Modeling and Analyzing Cultural Influences
on Team Performance through Virtual Experiments

Tamaki Horii
Stanford University
tamaki_horii@stanford.edu

Yan Jin
University of Southern California
yjin@usc.edu

Raymond E. Levitt
Stanford University
ray.levitt@stanford.edu

Abstract

This research aims to model cultural differences between Japanese and American firms in International Joint Venture (IJV) project teams and to analyze the effects of these cultural differences on team performance through virtual experiments. The paper characterizes cultural differences in two dimensions: *practice differences* and *value differences.* Practice differences refer to each nation's typical "organization style," such as its level of centralization of authority, level of formalization of communication, and depth of organizational hierarchy. Value differences refer to the micro-level behavior of individuals in making work and coordination decisions. Each nation has distinctive patterns of organization style and micro-level behavior. To study cultural influences on project performance, the model considers task complexity vs. team organization style and behavior. Simulation results indicate that: 1) both Japanese and American teams show better performance when each works within its typical organization style; 2) the American organization style has less tolerance for high task complexity than the Japanese organization style; and 3) process quality risk is not significantly affected by Japanese vs. American organization styles. Additionally, culturally preferred behavior patterns appear to have less impact on project outcomes than culturally typical organization styles. The simulated results of the effects of cultural impacts are qualitatively consistent with both organization theory and observations.

Contact:
 Tamaki Horii
 Dept. of Civil and Environmental Engineering
 Stanford University,
Stanford, CA 94305-4020, USA
 Tel/Fax: (650) 497-7944
 E-mail: Tamaki_Horii@stanford.edu

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Tamaki Horii, Yan Jin, and Raymond E. Levitt

Globalization of the construction industry is proceeding rapidly in every part of the world. Global construction projects face unique challenges, such as coordination among sponsors, financiers, developers, designers and contractors from different countries, as they cope with the complexities of the local physical, political, economical, and cultural environments. According to one study, two out of every five international joint-venture (IJV) project teams struggle through their projects and end up with poor performance (Beamish & Delios, '97). The case studies we conducted revealed difficulties in managing cross-cultural teams composed of Japanese and American participants. Problems such as misunderstandings and miscommunications arose because of pre-existing differences in the participants' core values , norms and preferred organizational structures, and because two parties comprising a joint-venture team do not comprehend the logic behind the other partner's approach. A computational model such as the Virtual Design Team (VDT) model (Levitt et al, '94: Jin and Levitt '96) provides a useful quasi-laboratory to examine a series of "what if" analyses on team performance. This research aims to characterize and model cultural differences in joint venture teams, and to analyze cultural effects on team performance through virtual experiments by using the VDT model.

Specifically, the research focuses on two cultures, Japanese and American, and views cultural differences in two dimensions—*practice differences* and *value differences*—as proposed by Hofstede (91). As the first step, we characterize the typical "coordination mechanisms" of Japanese teams vs. American teams based on practice and value differences through observation. Second, we link cultural factors (practice and value differences) to parameters of the VDT model. The current VDT model was not intended to capture cultural factors, but the rich parameters at both organization and micro-behavior levels in the VDT model provide capabilities to model cultural phenomena. One of the key goals of this work is to extend the representation and reasoning of the current VDT model to capture cultural impacts emerging in global construction projects. The simulated results are qualitatively compared with Hofstede's proposition of "the preferred coordination mechanism[1]" (Hofstede, '91).

Cultural Differences in Value and Practice
This research begins by defining the characteristics of Japanese and American teams through ethnographic interviews[2], observations[2], and literature survey. Hofstede (Hofstede, '91) proposed that cultural factors have two aspects: practices and values. Practices are composed of symbols, heroes, and rituals. This research extends the meaning of "practices" to include cultural norms of adopting or practicing specific project management styles and organization structures. Similarly, this research extends the term "value differences" to refer to the preferences with which people make work-related and communication-related decisions in business situations.

In the proposed culture model, the *practice difference* at the project team level is characterized by three attributes: level of centralization of authority, level of formalization of communication, and depth of organizational hierarchy. Different cultures or countries have evolved different norms for each of these attributes. Based on the observations, Japanese project teams tend to have multiple levels of hierarchy and to be more centralized, while American firms usually adopt a flatter organization hierarchy and decentralized authority. These observed tendencies are consistent with existing literature, e.g., (Ouchi, 81: Sullivan and Nonaka, '86). Therefore, Japanese and American firms are prone to have their own typical organization styles (Figure 1).

