How to Determine the Effectiveness and Efficiency of Coordination and Awareness Support Systems

Christoph Oemig, Tom Gross

Human-Computer Interaction Group, University of Bamberg, Germany

Abstract

Coordination and awareness have been research issues for many years. Effortless coordination and effective awareness support have been goals ever since. Yet, measuring the effectiveness and efficiency of these support systems has remained a complex issue leaving researches with the dilemma that achieving either goal requires some kind of measurement. In this paper we introduce our approach that has the goal to determine whether a certain coordination or awareness support system actually improves a user group's coordination. We demonstrate how a simple interactive task helps to achieve this goal.

1 Introduction

Coordination, awareness and their support as part of cooperative environments have been research issues in Computer-Supported Cooperative Work (CSCW) for more than two decades. Starting from the early days, many prototypes, e.g., media spaces, group editors (Dourish & Bellotti, 1992) or virtual environments (Benford & Fahlen, 1993), have been created and many studies thereof have been conducted. In general, the evaluation of CSCW systems and especially measuring the effectiveness of awareness and coordination support is said to be complex task (Grudin, 1988). This has remained an unresolved issue until today that contributes to the current dilemma since at least some kind of measurement is required to prove a solution's effectiveness and efficiency. None of the above-mentioned approaches provided figures illustrating to what extent their solution actually improved awareness or coordination in their respective situation. Evaluations of prototypes largely happened by using post task questionnaires or interviews (attitudinal), observation (behavioral) and in some cases statistical log file analysis (behavioral). Afterwards researchers usually knew that people liked or approved the prototype, however, they lacked true evidence for improved coordination. In this paper we briefly introduce our approach and tool demonstrating how

Platzhalter für DOI und ggf. Copyright Text. (Bitte nicht entfernen).

Name, Vorname (2017): Titel. Mensch und Computer 2017 – Tagungsband. Gesellschaft für Informatik. / Workshopband. Gesellschaft für Informatik. / Usability Professionals. German UPA. DOI: xxxxxx

researchers can benefit from a simple interactive task to learn whether their idea actually improved awareness and coordination or not.

2 Concept

Our concept's **goal** is straight forward: we want to know if a certain awareness or coordination support system actually improves a user group's awareness and coordination. For instance, if a typing indicator or permanent video link decreases coordination errors or if a tickertape helps a user to make quicker decisions on how to procede with shared work. We especially seek to see how little changes to such system or indicator affect awareness and coordination when such a support system is developed interatively. Finally, we want to be able to tell good approaches from bad ones, i.e., we seek to compare different approaches of awareness and coordination support for the same situation.

We came up with the following **idea** to reach this goal: as a first step we decided to focus on only one of the three coordination types (Malone & Crowston, 1990): simultaneity, i.e., the situation where multiple people are engaged in a common task at the same time. For this coordination type we create a simple interactive task and interrupt this task using freeze probes to query the participants especially targeting the knowledge needed for coordination and awareness (we also refer to it as secondary task knowledge). The questions asked follow the basic **assumptions** that *if I am aware of something then I can answer questions about it quickly and without error*. For the case of coordination, we assumed that *if I know my options, I can make quick and correct decisions*. For operationalization purposes, we emphasize the fact that coordination and awareness are two different concepts. While awareness always aims to facilitate coordination by providing relevant information from the past, coordination is basically about decision-making. More precisely, it is a decision among future options.

The **target audience** for this approach are researchers, software-, and user interface designers aiming to develop awareness or coordination support systems, cues or indicators by itself or as part of a cooperative application. The major **benefits** are the instant evaluations of coordination and awareness support since the necessary data is directly gathered with the freeze probes to be evaluated immediately. It allows drilling down into more details, e.g., distinct evaluations for self- and group awareness to learn more about why coordination errors occurred. Participants are not asked whether they liked a certain indicator, but the approach measures the effect this indicator has on their secondary task knowledge.

Yet, the approach also comes with some **restrictions**: currently, we only support the coordination type simultaneity. Other types like the access to shared resources or alternating flows of work with prerequisites are currently not part of the picture. We also currently offer only one interactive task, to be introduced in more detail in the next section.

3 Interaction

The approach’s initial **interactive task** uses the joint counting of letters. Participants have to count letters in a team effort and coordinate their activities accordingly. Launching the tool participants are scheduled for the next run. A **run** is a set of participants that use the same type and version of a coordination or awareness support system. They are shown a wait screen. The wait screen switches to the task screen (cf. Figure 1) when the administrator starts the run. The task screen contains in its current version the aforementioned counting task. It is accompanied by awareness and/or coordination support displays, depending on the system being evaluated. The counting task works in two steps: participants enter their counting intentions at the top of the task screen whereas counting results are entered at the lower portion of the screen (i.e., the data needed to generate the questions).

