on the screen. If the interface works well with these characteristics, the user can recognize the elements without having to memorize the location of the information. In the application, the titles are very close to each other, making it difficult to read them individually [6].

However, this difficulty can be overcome by the presence of data that are in a larger font size and that also have strong colors that draw attention. Despite

Fig. 3. Detail of Fitness app in Portuguese language

this, the colors compete with each other, making the user almost to have to look at all of them before finding the information he seeks, an aspect that also hinders the recognition of the elements.

Shortcuts. The interface should provide the user with options to streamline their interaction, such as offering a mechanism for frequent actions. In addition, the system should rescue potential customizations based on past interactions. In the Fitness app, in addition to not having an option to rank the most relevant data for each user, as a way to streamline their search, there is also the aggravation that different exercises, which have some data in common, are organized in identical ways, disregarding the user context (Fig. 4).

Fig. 4. Comparison between outdoor walk screen and pool swim screen

Simple and Natural Dialogue. Some evidence of the above characteristics is shown in image 4 where we compare the interface for two different exercises. Considering [12], it is necessary to consider the context of who will use the

system, such as the location, exercise characteristics and user objective. Possibly, the goals of those who practice swimming and those who practice walking are different. For example, perhaps a map for an outdoor walking is very important, as the person moves between different locations, but it may be irrelevant for a person who swims, since the pool will be in a static location. However, before removing or changing the information hierarchy, it is necessary to understand the user needs.

Prevent Errors. This heuristic says that a problem should be avoided, as the interface has no active interactions, there is no way for users to make mistakes when using it.

Good Error Messages. In this heuristic, error messages should be expressed in simple language, indicate the problem precisely and suggest a solution in a constructive way. As in the previous one, there is no way for users to experience this type of problem.

Help and Documentation. Finally, there is a help and documentation heuristic. Nielsen states that this heuristic is not always applicable, however, there are nomenclatures in the interface that are understandable only to practitioners of the sport, that is, users who do not have sports knowledge do not understand. For example, "Average cadence" is information that appears in an outdoor race and the researchers only managed to understand after an internet search. Because it is not necessarily the fault of the interface, but because of the relationship between information and exercise, it was considered that this heuristic was important and the application should contain a documentation section.

4.2 Redesign

The redesign was divided into two main phases: design and development. The design was made based on the findings of the previous step, for each missing heuristic, something was designed for the new interface to correct.

Speak the User's Language. Since it was found that most users understood what the terms were being used for, only a button named "Glossary" was added. This button led to a screen where all the data was listed.

Consistency. As previously mentioned, the organization of the screen in the previous app was not consistent because it used two and a half columns for information. In the redesign, the organization was changed to a consisted list with the iOS platform (Fig. 5).

In addition, the header has been modified to look similar to Telegram, a widely used messaging app.

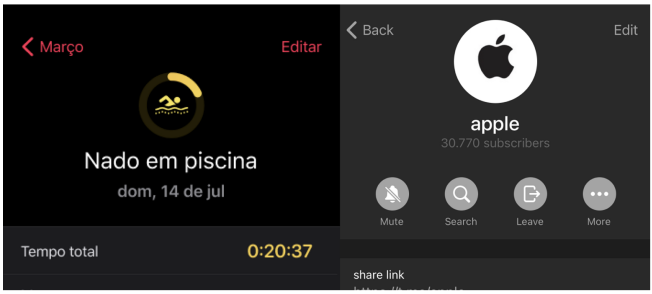

Fig. 5. Comparison between the redesign and app Telegram

Minimize User Memory Loads. The solution to this problem was made by making the standardized list with the platform, since the titles are always positioned on the left and the content always on the right, with adequate spacing. In addition, information that previously consumed almost the entire screen, such as, "Automatic Series", in the image below, was taken to a new screen. The goal of the exercise was not very visible, as this is a relevant data, more emphasis was given on this information. After the summary, the goal and its related data are in two columns above the other information.

Shortcuts. One of the shortcuts that can speed up the reading of information is the hierarchy, in other words, the order in which the information appears. For this, an edit button was added to the screen, when pressed, it activates the edit mode, which adds a "drag and drop" option to change the order of the data. This button has been consistently added to the platform, based on Apple's reminders application, in Fig. 6.

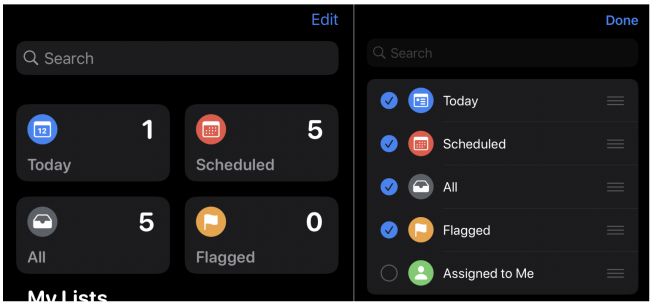

Fig. 6. Edit functionality in Reminders app.

