Design of Therapeutic Information Systems as Indicating Through Signs

Vânia Paula de Almeida Neris[(⊠)] and Kamila R.H. Rodrigues

Federal University of São Carlos (UFSCar), São Carlos, SP, Brazil
{vania,kamila_rodrigues}@dc.ufscar.br

Abstract. Therapeutic information systems are tools to support healthcare professionals to treat their patients, aiding on their rehabilitation, helping them to understand their condition and the treatment procedures, or even motivating themselves to persist on ongoing treatments. Although the importance of digital therapeutic systems, the design of this type of system is still a challenge. Inspired by the Organizational Semiotics, Baranauskas and Bonacin proposed a framework to conduct work in interactive systems design. In the proposed approach, these authors argue in favor of designing as a social process which focuses on problem setting as well as on problem solving. This paper brings reflections of an instantiation of this framework in the context of therapeutic systems and presents the results of an application in a real scenario with patients affected in their mental health.

Keywords: Therapeutic information systems · Semiotics · Organizational semiotics · Human-computer interaction

1 Introduction

Digital therapeutic information systems are tools to support healthcare professionals to treat their patients. These applications may help patients in different ways, such as aiding on their rehabilitation, helping them to understand their condition and the treatment procedures, or even motivating themselves to persist on ongoing treatments. Healthcare professionals may use therapeutic applications to help the patients express their feelings, relax, or improve their own abilities and personal relationships [1].

Although the importance of digital therapeutic systems, their design is still a challenge. The proposal of a design solution cannot be done without considering the individuals in treatment, their physiological and physical conditions, their relationships with family and society and the medical and health care protocols. Semantic, pragmatic and social issues should also be considered. The nature of therapeutic systems demands a sociotechnical approach to its design and development.

We share with those that understand design as an activity to solve problems in a scenario that is socially and dynamically constructed [2–4]. Therapeutic systems, in particular, are generally in an evolutionary scenario with patients with specificities, health care professionals with different backgrounds, medium and long term treatments. Moreover, according to Cheung [1], the involvement of different stakeholders – such as family – results in more effective treatments, often with better results.

Inspired by the Organizational Semiotics (OS) and by a sociotechnical view, Baranauskas and Bonacin [4] propose a framework to conduct work in interactive systems design. In the proposed approach by these authors, designing is a social process which focuses on problem setting as well as on problem solving. It involves a dialogue not only with design materials, but primarily among individuals (designers, developers, users and other stakeholders) in which different views of designing and different ways of framing design situations are contrasted. Several artifacts (informal, formal and technical) are used as communication and mediation tools with the participants during this process of designing the interactive system.

This paper brings reflections of an instantiation of this framework in the context of therapeutic systems and presents the results of an application in a real scenario with patients affected in their mental health.

This paper is organized as follows: Sect. 2 comments about the socio-technical view to the interactive systems design. Section 3 describes an academic extension project that has allowed the conduction of studies using Organizational Semiotics and Therapeutic Systems in the mental health context. Section 4 describes a design as indicating through signs to Therapeutic Systems. Section 5 presents conclusions and future works.

2   Theoretical References

Baranauskas and Bonacin [4] take Semiotics beyond the study of how we use signs for communication to include the shared knowledge and mutual commitment derived from communication in designing. These authors understand that design is about being engaged directly in a specific design situation. This "situatedness" locates the design process in a nested structure in which the informal, the formal and the technical layers of information and interaction co-exist [4].

Figure 1 is based on the "Organizational Onion" from OS and illustrates the Baranauskas and Bonacin [4] proposal. According to the authors, a problem setting is part of the design situation understanding and requires articulation in forms that can be appropriated and assessed by people involved in designing. The design process involves exploring the reality that constitutes the design situation. Ontology is an important aspect of what the involved group understands as constituting reality. The ontology charting allows a discussion on meaning and on what the group considers to be important aspects of reality in that particular design situation. System prototyping refer to the group's idea on how to shape their intervention in the situation, based on their ontology and problem articulation.
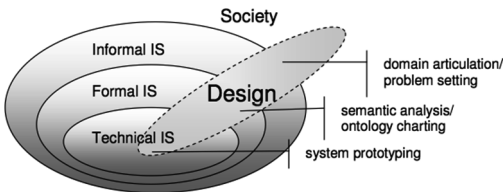

Fig. 1. The structure of design as indicating through signs from different layers [4]

Prototyping overcomes some of the problems of requirement specification oriented methods, which usually assume that system design can be based solely on observation and detached reflection [4]. Moreover, there is very little account of how prototypes are related to the current and future work practices of users. It is equally important that the people involved share a representation model of the work domain to be supported by the prospective system. Meaning-making is constructed as a result of cooperation between designers, developers, interested parts and prospective users of the technology being designed [4].

The design work in these three layers is established in parallel and co-evolves; a problem understanding is revealed as the group works on the semantics and solution ideas. Therefore, design is conceived as a social process of expressing meaning, communicating intentions and constructing knowledge, to be carried iteratively and interactively by designers and a group of stakeholders in a participatory style [4, 5].

