

# Tabletop Coordination: The Effect of Interaction Techniques on Group Activities

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## ABSTRACT

The interaction techniques that are used in tabletop groupware systems can affect users' abilities to track others' actions and can have a corresponding impact on the way people are able to coordinate their activities. Very little is known about how the different characteristics of the interaction techniques affect coordination in groups, making it difficult for designers to make informed decisions about which interaction techniques to implement in their systems. In this video, we consider the relationship between tabletop interaction techniques and group coordination and conflict. We present an overview of the results from a study where ten groups of three participants used five different techniques in two distinct tabletop groupware activities. The results show that the choice of interaction technique does indeed affect the coordination process in surprising ways. This provides insight into how tabletop systems can better support group work and coordinated activity.

## Categories and Subject Descriptors

H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces—*computer-supported cooperative work; synchronous interaction; collaborative computing.*

## General Terms

Design, Experimentation, Human Factors.

## Keywords

Tabletop groupware, interaction techniques, computer supported cooperative work, coordination, interference.

## 1. INTRODUCTION

Tabletop groupware systems combine real-world work surfaces with computational interaction, allowing people to collaborate over digital artifacts while still maintaining a co-located face-to-face working style. Tabletop groupware is now becoming more common with the increasing availability of large-scale input and display technologies. Tables have been proposed for a variety of situations, including meetings, design work, games, and leisure activities. Real-world tables are already common sites for collaboration because they have several natural advantages for group work: people can communicate naturally over the table, can see one another work, and can use many of the same coordination mechanisms that they already use in the real world.

Tabletop groupware users must interact with computational artifacts using the interaction techniques that are provided by the application. These techniques can vary significantly from the way that people normally interact with objects on regular tables. For example, with mouse-based input, people do not physically reach for items—they control a pointer remotely, and manipulate objects using button clicks. Tabletop interaction techniques vary along several dimensions—some use virtual cursors [2,9], some use physical reaching [8,12,13,11], and others use physical pointing [5, 3].

The variety of interaction techniques that are used on tables suggests that there will also be differences in the character of consequential communication that occurs for each type of technique. Consequential communication, information communicated as the consequence of activity [10], plays an important role in the coordination of group activities [7]. Interaction techniques that minimize users' movement in the tabletop workspace, for example, could possibly lead to a lower level of consequential communication than is available in real world tabletop activities.

Little research has been carried out to investigate how the choice of interaction techniques for tabletop groupware systems affects the way groups are able to coordinate their activities. Recently, Ha et al. [4] considered tabletop input at the device level, and compared mouse and stylus based input to determine which led to more coordinated action. However, it is still unclear what role interaction techniques that are implemented as part of the application (e.g. radar views, pick and drop, tractor beam) play in the collaborative process, and whether some techniques are better suited to certain types of activities than others. This lack of knowledge makes it difficult for designers to make informed decisions when selecting interaction techniques for tabletop groupware.

On the surface, it may seem that techniques that closely mirror real world actions may be the most effective at facilitating coordination on tables, since it is easy for people to see and interpret others' actions. For example, techniques where people physically reach across the table to retrieve objects provide group members with significant information about each person's activities. However, we believe that there are several other tradeoffs that need to be considered further. For example, physical reaching techniques could potentially make it difficult for users to reach for distant items and could limit people's ability to work together in limited areas of the table, while techniques such as the Vacuum [1] could make reaching easier and less obtrusive. It is

also unclear whether people can use verbal and gestural communication to overcome differences in the techniques, making consequential communication differences negligible.

## 2. VIDEO OVERVIEW

In this video, we summarize the results of an exploratory study that investigated the role that interaction techniques play in group collaboration in tabletop groupware systems (for further details see [6]). We selected five techniques with different input and embodiment characteristics. We then implemented them as part of two tabletop groupware applications: a multiplayer cooperative game and an application that supports storyboard tasks.

To compare the techniques, we carried out an experiment where ten groups of three participants (for a total of 30 participants) used the game and storyboard applications (five groups per application). Each group used five interaction techniques: Pantograph, Telepointers, Radar, Drag-and-drop, and Laser Beam. Our findings show interesting and sometimes unexpected differences across techniques in conflicts, reaching patterns, transfer patterns, group performance and user preference.

The video begins by describing the five techniques, and then it briefly introduces the two applications that were used in the study. It concludes by discussing the results of the study. Results cover the impact that interaction technique choice had on: conflicts, transfer patterns, and reaching patterns. We also report participants' technique preferences.

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