

Usability Evaluation of a Private Social Network on Mental Health for Relatives

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Abstract Usability is one of the most prominent criteria that must be fulfilled by a software product. This study aims to evaluate the usability of SocialNet, a private social network for monitoring the daily progress of patients by their relatives, using a mixed usability approach: heuristic evaluation conducted by experts and user testing. A double heuristic evaluation with one expert evaluator identified the issues related to consistency, design, and privacy. User testing was conducted on 20 users and one evaluator using observation techniques and questionnaires. The main usability problems were found to be related to the structure of SocialNet, and the users presented some difficulties in locating the buttons or links. The results show a high level of usability and satisfaction with the product. This evaluation provides data on the usability of SocialNet based on the difficulties experienced by the users and the expert. The results help in redesigning the tool to resolve the identified problems as part of an iterative process.

Keywords Usability testing · Heuristic evaluation · Social network · Information system · Patient care system · Web

Introduction

Usability is one of the most prominent criteria that must be fulfilled by a software product. Usability is defined as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” [1]. A valid perception of the usability of a system entails a deep appreciation of the system and its usage [2].

The use of new information and communication technologies (ICT) is widespread, with 46% of the world population being Internet users and 51% using mobile devices [3]. All these tools provide a wide range of possibilities in all areas of life. In particular, the medical field uses ICT tools not only to support the daily activities in hospitals and other health centers but also to improve treatments.

Psychiatric treatments differ greatly from other medical specialty treatments because most of them are conducted outside of the hospital environment, such as in day centers, supervised apartments, or community rehabilitation centers, to promote patients’ rehabilitation and social integration.

Each patient undergoing a psychiatric treatment has a unique personal situation because of the social context and the heterogeneity of mental illness. Most patients have people interested in their follow-up and wellbeing beyond hospitalization. The link between relatives and patients is positive for the prognosis of patients. For this reason, promoting the tools and methodologies for improving the communication between families or friends and users and professionals is necessary.

Recently, virtual communities in which patients, families, and health professionals share knowledge about a disease, a health problem, or a specific medical condition have emerged [4]. However, these tools do not provide an environment where people who are involved in the follow-up of the patient

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may share information securely with people close to the patient and his/her family.

SocialNet [5] is an online tool that provides a private social network for each patient, his/her family, and any person authorized by the patient. Caregivers or others involved in the treatment and follow-up of the patient can share information about activities, meetings, achievements, etc., in a private technological environment.

In any software product, usability plays a crucial role, and for users to have an effective and efficient interaction as well as a satisfactory experience is necessary. For this reason, evaluating the usability of SocialNet is indispensable. Several different usability evaluation methods are available. Usability evaluation methods are defined as the “procedures comprised a series of well-defined activities to collect data related to the interaction between the end user and a software product, in order to determine the specific properties of a software for contributing to the achievement of specific objectives” [6]. In general, these methods are used during all phases of the software development process to ensure a product design that is wearable and can meet high-quality standards. Several classifications of usability evaluation methods take into account the different techniques available [7]. Among these techniques, user testing and heuristic evaluation are perhaps two of the most popular ones. This study aims to evaluate the usability of SocialNet using a mixed usability approach. Two usability evaluation techniques, namely, heuristic evaluation and user testing, to provide results based on the difficulties experienced by both experts and users.

This paper is organized as follows: the first section provides a brief introduction to the topic. The second section outlines the research methodology and explains the materials and methods used to evaluate SocialNet, the evaluation procedures, and the participants involved. The third section presents the results. The fourth section gives the discussion, and the fifth section concludes the paper with its significant contributions.

Materials and methods

SocialNet

SocialNet is an online tool that provides a private social network composed of a set of private and safe areas, called walls, for each patient. The walls follow the same metaphor used in other social networks, such as Facebook or LinkedIn, but with a unique element: the patient is the center of the interaction [8]. That is, all posts are related to the patient; relatives and caregivers can publish on the wall information about the patient. Regarding the patient’s privacy, each wall is a single social network, and members do not know if are other walls or patients are present in SocialNet.

SocialNet has two user types: anonymous users, who only have access to the login page, and logged users, who can be patients, relatives, caregivers, caregiver managers, general caregivers, or administrator users. The roles follow a hierarchy in such a way that the passive user is the one that has limited access and the administrator user has all the access [5]. Patients and family members can have a passive or an active role to control their interaction on the wall. Passive users cannot post or comment, but they can read the posts or comments by others. Conversely, active users can share multimedia files and text on the wall and qualify or make comments on the posts.