3 A Design Challenge in the Context of the Mental Health

The Spiritist Hospital of Marilia (in Portuguese *Hospital Espírita de Marília* - HEM) is a philanthropic hospital whose primary objective is to offer tranquility and welfare for its patients for 66 years. A multidisciplinary therapeutic team – with psychiatrists, psychologists, social workers, nurses, and occupational therapists – work together to treat the patients [6, 7].

In 2013, the HEM's board invited us, computing researchers, to develop a computational solution that could assist therapeutic treatments conducted at the hospital. Since then, we have conducted collaboratively studies with the health professionals of the HEM. The teams have been meeting at least three times a year to discuss, evaluate and validate the artifacts generated during the project.

Two therapeutic games were defined collaboratively between stakeholders and are in development for the HEM: one to be used to support the treatment of patients with depression and the other to support the treatment of teenagers chemical dependency.

Considering the framework proposed by Baranauskas and Bonacin [4], we have been studying its adoption and instantiation to the design scenario described here. Next section presents our current view.

4 Design as Indicating Through Signs to Therapeutic Systems

The framework proposed by Baranauskas and Bonacin [4] serves to interactive systems in general and we acknowledge with their ideas. Our proposal here is based on our experience in the specific scenario of therapeutic systems and aims to instantiate their proposal to support further therapeutic systems design processes.

Since we have been working in this scenario, we have identified three main aspects as essential for these systems:

(1) Therapeutic systems are complementary tools to support the therapists' work. They may contribute to the treatment, many times supporting only one aspect of the felling better process. Therefore, they should have a well-established

therapeutic objective to be defined by the health care professionals and clarified between the entire design and development group.

(2) Depending on the condition and procedures, it might be difficult to generalize personal characteristics of each patient. Therefore, therapeutic systems should be highly flexible. This is important both to healthcare professionals and to patients. On the one hand, the professionals might want – or need – to customize the system to the treatment goals. Such changes might include modifying the user interface, adding new interaction mechanisms or new functionalities. On the other hand, patients' interaction needs may vary; thus, a single non-modifiable interaction scheme may not suit everyone [6].

(3) One intrinsic characteristic of computer based systems is that they are good on repeating actions and storing data. This can be useful to therapists to recognize even small changes in the patient's behavior. Therefore, logging meaningful patients' actions and report them to therapists may support analysis and decisions in treatments.

Reflecting on these aspects and considering the opportunity we had to work in a very multidisciplinary team, with health care professionals from different background, we propose the instantiation illustrated on Fig. 2.

The informal layer relies, among others, on the customs, values and intentions of each individual. In the therapeutic system scenario, the particularities of each patient should come from a holist view, i.e., considering information from himself, but also from the family and close people, health care professionals, as well as academic and demographical studies. Therefore, the Participatory Design [5] goes further users and designers and may consider a larger spectrum of stakeholders, including professionals from different knowledge areas.

Aiming to know these stakeholders and use their information to support the domain articulation and problem setting, adopting a holistic view but focusing on the individuals, we have proposed a Personas Enrichment Process [6].

Cooper [8] defines Personas as concrete and realistic representations – based on real or fictitious details – to create faithful representations of users of a system. Personas allow designers to document, organize and represent the diversity of possible users of a system [9]. Designers might include demographic, economic, and behavioral data onto a Persona to map relevant data into a detailed representation of users [10]. They may describe physical and mental characteristics of users, their histories, and daily and professional activities.

In the therapeutic systems design scenario, data may encompass, among others, the patient's clinical profile, therapeutic techniques and procedures for the treatment, and
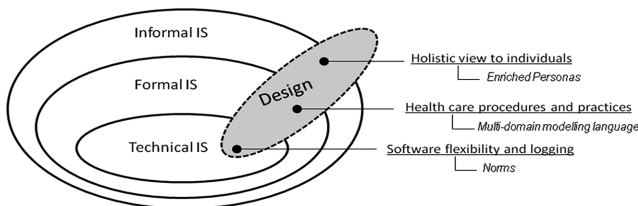

Fig. 2. Design as indicating through signs to therapeutic systems

the expected effects that the application will have on the user. The process uses the Stakeholder Analysis Chart [11, 12] (step 1) and the Evaluation Frame [13] (which one should not confuse with the Valuation Frame) (step 2 with other artifacts), to provide a sociotechnical vision regarding the design problem. Moreover, the process also supports the identification of the therapeutic objectives for the system.

In the HEM context, the stakeholders involved worked collaboratively with representatives of every group of professionals in the hospital to perform steps 1, 2 and 4 of the Personas Enrichment Process. The computer science members of the design team performed the step 3 – the creation of the Personas to represent the focus group for the application. Six different Personas were created. Each persona symbolizes information such as the clinical profiles of the patients, and relations of patients with the stakeholders and technology. Therefore, at this point, the existing Personas are able to aid the design team on making conscious choices regarding the design. The Organizational Semiotics' artifacts explored also provide further information, and allow the team to anticipate problems and work to address them.

