

# The 3C Collaboration Model

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## INTRODUCTION

Computational support for collaboration may be realized through the interplay between communication, coordination, and cooperation tools. Communication is related to the exchange of messages and information among people; coordination is related to the management of people, their activities and resources; and cooperation is the production taking place on a shared workspace. This model, which we call the 3C model, was originally proposed by Ellis, Gibbs, and Rein (1991), with some terminological differences. Cooperation, which Ellis et al. denominates “collaboration,” here characterizes the joint operation in a shared workspace.

The 3C model appears frequently in the literature as a means to classify collaborative systems, for example as done by Borghoff and Schlichter (2000). However, a few attempts have been made to use it in the context of groupware implementation. An example is the Clover design model, which defines three classes of functionalities, namely communication, coordination, and production (Laurillau & Nigay, 2002; Calvary, Coutaz, & Nigay, 1997). These three classes of services appear in each functional layer of the model and, during the system design phase, they “must be identified and their access harmoniously combined in the user interface.” The Clover model shares the same usefulness of the 3C model in terms of groupware functional specification, because both deal with the three classes of functionalities that a groupware application may support.

Given its complex interactive nature, groupware testing has not yet achieved its maturity. The 3C model may also help evaluators focus their attention on the communication, coordination, and cooperation aspects, guiding the detection of usability problems. A groupware evaluation approach based on a model similar to the 3C one is presented in Neale, Carroll, and Rosson (2004). Differently from the approaches found in the literature, we explore the 3C model as a means to analyze and represent a groupware application domain and also to serve as a basis for groupware development.

The relationship among the 3Cs of the model may be used as a guidance to analyze a groupware application domain. Groupware such as chat, for example, which is a communication tool, requires communication (exchange of messages), coordination (access policies), and cooperation (registration and sharing). Despite their separation for analytic purposes, communication, coordination and cooperation should not be seen in an isolated fashion; there is a constant interplay between them (Pimentel, Fuks, & Lucena, 2004).

For the sake of development, we propose the use of 3C-based components as a means of developing extendable groupware whose assembly is determined by collaboration needs. By conceiving the problem from the viewpoint of the 3C model and using a component structure designed for this model, changes in the collaboration dynamics are mapped onto the computational support. This way, the developer has a workbench with a component-based infrastructure designed specifically for groupware, based on a collaboration model.

## INSTANTIATING THE 3C MODEL

Below we present three different groupwork domains that illustrate that the iterative nature of collaboration may be represented as cycles connecting the 3Cs.

We start with the groupwork domain represented in Figure 1. According to this instantiation of the 3C model, while communicating, people negotiate and make decisions. While coordinating themselves, they deal with conflicts and organize their activities in a manner that prevents loss of communication and of cooperation efforts. Cooperation is the joint operation of members of the group in a shared space, seeking to execute tasks, and generate and manipulate cooperation objects. The need for renegotiating and for making decisions about unexpected situations that appear during cooperation may demand a new round of communication, which will require coordination to reorganize the tasks to be executed during cooperation.

Considering media spaces (Mackay, 1999), which are multimedia-enhanced spaces aimed at informal communication among people, the 3C model may be instantiated according to Figure 2a. The media space itself is the shared space. Since it is aimed at informal communication, its main goal is actually to create opportunities for informal meetings, which are coordinated by the standing social protocol, for example, by accessing the availability of remote colleagues. These meetings generate conversation, which may occur using the media provided by the system or any other available means, such as telephones.

Another example is the family calendar (Figure 2b). The main reason for the family calendar is to schedule family activities. Modern family members have a vari-

ety of conflicting interests that can render last evening defined schedules ineffective next morning. In order to restore proper family coordination, negotiation among family members is needed. “This process involves seeing what has already been scheduled... and negotiating errand, ride, and other responsibilities are needed” (Elliot & Carpendale, 2005, p.4). The reconciliation obtained after the negotiation round is placed on the shared calendar. But as life never stops, next morning the cycle may start all over again.

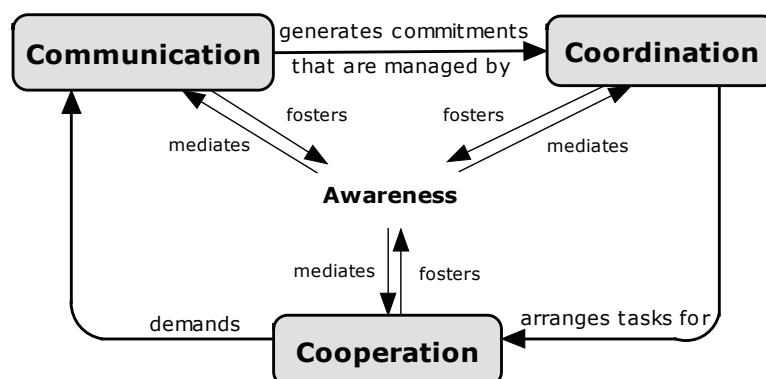
These cycles show the iterative nature of collaboration. The participants obtain feedback from their actions and feedthrough from the actions of their companions by means of awareness information related to the interaction among participants (Gerosa, Fuks, & Lucena, 2003). This information mediates each of the 3Cs, which are detailed in the next sessions.

## COMMUNICATION

The designer of a communication tool defines the communication elements that will set the communication channel between the interlocutors, taking into consideration the specific usage that is being planned for the tool (time, space, purpose, dynamics, and types of participants) and other factors such as privacy, development and execution restrictions, information overload, and so forth. Then, these elements are mapped onto software components that provide support to the specific needs.

The first communication element that must be considered is the choice of media. They can be textual, spoken, pictorial, or gestured—for example in a video

Figure 1. 3C collaboration model instantiated for group work



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