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Original article

The shared online whiteboard: An assistance tool to synchronous collaborative design



Le tableau blanc partagé : un support à la conception collaborative synchrone

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ABSTRACT

Introduction. – The work presented in this paper comes from an industrial need for the development of new support tools for remote collaborative design. Within this framework, we present a literature review on this concept and propose the development of an online collaborative whiteboard.

Objective. – This study aims to determine whether or not shared whiteboards can be used for remote design task collaboration, in conjunction with online chat interactions. It additionally seeks to discover if the organization of relationships and interactions within groups alter the structure of task completion.

Method. – This tool was evaluated through the remote design task of a data structure diagram with data collected from 42 computer science students. This approach was carried out through students in triads, separated into different rooms who communicated via online chat and/or whiteboard. There were two variables in this experimental design, the presence or absence of a project leader and the sequencing of exchanges (each member asked permission to use the tool). This experiment aimed to determine whether the task requested could be performed and if similarities to a natural situation could be observed. Data was collected from actions performed on the whiteboard and chat interactions. The observations were conducted using a verbal interactions observation grid that was taken from a natural synchronous collaborative design situation. It included different dimensions such as cognitive synchronization, the proposal and evaluation of solutions and non-task oriented interactions.

Results. – The results show that the tool allows students to collaborate. A variety of behaviors can be observed in terms of whiteboard usage and chat interactions that depend on the experimental conditions. This study shows that the tool may be used in a natural situation and that group consciousness and coordination are very important factors in this type of task. It is clear that the nature of the chat interaction depends on the role of the subject within the group. We also observed a high level of non-task oriented communication, which was more than we expected.

Conclusion. – The shared online whiteboard designed in this study allows for the completion of a collaborative design task with different groups structures.

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R É S U M É

Introduction. – Le travail présenté dans ce texte émane d'un besoin industriel pour l'élaboration de nouveaux outils d'aide à la conception collaborative à distance. Dans ce cadre, nous présentons un état de l'art sur cette question et proposons le développement d'un tableau blanc partagé.

Objectif. – L'étude conduite vise à déterminer si le tableau blanc partagé peut s'utiliser pour une tâche de conception collaborative à distance, en lien avec des interactions sur un chat et si l'organisation de la relation et des interactions dans les groupes modifient la structure de la réalisation de la tâche.

Mots clés :

Travail collaboratif

Conception distribuée

Tableau blanc partagé

Interactions chat

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Méthode. – Cet outil est évalué à travers une tâche de conception collaborative à distance d'un schéma conceptuel de données auprès de 42 étudiants en informatique. Les étudiants réalisent ce schéma en trinômes dans des salles différentes et communiquent par chat et/ou le tableau blanc. Les groupes sont formés selon deux modalités, l'une relative au mode d'action (séquentiel ou simultané entre les membres du groupe), l'autre relative à la présence ou non d'un chef de projet dans le groupe. La vérification de la conduite d'une telle tâche est réalisée grâce à au recueil d'une typologie d'interactions verbales observées en situation naturelle dans des travaux antérieurs.

Résultats. – Les données analysées concernent les actions réalisées sur le tableau blanc ainsi que les interactions par chat. Les résultats montrent que le dispositif permet aux étudiants de collaborer. On note également des relations entre actions sur le tableau blanc et les interactions par chat mais ces relations sont différentes en fonction de l'organisation de la relation. En revanche, l'efficacité de résolution de la tâche n'est pas différente en fonction des modalités.

Conclusion. – Le tableau blanc partagé conçu permet la réalisation d'une tâche de conception collaborative avec différentes organisations du groupe.

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1. Introduction

Current design contexts require the presence of different professional fields to work together collectively. There is a new openness for various professions to become involved in the design process (Lonchamp, 2003), which becomes collaborative when the task necessitates this cooperation. Jacobs, Sokol, and Ohlsson (2002) define collaboration as an activity carried out by several people to achieve shared goals. On the other hand, Blessing (1994) defines collaborative design as a complex activity involving actors, artifacts, tools, organization and a context. Additionally, it is an activity that integrates social, technical and organizational aspects, involving actors, tools, and instruments to perform predefined tasks (Darses, 2002). In the context of industrial companies, collaborative design is seen through a variety of situations throughout the product life cycle: the development, design, manufacturing, assembly, testing, quality, purchasing, and the relationships with customers and suppliers (Wang, Shen, Xie, Neelamkavil, Pardasani, & 2002). Collaboration is a complex activity and is associated with a number of problems that are defined through external limitations set by the client and internal limitations set by the designers with their speciality or the company's technical strategy (Hartley, 1992). Design collaboration is a collective activity with aiming to resolve open-ended issues. It is distributed and can be characterized by social order dimensions, as well as technique and organizational dimensions. Given its scientific and technical nature, it requires knowledge, models, methods and tools. The human dimension of design involves the integration of cognitive and social processes, including questions on knowledge and skills, as well as individual and collective roles. As a scientific and technical activity, it requires knowledge, models, methods and tools. To promote collaborative design, computer technology must not only increase skills in its specialists, but also improve collaboration abilities with regards to employees' interaction with one another through computer resources.

The complexity of collaborative design is increased when the actors are separated and work remotely. In this study, we focus on the tools that could support the phases of co-design (Darses, 2009), that is to say when actors design at the same time, working to find a solution to a problem which is acceptable to all parties concerned. Our focus lies more specifically on the shared whiteboard as a support tool for interactions that are necessary to achieve a goal.

First, we present a literature review on the concept of remote collaborative synchronous design as well as the proposal for a support tool for this type of activity: the shared whiteboard. Secondly, we present an empirical study conducted with a sample group

of students to observe the use of the shared whiteboard that we designed through observations in a natural situation.

2. Remote collaborative synchronous design

2.1. Design

Depending on the context or the disciplinary field, literature offers many definitions of design. For example, Simon (1996) has defined design as a series of human actions that consist of creating artifacts to achieve a goal. Cross, Chrisyiaans, and Dorst (1996) have presented design as an exclusively human activity to create artifacts in order to satisfy a particular need. For Darses (2004), design activities are characterized by the task that must be completed and the problem constructed is explored by designers. In an industrial context, Pahl, Beitz, Feldhusen, Wallace, and Bles-Sing (1996) have defined design as a situation in which the designer uses his/her scientific knowledge and experience to provide solutions to a problem in order to produce artifacts. A particularity of design is that in the majority of cases, it is poorly defined and structured, which makes the solution complex (Cross et al., 1996; Pahl et al., 1996). Darses (2004) has identified a number of characteristics of design tasks and associates them with problem solution activities: the problems tend to be vast and complex, with an incomplete set of information and unstable constraints. The resolution of this situation calls for the involvement of numerous fields of expertise. The solution to a design problem is not unique, but is actually part of a group of acceptable solutions. Generating all solutions to a problem is often impossible. These incomplete evaluations leave policy-makers in a position of uncertainty.

2.2. Collaborative design

These difficulties are increased when the collaborative dimension is added to this design process. Designers must confront new obstacles linked (Larsson, 2007) to the spacial dimension (virtual teams often work with different tools, in separate locations), the cognitive dimension (the project is carried out by numerous actors; each designer uses his/her own experience in the design of a product) and the instrumental dimension (graphic resources that aid in the execution of the activity are diverse and varied).

An additional effort is therefore necessary to create consistency so that each person understands the activity of the other. Also, given that distributed team members have often different deadlines and requirements, it is very important for each person to have a good understanding of where they are in the project (Jang, Steainfield, & Pfaff, 2000) and that they create a collective consciousness of

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