Study design and data collection

The objective of this study is to evaluate the usability of SocialNet using an iterative mixed usability approach. Therefore, this study presents the initial assessment phase that involves the application of a usability inspection method according to experts: heuristic evaluation [9]. Usability inspections are commonly applied, especially in the early stages of the development of a system [10]. They have gained popularity and are often employed in studies of usability because of their simplicity and low cost [11].

The second phase is user testing, which involves observing users in conducting tasks on the website and noting the problems users encounter in using it. The quantitative and qualitative findings were obtained. Nielsen [12] recommended conducting usability testing together with heuristic evaluation as they complement one other.

Heuristic evaluation

Heuristic evaluation is an inspection method in which one or more usability experts examine each element of the user interface of a system and verify if the proposed design is in keeping with the recognized usability principles called “heuristics” [13]. The expert discovers system usability problems by identifying heuristic violations and assesses the severity of each violation. The evaluation produces a list of usability problems that have a negative effect on the ability of the user to interact with the system, so that these problems can be corrected as part of an iterative design process.

One expert made a double heuristic evaluation of SocialNet [14]. First, the expert used the SocialNet website as a new user without any previous experience. For each of the user profiles (general manager, caregiver manager, caregiver, and family member/authorized), the expert provided a brief description of the problems found and selected the heuristic applied for each problem in accordance with the heuristic rules proposed by Nielsen [15]: (1) visibility of system status; (2) consistency between system and the real world; (3) freedom and user control; (4) consistency and standards; (5) error prevention; (6)

Table 1 Test participants

Participants	Female	Male	Average age
Caregivers Managers	3	2	33.4
Caregivers	4	1	24.8
Family	4	1	36.6
Patient	4	1	40.2
Total	15	5	33.75

better recognition for memorization; (7) flexibility and efficiency of use; (8) aesthetic and minimalist design; (9) helping users to recognize, diagnose, and recover from errors; and (10) assistance and documentation. One heuristic, (11) privacy, was added. This heuristic was proposed by Pierotti [16] and is considered necessary to be adopted because SocialNet is a private social network system that helps users to protect the personal information of the user and his/her family. Moreover, the expert scored the severity of each problem according to three levels: *low level*, which indicates minor usability problems with low priority in fixing them; *medium level*, which indicates usability problems with a certain priority; and *high level*, which indicates serious usability problems that should be solved with high priority.

The results from the first heuristic evaluation provided relevant information on developing a new version of the social network to resolve the identified problems.

Once a new version of the functional prototype was released, the same expert performed a second heuristic evaluation following the same procedure as in the first. Although the same evaluator was used, the experience of this evaluator with

SocialNet was different because the evaluator had gained knowledge about the tool during the first heuristic evaluation.

User testing

User testing is considered one of the best techniques for acquiring insights into usability problems [17]. User testing refers to the evaluation of a product or service by testing it with representative users. It involves observing users of the site in carrying out tasks and noting the problems the test users encounter in using it, that is, the areas where they are successful and where they have difficulty.

During the test, the participants attempted to complete typical tasks, which covered the main functionality of the system and simulated the expected usage patterns.

The goal was to identify any usability problems, collect data such as the time taken to complete the tasks, and determine whether the participants completed the tasks correctly as well as the usability of and satisfaction with the system.

The experiment was conducted in a usability laboratory in a quiet environment. The tools used for the evaluation in this study included a 22-in. all-in-one computer. Twenty individuals (15 females and 5 males) with an average age of 33.75 years participated in the test (Table 1). Among them, five were caregiver managers, five were caregivers, five were family members/authorized, and five were patients, and they were all recruited from the INTRAS Foundation environment. All participants had some experience with computer and Internet use. Before starting the test, they signed an informed consent, which guaranteed the confidentiality of the information collected during the test.

