Applied Ergonomics 50 (2015) 31–40

Contents lists available at ScienceDirect

Applied Ergonomics

journal homepage: www.elsevier.com/locate/apergo

Designers' and users' roles in participatory design: What is actually co-designed by participants?

Flore Barcellini [a, 1], Lorène Prost [b, 1, *], Marianne Cerf [b]

[a] Ergonomics Team, CNAM, CRTD, 41 rue Gay-Lussac, 75005 Paris, France
[b] INRA, UMR 1326 LISIS, F 77420 Marne-La-Vallée, France

ARTICLE INFO

Article history:
Received 7 August 2014
Accepted 17 February 2015
Available online 11 March 2015

Keywords:
Participatory design
Sustainable agriculture
Roles

ABSTRACT

This research deals with an analysis of forms of participation in a participatory design (PD) process of a software that assesses the sustainability of agricultural cropping systems. We explore the actual forms of participation of designers and users by adapting an Actual Role Analysis in Design approach (Barcellini et al., 2013) to capture the levels of abstraction (conceptual, functional and operational) of participants' discussions. We show that: (1) the process does not only concern the design of the artifact itself, but also the design of the concept of sustainability; (2) all participants (users & designers) have a role in co-designing the concept (in our case, sustainability); (3) some roles and profiles are key to this co-design. We discuss our contributions to both the research and the practices of participatory design. These contributions deal with the production of a method and related knowledge about actual activities in participatory design situations. They may support the development of relevant training programs regarding participatory situations, or be reflexive activities that can help those who are involved in designing and leading in participatory situations, to make improvements.

1. Introduction

Our research is focused on a participatory design process involving agricultural scientists of the French National Institute for Agricultural Research (INRA) who were designing software to support the assessment of cropping system sustainability. Developing sustainable agriculture is currently a strong challenge in the agricultural world since the productive model of agriculture has been linked to a depletion of natural resources (energy, soil, biodiversity) with severe degradation of the environment (water and air mainly) (Millennium Ecosystem Assessment, 2005). The tool these scientists designed – MASC©, for Multi Attribute Sustainability Cropping systems – was a decision tree that broke the sustainability assessment decisional problem down into simpler units (environmental safety, economic viability, and social equity, usually acknowledged as the three pillars of sustainability). It thus generated elementary criteria to rate the sustainable potential of cropping systems (Sadok et al., 2009). The designers' aim was to make the concept of sustainability more tangible and easier to challenge by those involved in the assessment of current or new cropping systems. These targeted users were mostly scientists working on innovative cropping systems and advisors who accompanied farmers in examining their practices. Individual farmers were not directly targeted as use of the tool required large amounts of data which were not available on the scale of a farm. The designers' group therefore set up a participatory design process for MASC and asked us afterwards to assist them in understanding and transforming this participatory design situation. In this sense, our approach was to characterize the actual forms of participation in design meetings.

To do so, we grounded our work in research in ergonomics, investigating collaborative[2] design – or co-design – activities occurring in design meetings and participatory design situations (e.g. Darses et al., 2001; Détienne, 2006; Visser, 2006, 2009). Here, design is viewed as a socio-cognitive activity, which is analyzed through verbal interactions between participants in meetings.

* Corresponding author. INRA, UMR 1326 LISIS, Bâtiment EGER, BP 01, F-78850 Thiverval-Grignon, France. Tel.: +33 1 30 81 53 56; fax: +33 1 30 81 59 39.
E-mail addresses: flore.barcellini@cnam.fr (F. Barcellini), lorene.prost@grignon.inra.fr (L. Prost), cerf@agroparistech.fr (M. Cerf).
[1] Joint first authors.

[2] Collaboration is coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of the design problem (Roschelle and Teasley, 1995).

