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An investigation of project complexity's influence on team communication using Monte Carlo simulation

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ABSTRACT

Research using empirical methods has established a curvilinear relationship between team communication and performance. We conduct virtual experiments to examine team communication and performance when teams work under varying types and levels of project complexity. Data samples, generated using Monte Carlo simulation, are based on the statistical characteristics of empirical data collected from 60 cross-functional project teams that communicated over multiple media (email, phone, and face-to-face) and were completing projects of varying complexity. Regression analysis indicates that project complexity influences the communication–performance relationship. Optimization shows that the communication frequencies at which teams maximize or minimize their performance are dependent upon media used.

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Introduction

Cross-functional teams are commonplace in today's work environment. Understanding how to facilitate effective team behaviors is critical for successful project and engineering management. Herein, we focus on team communication, as it plays a crucial role in a cross-functional project team's ability to complete its work. Indeed, communication among team members promotes team processes such as cooperation (e.g., Pinto and Pinto, 1990), coordination (Hauptman, 1990), information processing (e.g., Hinsz et al., 1997), and decision making (e.g., Poole and Hirokawa, 1996). As well,

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communication may enhance team member attitudes about their work relationships (Oh et al., 1991) and knowledge sharing (de Vries et al., 2006). Research indicates, however, that the link between team communication and performance may not be straightforward. Evidence suggests that too little communication may decrease performance over time (Katz and Allen, 1982) whereas too much may lead to information overload that hinders a team's task achievement (Fussell et al., 1998). These findings indicate that communication may have a more nuanced relationship with outcomes than at first perceived.

The relationship between team communication and performance, tested through empirical research, has been found to be curvilinear (Hoegl and Wagner, 2005; Leenders et al., 2003; Patrashkova-Volzdoska et al., 2003). Specifically, the performance of product development teams (Hoegl and Wagner, 2005) and creative teams (Leenders et al., 2003) is adversely impacted when team communication frequency is too low or too high. Patrashkova-Volzdoska et al. (2003) advanced this research stream by examining the communication–performance relationship across several media types. They found an inverted U-shape relationship between communication frequency and performance, but the amount of communication for email and face-to-face at optimal performance was different. Indeed, the amount of email associated with optimal performance was much lower than the amount of face-to-face communication. While these studies make an important contribution to our understanding of the relationship between team communication and performance, they do not take into account the conditions under which the communication transpires.

To further this line of inquiry, we incorporate the team's task into our analyses. The task is a logical extension as it is the impetus for all team activities, including communication. Moreover, the nature of the task may drive the communication requirements (Daft and Lengel, 1984, 1986) and the media used (Lewis, 1998). Herein, we operationalize the task by examining project complexity, including the approaches and endstates a team must consider as well as the conflict and ambiguity associated with decisions they must make (McComb et al., 2007). Complexity may intensify the role of team communication because of the increased need for coordination and decision making (Marks et al., 2001). Moreover, since media may be differentially effective in transmitting the information necessary to diffuse uncertainty and equivocality about the task (Daft and Lengel, 1986), the use of multiple media types may be influenced by a project's complexity.

Thus, the purpose of this study is to extend our understanding of the curvilinear team communication–performance relationship across various media by studying the way in which it is influenced by project complexity. To accomplish our purpose, we design a factorial experiment to reveal the effects of project complexity on the team communication–performance relationship. Instead of controlling for project complexity in regression analyses, we treat multiplicity and ambiguity as three-level factors (i.e., not controlled, high, and low) and investigate the communication–performance relationship by replicating Patrashkova-Volzdoska et al. (2003) model under eight combinations of these factors. Their dependent variables assessed team performance, namely goal achievement (the ability of the team to meet technical objectives of the project and business goals of the organization) and efficiency (the team's ability to achieve cost and schedule goals). The independent variables in their model include three communication media (i.e., email, phone, face-to-face and a squared term for each) and four control variables (i.e., task significance, team size, and co-location (requiring two dummy-coded variables)) for a total of 10 independent variables in each regression equation. To acquire the large sample necessary for our experiment we employ Monte Carlo simulation.

Our study achieves several scholarly, practical, and methodological contributions. First, we extend previous research by testing the curvilinear team communication–performance relationship in the presence of project complexity using regression analysis. Our investigation lends insight into the dynamics of this relationship when teams use various media to exchange information and face varying types and levels of project complexity. Second, we examine the differences in communication frequencies at optimal performance. Previous research suggests that optimal performance occurs at lower communication frequencies for email than for face-to-face interactions (e.g., Patrashkova-Volzdoska et al., 2003; Patrashkova and McComb, 2004). We investigate relative communication frequencies across email, phone, and face-to-face at optimal performance. Further, we examine the changes in communication frequencies across media under varying types and levels of project

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