Fig. 1 Number and severity level of the problems found in IHE

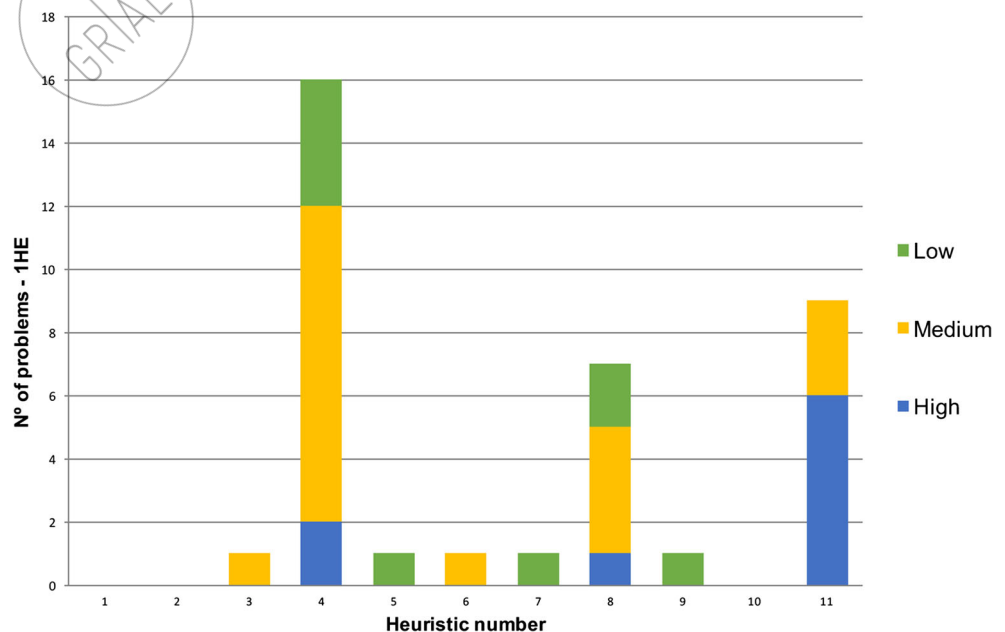
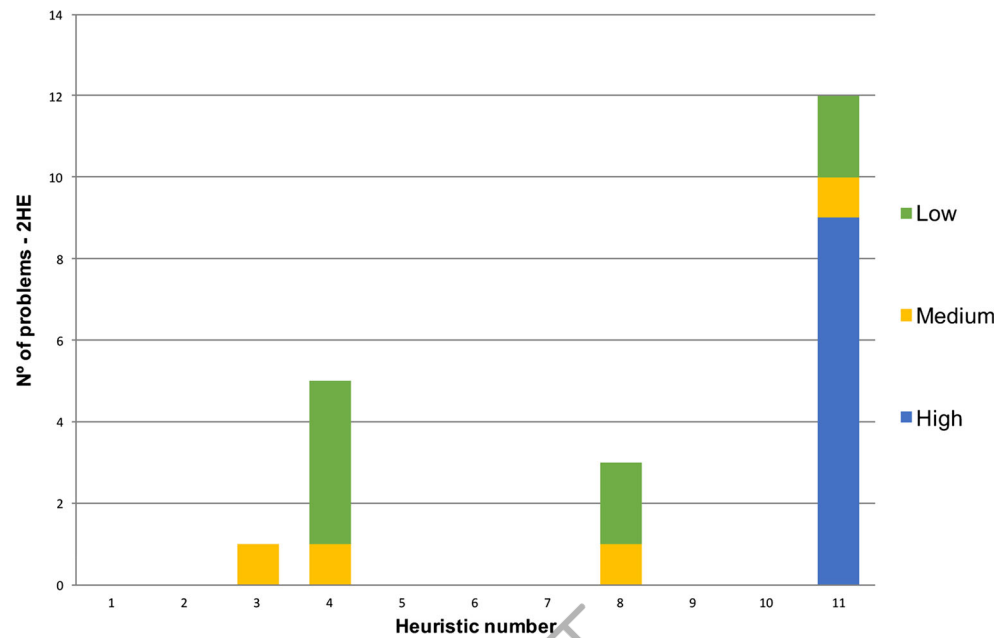


Fig. 2 Number and severity level of the problems found in 2HE



The procedure was introduced, sociodemographic data were collected, and the tasks that would be performed on the SocialNet website were explained. User testing was administered in such a way that only one user at a time could perform the experiment. The tasks were as follows:

- Access SocialNet (username and password).
- Access the anonymous wall (only CM and C).
- Open the form to post content.
- Fill in the form fields (title, date, tags, and content).
- Insert a photo (add and load).
- Save form information.
- Close session.

The evaluation was conducted with 20 users and one evaluator. The evaluator went through the tasks with the users, and observations were noted down during the process.