In the formal layer, it is important to identify the health procedures and protocols which also underline the therapeutic objectives. Considering the therapeutic scenario, the aim in this layer relies on replace meanings and intentions in the treatment to actions by the actors involved. This leads to interaction scenarios in which the desired action will happen. The scenarios come from a collaborative work with stakeholders having in mind the Personas created. The collaborative work asks for an instrument to formalize the interaction scenarios that could be understood by people from different knowledge domains.

We, therefore, proposed a modeling language (still without a name) with symbols that represent an interaction scenario. It is important that the scenario be not confused with screens or user interfaces. In a further moment in the design, a scenario or sub-scenario may have multiple screens to represent it. For instance, in the proposed language there are stamps indicating flexible aspects, as a number of options that may vary from patient to patient according to the therapist choices. It is also possible to indicate that the patient actions need to be recorded for further analysis by the therapist or explicitly indicates a therapeutic objective, as in this case the memory recovery.

Finally, in technical level system flexibility and data logging aspects need to be addressed. Flexible features can be implemented considering cognitive and physical aspects of the patients that are important to be respected during the interaction.

In the HEM context, we considered patients with vision problems (due to low vision or advanced age) that could have interface elements such as images and texts in an increased size. Moreover, depressed patients tend to have difficulty with choices. Thus, we chose to let the health professionals select the amount of options to choose from, according to the need of each patient. Moreover, the therapist also has the option to print a report with selected information from each patient.

5   Conclusion and Future Works

This paper presented an instantiation of the framework proposed by Baranauskas and Bonacin [4] to the domain of therapeutic information systems. Some particularities of therapeutic systems were considered and reflected in a continuous design process.

Some artifacts, understood as mediator tools, were presented to illustrate the emerged knowledge in this specific domain.

The information systems created are now being used and monitored. We hope they will serve as a complementary tool for healthcare professionals of a HEM. As future work, we plan to apply the framework proposed here in other therapeutic scenarios.

References

1. Cheung, M.: Therapeutic Games and Guided Imagery: Tools for Mental Health and School Professionals Working With Children, Adolescents and Their Families. Lyceum Books, Chicago (2006)
2. Fischer, G., Lindstaedt, S., Ostwald, J., Stolze, M., Sumner, T., Zimmermann, B.: From domain modeling to collaborative domain construction. In: ACM Proceedings of DIS, pp. 75–85 (1995)
3. Kyng, M.: Designing for cooperation: cooperating in design. Commun. ACM **34**(12), 65–73 (1991)
4. Baranauskas, M.C.C., Bonacin, R.: Design–indicating through signs. Des. Issues **24**(3), 30–45 (2008)
5. Schuler, D., Namioka, A.: Participatory Design: Perspectives on Systems Design. L. Erlbaum Associates, Hillsdale (1993)
6. Rodrigues, K.R.H., Garcia, F.E., Bocanegra, L.F., Goncalves, V.P., Carvalho, V.G., Neris, V.P.A.: Personas-driven design for mental health therapeutic applications. J. 3D Interact. Syst. **6**, 18–34 (2015)
7. Rodrigues, K.R.H., Bocanegra, L.F., Gonçalves, V.P., Carvalho, V.G., Neris, V.P.A.: Enriquecimento de personas para apoio ao design de aplicações terapêuticas para a saúde mental. In: Proceedings of the 13th Brazilian Symposium on Human Factors in Computing Systems, pp. 51–60. Sociedade Brasileira de Computação, Brazil (2014)
8. Cooper, A.: The Inmates are Running the Asylum: Why High Tech Products Drive Us Crazy and How to Restore the Sanity, 2nd edn. Pearson Higher Education, New York (2004)
9. Aquino Jr., P.T., Filgueiras, L.V.L.: User modeling with personas. In: Proceedings of American Conference on Human-Computer Interaction, pp. 277–282. ACM, New York (2005)
10. Masiero, A.A., Leite, M.G., Filgueiras, L.V.L., Aquino Jr., P.T.: Multidirectional knowledge extraction process for creating behavioral personas. In: Proceedings of The 10th Brazilian Symposium on Human Factors in Computing Systems, pp. 91–99. Brazil Computer Society (2011)
11. Kolkman, M.: Problem articulation methodology. Ph.D. thesis, University of Twente (1993)
12. Melo-Solarte, D.S., Baranauskas, M.C.: Resolução de problemas e colaboração a distância: modelo, artefatos e sistema. Revista Brasileira de Informática na Educação **17**(2), 21–35 (2009)
13. Baranauskas, M.C.C., Schimiguel, J., Simoni, C., Medeiros, C.B.: Guiding the process of requirements elicitation with a semiotic-based approach – a case study. In: Proceedings of the 11th International Conference on Human-Computer Interaction 3, Las Vegas, USA, pp. 100–111. (2005)