Chapter XXI
Personal Assistants for
Human Organizations

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ABSTRACT
Intelligent software personal assistants are an active research area with the potential to revolutionize the way that human organizations operate, but there has been little research quantifying how they will impact organizational performance or how organizations will or should adapt in response. In this chapter we develop a computational model of the organization to evaluate the impact different proposed assistant abilities have on the behavior and performance of the organization. By varying the organizational structures under consideration, we can identify which abilities are most beneficial, as well as explore how organizations may adapt to best leverage the new technology. The results indicate that the most beneficial abilities for hierarchical organizations are those that improve load balancing through task allocation and failure recovery, while for horizontal organizations the most beneficial abilities are those that improve communication. The results also suggest that software personal assistant technology will facilitate more horizontal organizations.
INTRODUCTION

Intelligent software personal assistants (SPAs) are one of the most exciting applications for organizational multi-agent systems. A software personal assistant (SPA) is an agent that acts to support a user in a human organization by automating individual tasks and facilitating coordination with other members of the organization. Recent and current research has looked at developing SPAs for a diverse range of domains, including emergency response and military teams, office environments, factory floors, and even outer space. The envisioned SPAs possess a wide range of abilities, such as scheduling joint activities (Dent et al, 1992; Garrido & Sycara, 1996; Modi et al, 2004), sharing key information (Wagner et al, 2004), monitoring and reminding individuals of key timepoints (Chalupsky et al, 2001), filtering incoming communication (Maes, 1994), assisting in negotiation decision support (Li et al., 2006), and even ordering lunch (Chalupsky et al, 2001).

Software personal assistants stand to benefit from multi-agent organization research in two ways. First, as large-scale, complex multi-agent systems, SPA deployments are natural candidates for organization-centric engineering approaches to manage control and coordination complexity. As SPA-enabled organizations become more commonplace, the need for an organization-centric approach will only become more apparent, because SPA interactions between different organizations will require that these systems operate flexibly, robustly, and securely as open systems. Secondly, no matter what engineering approach is chosen for an SPA system, the SPAs will be situated in human organizations with specific organizational constraints, and thus the SPAs must be able to represent and reason about those constraints in order to operate successfully and transparently. The representation and reasoning of organizational structures and norms is currently one of the hottest areas of agent organization research (Grossi et al., 2007; Vasconcelos et al., 2007).

While significant technical challenges remain in developing SPAs, many of these issues are the subject of recent and current research and will not be discussed extensively in this chapter. Instead, we will focus on the crucial issue of how human organizations will be affected by the use of this technology, which has gone largely unexamined. This represents a significant gap in the current research, as it is likely that SPAs will have a revolutionary effect on the way human organizations operate, just as previous information technology innovations such as personal computers, corporate databases, and e-mail revolutionized the way organizations operate. In addition, the issue of which of the many envisioned SPA abilities are most useful for improving the efficiency and effectiveness of an organization is only poorly understood. This is a possibly costly oversight, as history is replete with examples of technological innovations, including early SPA systems, that have unexpected and even undesirable impacts when coupled with existing organizational practices and behaviors.

Our goals for this chapter are three-fold: first, to develop a conceptual framework that can be used to quantifiably evaluate proposed SPA technologies; second, to quantify the impacts proposed SPA abilities will have on existing organizations, in order to provide input to SPA designers on which abilities are most promising to pursue; and third, to explore how organizations may best be redesigned to leverage the SPA technology, in order to provide input to SPA adopters on how to best apply the technology. The approach taken in this chapter lies at the crossroads of agent organization modeling and computational organization theory. We develop a computational model of the organization. This methodology of computational modeling is similar to that used for quantifying performance in organizational theory (Carley 1994; Prietula & Carley, 1998). We evaluate the impact different proposed SPA abilities have on the behavior and performance of the organization. Because SPAs frequently affect detailed work
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