Post-questionnaire

After the user testing, each participant answered an ad hoc usability questionnaire. This questionnaire assessed the opinion of the user about SocialNet using seven Likert scales (usability, usefulness, controllability, confidence, appearance, intent of use, and feelings) rated from 0 to 4.

Data analysis

The expert's notes from each heuristic evaluation and user testing were computed and transferred to an Excel sheet. The data obtained from the heuristic evaluation were categorized into problem, heuristics violated, severity, location, and recommendation. The usability issues during user testing; evaluator observations; time taken to complete the task; whether the participants completed the tasks

Table 2 Average time and success rating of the tasks

Task	Average time (seconds)	Successful users	Partially successful users	Failed users	Success rating
Access SocialNet (username and password)	34.93	20	0	0	100%
Access the anonymous wall	3.72	10*	0	0	100%
Open the form to post an activity	15.17	20	0	0	100%
Fill in the form fields (name, date, tags, and content)	73.64	14	5	1	82.5%
Insert a photo (add and load)	59.09	13	4	3	75%
Save form information	5.72	20	0	0	100%
Close the session	9.92	20	0	0	100%

*This task is for caregiver managers and caregivers only

Table 3 Average time to complete all tasks and success rating by user profile

User profile	Average time of all tasks	Success rating
Caregiver Manager	143.41 s	98.5%
Caregiver	152.49 s	97.1%
Familiar/Authorized	177.31 s	91.6%
Patient	322.37 s	85%
Total Average	198.90 s	93.05%

correctly, partially, or not; average time and success rate (using Nielsen’s formula for measuring the success rate) [18]; and the usability and satisfaction with the system were collected and categorized.

Results

Heuristic evaluation results

Figure 1 shows the distribution of usability problems found for each heuristic in the first heuristic evaluation (1HE). The heuristic numbers presenting the highest number usability problems are (4) (*consistency and standards*) with 16 problems, (8) (*aesthetic design and minimalist*) with 7 problems, and (11) (*privacy*) with 9 problems. The other heuristics are not relevant because they only have one or no problem detected.

Overall, the severity level of the found problems in the 1HE is medium-high (Fig. 1), and most of the problems (28 of 37) are rated at these levels. The most serious usability problems are related to the heuristic number (11) (*privacy*).

The user profiles of general manager and caregiver manager have the greatest number of problems detected. One exception is the *privacy* heuristic, in which the user profile of the

caregiver has the most number of detected problems. These data are considered in the redesign of SocialNet.

The second heuristic evaluation (2HE) was conducted after resolving the problems detected previously in 1HE. Figure 2 presents the distribution of usability problems found for each heuristic in 2HE. In this case, only 4 of the 11 heuristics have problems: heuristic number (3) (*freedom and control of user*) with 1 problem, (4) (*consistency and standards*) with 5 problems, (8) (*aesthetic design and minimalist*) with 3 problems, and number (11) (*privacy*) with 12 problems.

Regarding the severity level of the problems found in 2HE, most of the heuristics have medium-low level problems, except heuristic number (11) (*privacy*), in which most problems present a high level of severity. The results are illustrated in Fig. 2.

In terms of the different user profiles, the profiles with the most detected problems are general manager and caregiver manager. Same with 1HE, one exception is heuristic 11 because, in this case, the user profile with the most identified problems is caregiver manager.

User testing results

Although most of the tasks were completed successfully (Table 2), some of them were found to be difficult to do. The most difficult tasks observed by the evaluator are fill in the form fields and insert a photo, with success rates of 82.5% and 75%, respectively.

The users found the following difficult: understanding the “name” field, poor visibility of the “add files” link of the picture section, and locating the “add users” button

The time taken to perform all the tasks is similar in all user profiles except for patients who took twice as long as the other profiles. Nevertheless, the success rate of the tasks by the patients is high at 85% (Table 3)

Table 4 Post-questionnaire results (percentage of response and number of users)

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
The system I just used was easy	60% (12)	35% (7)	5% (1)	0	0
The system I just used was useful	45% (9)	45% (9)	10% (2)	0	0
I generally knew what to do at all times	50% (10)	30% (6)	15% (3)	5% (1)	0
I felt confident in using this system	55% (11)	45% (9)	0	0	0
The color and general appearance of the system seemed visually attractive	30% (6)	45% (9)	15% (3)	10% (2)	0
I would like to use this system frequently	25% (5)	40% (8)	30% (6)	5% (1)	0
	Very good	Good	Normal	Bad	Very bad
While using the system I felt	30% (6)	55%(11)	15% (3)	0	0
Overall usability and satisfaction categorized into positive, neutral, and negative	84.28%		12.85%	2.85%	