The *Value difference* is related to national culture, as described by Hofstede ('91)[3] and others, e.g., (Trompenaar, '04[4]). Their work provides a useful set of dimensions against which value differences can be measured. At the project level, when participants make decisions or coordinate with each other, their behavior is based on their values. This is called "micro-level behavior" (Jin and Levitt, '96). Observed key elements of micro-

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[1] His proposition implies that members of a given cultural group will show better performance when working within their preferred organization structure.

[2] We conducted 4 case studies and 8 ethnographic interviews from April 2003 to August 2003. All 4 projects were joint venture projects between Japanese and U.S. firms located in the San Francisco Bay area .

[3] Hofstede proposed four dimensions to describe cultural differences among 53 countries including Japan and the United States: 1) Power distance, 2) Individualism vs. Collectivism, 3) Masculinity vs. Femininity, and 4) Uncertainty avoidance

[4] Trompenaar has proposed three additional cultural dimensions: 1) Universalism vs. Particularism; 2) Specificity vs. Diffuseness; and 3) Individualism vs. Communitarianism

level behavior include the decision-making and coordination behaviors. In the proposed model, *cultural values* at the project team level are defined by how project participants make work and coordination decisions. Japanese workers, for instance, tend to seek consensus before making decisions, while Americans prefer to decide independently. Both Japanese and American have their own distinctly different patterns of micro-level behavior (Figure 1).

Thus, each nation will have its own sets of organizational style and micro-level behavior, which comprise the typical coordination mechanisms of a Japanese team vs. an American team (Figure 1).

		Culture A (American)	Culture J (Japanese)
Practices	Centralization	Decentralized authority	Centralized authority
	Formalization	Medium level of formalization	High level of formalization
	Org. hierarchy	Flatter hierarchy	Multiple Hierarchy
Values	Decision Making	Individual decision making	Consensual decision making
	Communication	Individually-based	Group-based

Figure 1: Summary of Cultural Differences

Computational Simulation Model

This research uses the VDT[5] model as a virtual organizational laboratory to do a series of "what if" analyses that allow us to analyze the effects of organizational and group behavioral changes. By linking cultural factors observed through case studies, our research assumes four independent variables: *organization style* (cultural practice), *micro-level behavior of actors* (cultural value), *task complexity*, and *team experience* (Figure2).
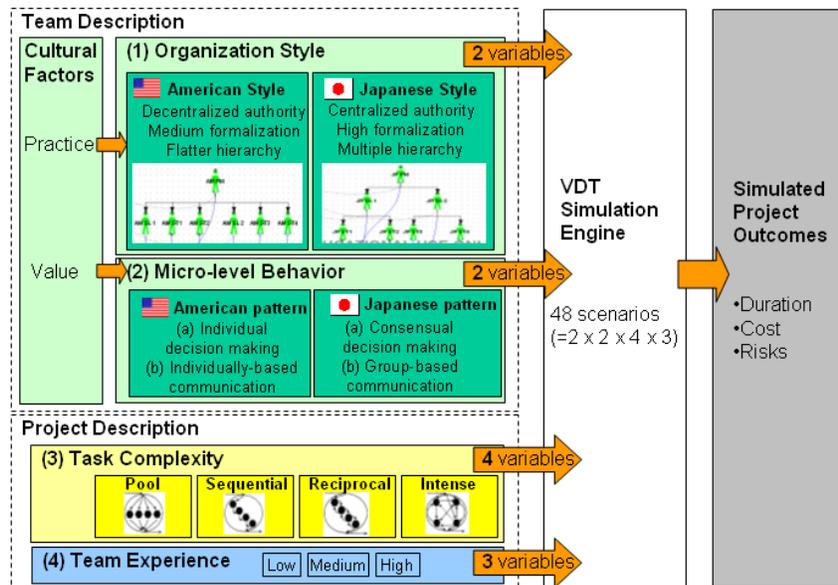

Figure 2: IJV Cultural Difference Framework

(1) *Organization style*, which is linked to *practice differences*, refers to the organizational settings to determine the level of authority and paths of exception handling. Since practices within an organization are the ways of organizing that enable the organization to conduct a project, practices are linked to an organization's structure. Specifically, we set three organizational parameters in the VDT model such as centralization level, formalization level, and depth of organizational hierarchy, based on the observations. A set of three organizational parameters represents each nation's typical organization style. For instance, the American organization style is set as low level of centralization (decentralization), medium level of formalization, and direct supervision links between

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5 We use SimVision®, educational version 3.11.1, which was developed by Vité Corporation and is licensed from ePM, LLC, Austin Texas. Please see the website for more information: < http://www.epm.cc/ >.

the project manager and subordinates. Thus, we set two types of typical organization styles: Japanese and American styles (Figure 2-(1)).