Simple and Natural Dialogue. Along with the "drag and drop" action, it was also added in the functionality to edit a button to show and hide information. Thus, the user can customize which information interests him or not. The result is in the Fig. 7.

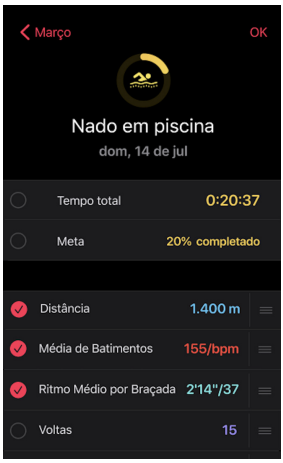

Fig. 7. Redesign with the edit functionality activated

Help and Documentation. For this heuristic, a glossary has been added, as stated in speak the user's language.

4.3 Development

The development of the application was necessary because it was easier to be tested by the user than the prototype built on the figma platform. This was due to the author having a good command of development for iOS systems, the functionality of editing was very complex to be done using design tools and the distribution of the application is relatively simple using the Apple test platform testflight.

The application was developed in three days, using the Swift language and the SwiftUI framework. The information contained in it was static, inserted into the code so that it was always the same regardless whether the user used the application before.

4.4 Evaluation

The usability assessment step was done with the intention of validating the study proposed by this article. However, it goes beyond that, it will not only show if the usability of an application is better in one than in the other, it will indicate

whether the way the heuristic applied resulted in increased usability, in addition to answering the reasons for such result.

Based on this motivation, the first step of this stage was making the material that would be used. In addition to the prototype mentioned in the previous point, two forms were also developed based on the SUS system and material with questions to guide the assessment of communicability.

Profile. With materials in hand, seven Apple Watch users were invited. From this group, only one did not know the Apple application. Two of them knew, but did not use it to record exercises and the others knew and used the application. The participants were heterogeneous in relation to the main sport they practiced using the watch.

App Fitness Review. At the beginning of the evaluation, the researcher explained the research, the terms and how the dynamics of the application would work. A script of tasks was elaborated that the participant needed to perform, at this point, it is important to emphasize that the participant was told he could perform any action he wanted to perform the task.

In the assessment of communicability, the participants demonstrated a certain facility in finding some information, but a great deal of difficulty in finding other information. In addition, there was a task in which the interviewer described one of the data and asked the user to find, in this task, only one of the participants stated with certainty what was the correct information. The others used questions, such as "Is that information?" or dubious statements "I think this is it, but I'm not sure."

Regarding the goal of the exercise, which is at the top of the interface, all participants were able to successfully find the places where the goal was. However with the exception of a single participant, all the others had difficulty in relating which information would be related to the goal. Most chose data that they found most important for themselves, while others stated that it was the information that had the same color as the graph located around the image, but when there were two pieces of information with the same color (for example, total calorie and active calories) the user was unable to answer the question correctly.

At the end of the evaluation, the user was asked to answer a form that contained open and closed responses. The open questions were related to an adaptation of the SUS scale, while the closed questions were for the user to say what they liked or disliked in the application. The result of the first part, referring to the SUS scale resulted in average of 51 points, which is considered as "poor" below the recommended, which is an average of 68.

In the result of the second part, the positive points raised by the users were that the application was simple, had pleasant colors and contained important data. Some drawbacks are about confusing information, irrelevant information and lack of emphasis about the sports' most important information.

Redesign Evaluation. The evaluation of the redesign followed the same methodology as the evaluation of the Apple app, so it would be simpler to make a comparison between the two. The only difference was in the questionnaire, to make future improvements, an extra open question was added, asking for suggestions for improvement in the prototype.

In the assessment of communicability, the interviewees easily located the information. There was no difficulty regarding the search for data. However, in the task of locating data based on its meaning, only four out of the seven respondents accessed the glossary to find out which information was being questioned. It was also noted that in other tasks users entered the glossary and were surprised and asked to return to the task mentioned above.

In addition, there were tasks that asked users to reorder information and hide those that were unnecessary, in both they performed quite easily. When asked which information was related to the goal, the participants responded quickly and confidently.

After the evaluation, the interviewees answered the questionnaire containing the SUS scale and the open questions. The result of the scale was an average of 75, which is equivalent to a "good" index, above the recommended average of 68. The result of the responses on positive points showed that all participants liked the power to reorder and hide information. They were also praised for new hierarchy and the presence of the glossary. On the negative side, several users did not like the graphics being moved to a new screen and commented that they preferred how it was being done in the original application.

