# Activity Awareness in Computer-Supported Collaborations

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In order to collaborate effectively one needs to know many things about one's collaborators: Who are they? What do they know? What do they expect? What do they want to do? What are they doing now? What tools are they using? To what other resources do they have access? What are they thinking about? What are they planning to do in the near future? What criteria will they use to evaluate joint outcomes?

In ordinary face-to-face communication, people work to establish and maintain a shared background of understanding called common ground (Clark, 1996). Conversational interaction involves continual testing for evidence of common ground, and coordinated effort to enhance common ground. For example, if an interlocutor fails to respond to a request, one might restate presupposed information, point to a relevant object, request acknowledgement, or otherwise remediate. Common ground is unproblematic in face-to-face interactions because such a wide variety of situational elements contribute to it, and the work that people do to maintain common ground is so well integrated into habits and conventions of interaction.

When people work collaboratively, but not face-to-face, many interaction resources are disrupted (Tang, 1991): field of view is reduced, the possibility to use gesture is limited, facial expressions are eliminated or constrained, auditory cues are diminished, tools and artifacts cannot be as easily shared, exchanged information is delayed or decoupled by seconds or even minutes, and collaborators may be in different time zones or different cultures. In remote collaboration it is difficult to convey or discern successful comprehension, current focus of attention, or concomitant attitudes and affect. It is difficult to repair or remediate miscommunications. This transforms the maintenance of common ground into a significant task, which is itself problematic: People are accustomed to taking common ground for granted, as a background task. They do not want to spend attention and effort on it.

These issues have made awareness an increasingly prominent issue in the design of user interfaces for computer-supported collaboration. Investigators have explored numerous user interface tools to help collaborators establish and maintain common ground by supporting their mutual awareness of one another. Prior research has focused on *social awareness* (of the presence of one's collaborators) and *action awareness* (of what collaborators are doing or what they have recently done). Tools investigated include video tunnels (for social awareness) and radar views (for action awareness).

To effectively coordinate complex projects, collaborators need to be aware of one another beyond mere presence and individual actions. We are developing the concept of *activity awareness* (Carroll et al., 2002). Activities are longer term endeavors directed at meaningful goals like "designing the layout of a town park". Longer term activity entails top-down goal decomposition, nonlinear development of partially-ordered plan fragments, interleaving of planning, acting, and evaluation, and opportunistic plan revision. It involves coordinating and carrying out different types of task components, such as assigning roles, making decisions, negotiating, prioritizing, and so forth. These components must be understood and pursued in the context of the overall purpose of a shared activity, the goals and requirements for completing it, and how individual tasks fit into the group's overall plan.

Contemporary user interfaces support collaborative awareness through explicit notifications—requests for chat, email alerts. However, explicit messaging is problematic for supporting activity awareness: Activities are multifaceted and continuing, not simple and ephemeral like presence and action. Thus, notification messages for activity awareness must be meticulous and persistent. But creating such notifications is itself a significant task. It compels a discipline of explicitly externalizing and broadcasting one's goals and plans, something people perceive as both tedious and invasive (Grudin, 1994).

Our work is pursuing the strategy of supporting activity awareness by designing workspace views that embed activity awareness documents. One example is a timeline view of a shared file system that incorporates deadline, active task, and version documents. In such an environment, collaborators would directly, but incidentally, understand the status of a shared activity as they participate in it.

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