(2) *Micro-level behavior* of actors is related to *value differences*, and refers to actors' decisions on how to process information. Since values form the basis of how people behave and how they make decisions, cultural values are linked to micro-level behavior in the VDT model. We assume that American behavior pattern is the same as the original set of micro-behavior parameters in the VDT model, because the VDT model has been calibrated based on the American firms. Based on the observations and extant literature, we create the Japanese behavior pattern by manipulating two micro-behavior parameters related to decision-making and communication behaviors as the distinct value differences between the Japanese and American teams.   Thus, we set two types of micro-behavior patterns: Japanese and American patterns (Figure 2-(2)).

(3) In building a model that predicts project performance, we consider one aspect of contingency theory (Galbraith, '77; Thompson, '67): *task complexity*. We examine four different levels of task interdependencies: pooled, sequential, reciprocal, and intensive workflows (Thompson, '67; Bells & Kozlowski, '02). These dependencies represent a range of task complexity, from low to high, respectively (Figure 2-(3)).

(4) The level of *team experience* from low to high is also taken into consideration in order to see the effects of the team mutuality on their team performance (Figure 2-(4)).

Virtual Experiments Design

As shown in Figure 2, we simulated a total of 48 scenarios (= 2 organization styles x 2 micro-behavior patterns x 4 task complexity levels x 3 team situation levels). For experimental purposes, the actor and task configurations are identical[6]. The VDT model is designed to predict duration, cost, quality risks and project risks as measures of team performance. The cultural practice and values differences in the Japanese vs. American structures and micro-behaviors of the actors cause differences in "hidden work volume (Levitt & Kunz, '02)", and hence in schedule, cost and quality outcomes. Thus, we analyze three dependent variables, - 1) hidden work volume, 2) *product quality risks*[7], and 3) *project quality risks*[8] -, to analyze the impacts of changes in organization styles and micro-level behaviors on team performance.

Analysis of Effects on Team Performance

Based on the cultural model described above, an analysis of the cultural impact on relationships among organization style, team cultural behavior patterns, task complexity, and team experience was carried out:

(1)   The hidden work volume increases as level of task complexity increases. The American organization style has less tolerance for high task complexity with low team experience than does the Japanese organization style. The simulated results of micro level behavior patterns confirm Hofstede's proposition about "the preferred coordination mechanism." Specifically, organizational performance using the culture's preferred patterns for micro-level behavior is positively correlated to the use of each culture's typical organization style, in the cases of medium to high task complexity. In the case of pooled and sequential workflow, the differences between Japanese and American behavior patterns are relatively small. This implies that increasing task complexity amplifies the impact of cultural practice-behavior mismatches.

(2)   There is no significant difference between the Japanese and American organization styles and behavior patterns in terms of predicted *product quality risks*.

(3)   The Japanese organization style tends to have lower *project-quality risks* than that the American organization style.

(4)   Changes in behavior patterns have less impact on team performance than changes in organization styles.

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[6] Actor and task configurations include actors' skills, skills required by tasks, duration of tasks, hourly salary of actors, total number of team participants (all team is composed of 7 members including 1 project manager, 2 sub team leaders, and 4 sub team members), and tasks' responsibility position.

[7] *Product quality risk* index represents the likelihood that components produced by this project have defects based on rework and exception handling (Help function in the SimVision ®).

[8] *Project quality risk* index represents the likelihood that the components produced by this project will not be integrated at the end of the project, or that the integration will have defects based on rework and exception handling (Help function in the SimVision ®).

Discussion and Conclusion

The results of this study support the Hofstede's ('91) proposition that each culture has a "preferred coordination mechanism." Extrapolating from these findings of correlation between organization structure style and micro-level behavior, we have observed that each nation's typical organization structure style is built to match its culturally preferred micro-behavior in terms of efficiency. The impacts of mismatches in cultural practices *vs.* behavior are contingent on the characteristics and requirements of a given project. In summary, when organizations assemble joint venture teams composed of members from different cultures, a project manager should pay attention to four elements: team situation, task complexity, organization style, and micro-level behavior. Since *task complexity* and *team experience* are given at the start of a project, and *micro-level behavior* is fixed in the short term based on national culture, *organization style* is the only variable a project manager can control. Managers can find the organization style that provides the best match to their project's characteristics and their team's micro-behavior by virtual experimentation.

This research focused only on the impact of different patterns of micro-level behaviors and organization structures. Currently, there are intriguing and unexplored research opportunities in using the computational model to explore the impact of the learning curve on cross-cultural teams, the influence of multi-cultural team members from different cultural backgrounds, and the development of appropriate training programs. Understanding how efficient and effective cross-cultural teams can be created will, no doubt, remain an important area of research inquiry. This research represents an initial step in that direction.

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