Finally, in relation to the improvements, the participants indicated that they felt they lacked what was the total goal. In the app only the percentage and how much was achieved is shown. As in the previous paragraph, it was also mentioned at this point that the graphics should be on the same screen as the information. In addition, one of the interviewees complained that the glossary was not visually striking, that because it is an important part of the redesign it should be somewhere more visible. The last point indicated on the form was the possibility to move information from the table below to the table above, where the goal is.

The comparison between the two applications, the conclusion and possible future work will be discussed in the next section.

5 Results Analysis

Regarding the result from the SUS scale, the redesign of the application screen obtained 24 points more than the original application, which shows a positive aspect of the application of heuristics in the interface design. However, this result is only indicative. In order to obtain more information regarding the improvements, it is also necessary to examine the other artifacts, such as open responses and also the perceptions of the evaluations of communicability. With that in mind, in this section, the results will be discussed in order to reach a conclusion.

In both interfaces, a certain easy search for information was perceived, but being slightly slower in Apple software. In this context, it is important to remember that most users already had prior knowledge of the original application, while none knew the redesigned interface and for that reason it is valid to state that the performance of the redesign was superior.

Regarding confusing data, the glossary helped many users to understand better data and also being one of the features praised by the participants in the forms answered. However, this component would have a greater effectiveness if it were better positioned on the screen or if it was implemented other way. However, in relation to the original app, thanks to the glossary, the redesign had a superior performance, evidencing a successful heuristic "speak the user's language".

Regarding the goal, in the app, participants were confused with which data it was related to the goal of the exercise, which did not happen with the redesign. That positive result is attributed to the consistency heuristic since it follows the pattern of the interfaces that users are used to seeing. In return, it was perceived in both systems that users missed the total goal value, since only the achieved value was displayed and how much it was worth, in percentage of the total.

In addition to comparatives, the redesign stood out for giving the power to edit the information list. The participants commented several times during the evaluation of communicability and also in the open responses that was a fundamental functionality within the application. This fact shows the importance of one of the heuristics cited by [10], the minimalism (minimize memory User memory loads) and also another heuristic: shortcuts.

However, the preference of the participants for the original application in relation to the exercise graphs, such as the beat map, was clear. This change was done following the heuristic minimize user memory loads, however the effect was obtained reverse, since users needed to move from one screen to another.

6 Conclusion and Future Work

This article has analyzed the growing use of mobile devices, specifically wearables, associated with health and practices related to physical activities. In this sense, the research sought to analyze the application called Fitness, developed for iOS platform and which aims to practice sports in search of physical conditioning. The choice for iOS was due to the fact that the wearable device Apple Watch be considered the best selling smartwatch in the world.

Fitness is a native application from Apple, dedicated exclusively to sports and physical conditioning. Apple Watch users, during their physical activities, have their data captured by the biosensors present in the watch. Such data is transferred for the iPhone, processed and the result presented to the user through a structured report. However, the generated report by the mobile application presented serious problems with related design, probably by disregarding the user context.

In this sense, the objective of this research was to identify the problems in Fitness, in addition to seeking solutions in order to improve its usability and

engagement by through the heuristics presented by Nielsen. The solution to such problems was presented from a restructuring of the design.

For this, three steps were performed. The first step was the heuristic, in which one of the researchers analyzed whether the interface had certain characteristics in order to meet the quality that each demanded. However, it was noticed that some of them needed investigation with some specific profile. Thus, an additional questionnaire was made, which included 51 people with a swimming profile. At the end of the questionnaire, it was possible to complete the heuristic and move on to the next phase.

Then, the second stage began, which consisted of the redesign. This step used input from the last stage. For example, the absence of a mechanism that met the shortcut heuristic was thus added to the redesign a button for the user to be able to reorder that most important information, in order to read it before any other information, thus being a shortcut to its use.

With the redesign in hand, it was then possible to proceed to the third phase, which aims to evaluate comparatively the two interfaces, the original and the redesigned. That phase was carried out in two phases: a communicability assessment and a form containing objective and subjective questions. The objective questions were based on the SUS system to measure usability.

The results showed a great improvement in usability, with more than 20 points of SUS scale. In addition, it was noted that the heuristics minimize user memory loads, shortcuts and speak the users' language were the ones that most brought benefits to the interface. However, when applying user memory loads, an error was noticed by the redesign, which resulted in an inverse effect.

As future work, it is intended to implement and apply the same methodology in the version of the Fitness app for smartwatch, and thus seek heuristics that best serve the platform.

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