http://dx.doi.org/10.1016/j.apergo.2015.02.005
0003-6870/

These interactions are seen as the traces of the participants' activities in these meetings. This approach reveals how the negotiation of various perspectives involved in collaborative design processes (Bucciarelli, 1998; Détienne et al., 2005; Baker, 2009) contributes to building design solutions (their generation, exploration, comparison, and selection). Analyzing the exchanges that result from the confrontation of perspectives is particularly relevant in *participatory* forms of design. In line with participatory ergonomics proposals (Haines et al., 2002; Rocha et al., 2015), ergonomists focusing on design activities have often emphasized the need to involve the potential users of the artifact under design (whether it be software or work organization) in the design processes. While there are rich discussions in the ergonomics literature about the objectives and methods of participation in design processes (see for instance Broberg et al., 2011), fewer studies have focused on the content of the interactions in participatory design meetings (e.g. Darses et al., 2001; Béguin, 2003; Engeström and Toivainen, 2011). This parallels some current challenges of Participatory Design research (Greenbaum and Loi, 2012). Participatory Design has been defined as "*a strong commitment to understanding practice, guided by the recognition that designing the technologies people use in their everyday activities shapes, in crucial ways, how those activities might be done*" (Robertson and Simonsen, 2012). In this trend, the users occupy a very specific and demanding place in the design process, as co-designers, which goes beyond the way they are usually considered in design meetings (Nelson et al., 2013). But what exactly do they contribute to design? What content is shared among users and designers in such processes? The *epistemic* content of the design interactions is thus the subject of interest. This paper follows this line of investigation of participatory design meetings. Our objective is to investigate the actual content of participatory design meetings and to establish whether the participants discuss the operational dimensions of the tool under design or its conceptual dimensions. In other words, do all the participants (and which participants?) design the MASC tool/and/or the concept of sustainability which is implemented in this tool? We assume that this understanding is of particular interest to researchers, teachers and practitioners in ergonomics involved in the development of accurate participatory design processes. This objective requires us to develop interactionist and developmental methodologies, using a fine-grained qualitative approach. One of them is the "Actual Role Analysis in Design" (ARAD) approach proposed by Barcellini et al. (2013) to study participation in Open Source Software (OSS) design (see Section 2.1). We have adapted the ARAD approach to capture the *roles* of participants regarding the actual content of their discussions, and to identify key-participants fostering participatory design processes by performing specific combinations of roles (called *profiles*). In the following sections we first set out the theoretical approach that we built by adapting the ARAD approach. We then describe and explain how our data were collected and processed, before presenting and discussing our results. We finally discuss the contribution of our research to the development of methodologies for studying actual participation in participatory design.

2. Theoretical approach

2.1. Adapting the ARAD approach to identify forms of design participation

The ARAD approach proposed by Baker et al. (2009), Détienne et al. (2012b) and Barcellini et al. (2013) has been designed to capture actual collaborative design activities, i.e. that are not predefined but are effectively performed by participants, and that emerge from actual interactions between participants. It identifies roles that correspond to distinctive and regular individual behaviors emerging in the interaction. Four types of role are considered to embrace different facets of participation (Table 1). They are characterized on the basis of the structure of the interactions during design meetings (interactive role), as well as according to the orientation of the interactions amongst the participants engaged in discussions (group-oriented or task-oriented), and by quoting the direct actions undertaken to modify the artifact (production role).

Applying this approach to the specific concern of this paper requires us to adapt the characterization of the four roles proposed by Barcellini et al. (2013). These roles were defined to study participation among participants interacting "online" (e.g. through mailing-lists) – and not in a "face-to-face" context. We therefore had to adapt the characterization of interactive and group-oriented roles to a "face-to-face" context. Moreover, the original task model was focused on the way design solutions were collaboratively developed, whereas in this paper we wanted to ascertain whether the participants discussed operational or conceptual dimensions of MASC. We therefore based our task-oriented role analysis on the themes addressed by participants, rather than on their contribution to collaborative design activities (e.g. proposition or evaluation of design solutions) as in Barcellini et al. (2013) (in bold in Table 1). To do so, we categorized interactions according to the "levels of abstraction" characterizing the participants' input (Pols, 2012; Rasmussen, 1986; Visser, 2006). The notion of "level of abstraction" models the evolving representations of artifacts during the phases of the design process, from more abstract representations to more physical-concrete ones, and helps in considering how the participants progress throughout levels of abstraction (Visser, 2006). We choose to refer to a specific abstraction hierarchy adapted to our case study. Thus, MASC©, which is dedicated to the assessment of the sustainability of cropping systems, can be considered as a management instrument, i.e., an "*apparatus*

Table 1
The four types of role.

	Interacting role	Group-oriented role	Task-oriented role	Production role
Goal	Embracing the level of participation of a participant & his/her position in the related communication network of design discussions	Characterizing participation to coordinate the group: – coordination of activities (e.g. allocation of tasks) – regulation of interactions	Embracing participation in the considered task	Characterizing direct actions on the considered artifact
Descriptors	Number of contributions or turns in discussions	Position in interactions: opening a turn, closing a turn	Depends upon the design situation under scrutiny: - In Barcellini et al. (2013), the task model used was that of collaborative design activities (generation, clarification, evaluation of solutions) - **In our study: Themes grouped into levels of abstraction and number of turns of each participant for this level (see Table 4)**	Number of modifications of the source code of the software