February 2009

Team Collaboration in Virtual Worlds: The Role of Task Complexity

Fiona Fui-Hoon Nah
University of Nebraska-Lincoln College of Business Administration, fnah@unl.edu

Brian Mennecke
Iowa State University College of business, mennecke@iastate.edu

Shu Schiller
Wright State University, shu.schiller@wright.edu

Team Collaboration in Virtual Worlds: The Role of Task Complexity

Fiona Fui-Hoon Nah
University of Nebraska-Lincoln
College of Business Administration
Lincoln, NE 68588-0491
fnah@unl.edu

Brian Mennecke
Iowa State University
College of Business
Ames, IA 50011
mennecke@iastate.edu

Shu Schiller
Wright State University
Raj Soin College of Business
Dayton, OH 45435
shu.schiller@wright.edu

ABSTRACT

Virtual worlds are three-dimensional, computer-generated worlds where team collaboration is facilitated through the use of shared virtual space. In this research, we are interested in studying the effect of task complexity on team collaboration. We use a puzzle as the collaboration task and manipulate task complexity using the number of puzzle pieces. We hypothesize that task complexity will influence team cohesion as well as satisfaction with team process and outcome, increase the time taken to complete the task, and increase the relative unevenness in team members' contributions in terms of physical effort to accomplish the task due to the increased challenge of the task.

Keywords

Virtual worlds, avatars, task complexity, puzzle, team collaboration.

INTRODUCTION

Three-dimensional virtual worlds provide shared spaces that can be used by teams to engage in collaboration tasks. Businesses are realizing the significance of such shared spaces for visualizing product designs and developments as well as for simulations and training [5]. Collaboration is a key theme in organizational uses of virtual worlds [6]; however, an important question is to understand how the nature of the task influences attitudes and behaviors. In this research, we examine the attitudes of dyadic team members completing a puzzle task of varying task complexity in a shared virtual space. Our goal in this research is to understand the role of task complexity in team collaboration.

LITERATURE REVIEW

Task complexity is an important dimension of collaboration and team building [1, 4]. Braarud [1] found the task complexity index to be a better predictor of team performance than the NASA task load index [3]. Higgs et al. [4] found diversity in a team to be positively related to performance for complex tasks and negatively related for straightforward tasks, and hence, suggests that task complexity should be taken into account before assembling a team. Task complexity has been shown to be an important predictor of team processes and outcomes in a variety of team contexts in the literature.

There are many ways to classify team tasks. Steiner classifies team tasks into five main categories [8]: additive, conjunctive, disjunctive, divisible/complementary, and compensatory. McGrath classifies team tasks into a circumplex comprising four main task types [7]: 1) generate tasks (planning vs. creativity), 2) choice tasks (intellectual vs. decision making), 3) negotiation tasks (cognitive conflict vs. mixed motive), and 4) execution tasks (contests/battles vs. performances/psychomotor). Campbell classifies task types into simple, decision, judgment, problem, and fuzzy tasks [2]. Based on the combination of Campbell's, McGrath's and Steiner's classifications, the puzzle task used in this research is a simple, disjunctive execution task, focusing on the component complexity of the task [10].

HYPOTHESES

In this study, we vary the complexity of the task by increasing the number and combination of pieces for the same puzzle. According to the task/technology fit model proposed by Zigurs and Buckland [9], our puzzle task, which is classified as a simple task among the five categories proposed by Campbell, is a good fit with the 3-D features of most virtual world environments. A simple task requires high communication support, low process structuring support, and low information processing support [9]. Existing virtual world environments such as Second Life provide a high level of communication support via both text and audio, but no explicit group process structure or information processing support within the environment. Hence, the task/technology fit theory suggests that the virtual world environment provides the appropriate support necessary for accomplishing a simple task of the type we used in our research. Furthermore, because of the spatial nature of the virtual environment, a puzzle task, which requires manipulating virtual objects in a 3-D space, fits with the affordances offered by the virtual world.

Given that task complexity has been shown to influence team processes and outcomes, we hypothesize that:

H1: Task complexity will influence satisfaction with the team process.

H2: Task complexity will influence satisfaction with the team outcome.

H3: Task complexity will increase the time taken to complete the task.

H4: Task complexity will influence the cohesion in a team.

H5: Task complexity will widen the relative contributions of the members in completing the task.

METHODOLOGY

An experiment will be used to test the above hypotheses in the virtual world, Second Life. We will randomly assign subjects to different levels of task complexity based on the number of pieces given on the same puzzle image. We plan on using three levels of task complexity – low, medium, and high. The low complexity task consists of 6 (i.e., 2 x 3) pieces of a puzzle. The medium task consists of 12 (i.e., 3 x 4) pieces, and the high complexity task consists of 24 (i.e., 4 x 6) pieces of the puzzle.

We will randomly assign subjects to teams of two and further randomly assign each team to one of the experimental conditions. Training will be provided to familiarize the subjects with moving and lifting physical objects in Second Life after which the dyads begin fitting the puzzle given to them. The amount of time subjects take to complete the task will be tracked and a post-study questionnaire will be given to the subjects to assess the outcome variables.

CONCLUSION

This research is in progress. We have completed the pilot for the study and are in the process of collecting data for the full-scale study. The findings will be presented at the conference.

REFERENCES

1. Braarud, P. Ø. (2001) Subjective task complexity and subjective workload: Criterion validity for complex team tasks, *International Journal of Cognitive Ergonomics*, 5, 3, 261-273.
2. Campbell, D. J. (1988) Task complexity: A review and analysis, *Academy of Management Review*, 13, 1, 40-52.
3. Hart, S. G. and Staveland, L. (1988) Development of the NASA task load index (TLX): Results of empirical and theoretical research. In P.A. Hancock and N. Meshkati (Eds.), *Human Mental Workload*, North-Holland, Amsterdam, 139-183.
4. Higgs, M., Plewnia, U. and Ploch, J. (2005) Influence of team composition and task complexity on team performance, *Team Performance Management*, 11, 7/8, 227-250.
5. Ives, B. and Junglas, I. (2008) APC forum: Business implications of virtual worlds and serious gaming, *MIS Quarterly Executive*, 7, 3, 151-156.
6. Kock, N. (2008) E-collaboration and e-commerce in virtual worlds: The potential of Second Life and World of Warcraft, *International Journal of E-Collaboration*, 4, 3, 1-13.
7. McGrath, J. E. (1984) Groups: Interaction and Performance, Prentice Hall, Englewood Cliffs, New Jersey.
8. Steiner, I. D. (1972) Group Process and Productivity, Academic Press, New York.

9. Zigurs, I. and Buckland, B. K. (1998) A theory of task/technology fit and group support systems effectiveness, *MIS Quarterly*, 22, 3, 313-334.
10. Wood, R. E. (1986) Task Complexity: definition of the construct, *Organisational Behaviour and Human Decision Processes*, 37, 1, 60-82.