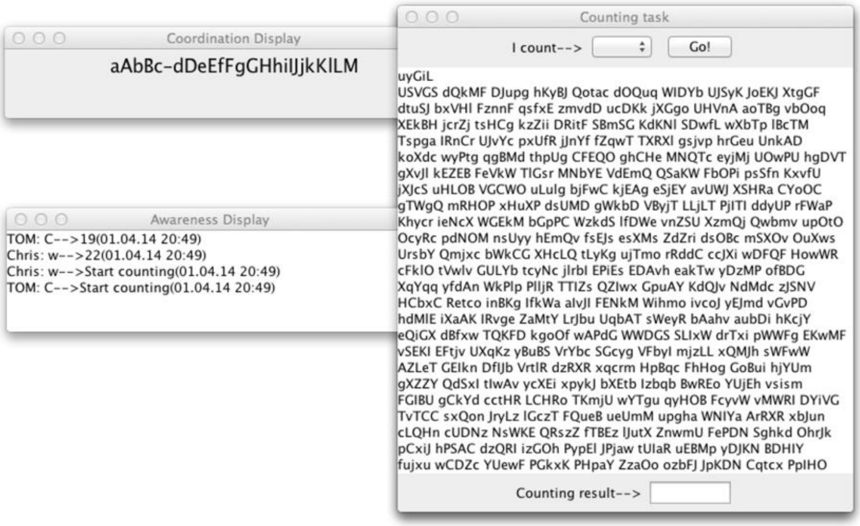

Figure 1: The task screen with the counting task in addition to coordination and awareness displays.

Freeze probes interrupt the counting task. In this case, the task screen switches to the freeze probe screen, which presents the questions along with possible answers as multiple-choice items. There are distinct questions about what letters were and by whom they were counted (awareness) and which letters may be counted next and by whom (coordination). The questions are generated automatically from the gathered counting data on an individual basis, i.e., per participant. The actual counting results do not matter (since they belong to the primary task). Instead the system measures response times and whether the answers to the questions were correct. Finishing the freeze probe the system switches back to the counting task. Once the run’s time elapsed the application releases all participants showing the Thank-you screen. Now the administrator is ready to analyze the data.

4 Analysis

Once the run is over, administrators may launch an instant evaluation of the gathered data. In the admin screen they simply switch to the evaluation tab and push the button “Evaluation”. The results are shown inside the approach’s own visualization, the 4I diagram. It uses response times (in relation to the forgetting time) and the ratio of correctly answered probe questions to determine the x- and y-coordinates. The quadrants of the resulting diagram are named after the characteristics of the assessed secondary task support: ineffective (slow and large degree of wrong answers), inefficient (slow and large degree of correct answers), illusive (fast and large degree of wrong answers), and ideal (fast and large degree of correct answers). The number of coordination errors (i.e., the number of letters which were counted more than once) is determined as well as the performance. Another option for evaluation and visualization is the export as CSV data to be processed in standard spreadsheet tools.

Acknowledgments

We like to thank all people participating in the original setup of our approach, and all reviewers for their valuable comments and suggestions on earlier versions of this work.

References

Benford, S., & Fahlen, L. (1993). *A Spatial Model of Interaction in Large Virtual Environments*. (G. de Michelis, C. Simone, & K. Schmidt, Eds.)*Proceedings of the third conference on European Conference on Computer-Supported Cooperative Work*. Dordrecht: Springer Netherlands. http://doi.org/10.1007/978-94-011-2094-4

Dourish, P., & Bellotti, V. (1992). Awareness and coordination in shared workspaces. In *Proceedings of the 1992 ACM conference on Computer-supported cooperative work - CSCW ’92* (pp. 107–114). New York, New York, USA: ACM Press. http://doi.org/10.1145/143457.143468

Grudin, J. (1988). Why CSCW applications fail: problems in the design and evaluationof organizational interfaces. In *Proceedings of the 1988 ACM conference on Computer-supported cooperative work - CSCW ’88* (Vol. 4, pp. 85–93). New York, New York, USA: ACM Press. http://doi.org/10.1145/62266.62273

Malone, T. W., & Crowston, K. (1990). What is coordination theory and how can it help design cooperative work systems? In *Proceedings of the 1990 ACM conference on Computer-supported cooperative work - CSCW ’90* (pp. 357–370). New York, New York, USA: ACM Press. http://doi.org/10.1145/99332.99367