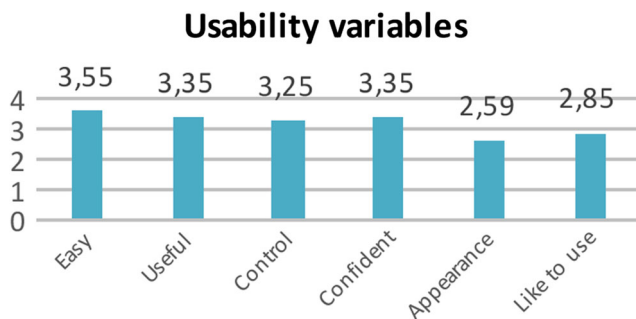


Fig. 3 Average of the usability variables

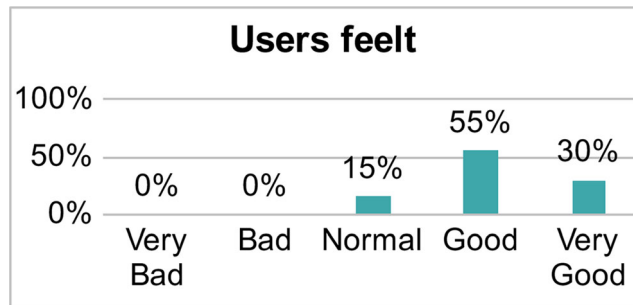


Fig. 4 Percentage of user's feelings in using SocialNet

Post-questionnaire results

In our experiment, 20 subjects used the system and completed an ad hoc post-questionnaire to assess the usability of and satisfaction with SocialNet. As shown in Table 4, most users rate usability of and satisfaction with SocialNet positively (84.4%), 12.8% of users are neutral with respect to SocialNet, and 2.8% of users give the lowest rating.

Generally, the users' opinions are very good, as all usability variables are scored on the positive side of the scale with an average of 2.59–3.55 (Fig. 3).

In addition, the users feel normal to very good. According to the results, most users have a good experience with SocialNet (Fig. 4) despite some difficulties in carrying out the tasks, especially the patients.

Discussion

In terms of the double heuristic evaluation, the analysis of the data after 1HE indicates that homogenizing the labels, eliminating the presence of irrelevant information, and improving the aspect of privacy are necessary. The severity level of the problems encountered is medium-high, which stresses that the most serious problems are in the privacy heuristic. As this heuristic is an important aspect, the problems related to it are immediately corrected. In terms of application profiles, the profiles with the most problems are those with many tasks

assigned as caregiver manager or general manager, who have more access and have to carry out more complex tasks, and therefore the interface is complex. When access is limited, the interface becomes simple. The results of the data analysis in 2HE show a substantial reduction of errors in 1HE (Fig. 1). Errors are found only in 4 of the 11 heuristics, although in one of them (privacy) increases. In terms of the severity level of the problems in the second evaluation, most of the heuristics have medium-low level problems, except privacy, in which most of the problems are at a high critical level. In relation to user profiles, the same as in the first evaluation, the profiles with the most problems are those with many tasks entrusted as general manager or caregiver manager.

Once the previous problems were corrected, user testing was conducted. The time taken to perform all the tasks is similar in all user profiles except for patients who took twice as long as the other profiles, which is expected given that they are psychiatric patients. The main problems are related to the structure of SocialNet, for example, the difficulty in locating the buttons or links. Most of the users positively rated all variables. Satisfaction is one of the main features of user experience. In the case of SocialNet, the participants showed a high level of satisfaction.

Conclusions

We described a usability evaluation involving heuristic evaluation and user testing. The results of both techniques provided valuable data on the usability of SocialNet. The double heuristic evaluation identified the issues related to consistency, design, and privacy. These issues were redesigned and included in the tool as part of the iterative development process.

Heuristic evaluation was complemented with user testing, and this technique determined that the real problems of users were mainly related to the structure of SocialNet. The results indicated that using SocialNet is difficult for users with the patient profile. Despite the users encountering some difficulties and usability problems when performing the tasks, the results showed that SocialNet is highly usable. This conclusion was supported by the fact that the problems encountered in the heuristic evaluation were significantly reduced. Moreover, the performance of the users in the test showed a high percentage of success in the tasks and a high satisfaction with SocialNet.

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