A Behavioral Theory of the Merger

Dynamics of the integration process

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Abstract:

During the idiosyncratic process of post-merger integration, how do the pre-existing characteristics of the two merging organizations influence the behavioral dynamics of the combined entity? This thesis proposal describes an investigation into the dynamics during the complex and vulnerable integration process along three fundamental dimensions: (a) knowledge transfer, (b) culture transmission, and (c) organization performance. While each has been studied intensely in the broad realm of organization research, there remains a void of comprehensive research in the particular context of a merger. This thesis takes an attribute-based view of the *pre*-merger organizations to investigate the *post*-merger organizational dynamics. To explore the post-merger behavioral dynamics, I will examine organizational constructs such as: structural complexity; cultural complexity; team interdependence, infrastructure support; actor specialization orientation; cultural adaptation pressure; cultural fit tolerance, and organization performance.

The methodological approach to exploring these dynamics is to conduct virtual experiments using computer simulation. The controlled experiments are designed and grounded according to prior empirical research and theoretic literature on organization behavior. The computational model for the simulation is based on the Construct model of social behavior, which has an established history of use in the social and organizational research realm. The Construct model applies the agent-based paradigm, which equips the model for incorporating the representational structures and theoretic dynamics of the social theory collectively known as the Carnegie School, i.e., Dynamic Network Analysis and the Information-Processing theory of social exchange. Construct embodies concepts such as social exchange theory, transactive memory, organizational routines, acculturation, and group decision-making, among relevant other established principles. The various processes and outcomes of these experiments will be validated by subject-matter experts and involve an extensive comparison to prior scholarly works.

This study will make substantial contribution to the knowledge about post-merger integration dynamics. Beyond the fresh findings about post-merger integration dynamics, this thesis will be the first scholarly work to undertake the development of a comprehensive computational model of the organizational merger-integration process. Moreover, it will break new ground by providing the first detailed and comprehensively complete dataset of the merger integration. This work will enable future scholars to study integration dynamics at a resolution impossible in an empirical or human-laboratory study. Furthermore, the data produced in this proposal will allow for substantiated hypothesis development and extensive data analysis that, in the future, may provide additional insight and further support for previous, traditionally-based post-merger integration research.

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CHAPTER 1 - INTRODUCTION

Overview

To develop a behavioral theory of the merger, the overarching question this thesis will address is:

> *To what extent do the pre-merger characteristics of the merging organizations affect the organizational dynamics during the post-merger integration process.*

I will study the effects the pre-merger characteristics on three fundamental organizational dimensions: (a) knowledge transfer, (b) culture transmission, and (c) organization performance. The organizational dynamics are investigated from the point in time of the merger being formally consummated, through to the completion of the integration process. The characteristics of the original organizations that are controlled as explanatory variables include: organizational, team and cultural complexity, team interdependence, infrastructure support, actor specialization orientation, cultural adaptation pressure and fit tolerance.

To explore these dynamics and begin to provide answers to this open question, three inter-related, but separate, virtual experiments will be conducted using the Construct model of social behavior as it is currently embodied in CASOS' agent-based computer simulation software. Each experiment is full factorial-designed and will lead to an extensive amount of data that is not possible using real-world empirical or human laboratory methods. Having access to this large amount of simulated, high-fidelity data will allow for precise regression models to be developed and a thorough sensitivity analysis to be conducted.

For this thesis, as a follow-up to the three studies, extensive validation of the underlying models and results will be carried out. A thorough face-validity process of outcomes will be conducted, involving both academic and practitioner subject-matter experts. The extensive quantitative analysis work will support the thesis' ultimate objective of providing a thorough qualitative discussion of post-merger integration dynamics as explainable by the pre-merger characteristics of the constituent organizations.

> Note: *Throughout this proposal and the later thesis documents, the term "Alpha" refers to one of the organizations being merged, and "Beta" refers to the other, both in pre-merger status; furthermore, it can be considered that Alpha has acquired Beta. The term "NewCo" refers to the combined, post-merger organization collectively made up of all the pre-existing aspects of Alpha and Beta, only now under one organizational umbrella.*

Research Questions

This proposal establishes three separate studies that are the cornerstone of the thesis; each can be considered a stand-alone scholarly work, though they are ultimately entwined with an additional validation process and qualitative discussion to form the complete thesis. Each study investigates one of the research questions that are introduced below. Later, each of the questions is grounded to theory and further justified in the chapter corresponding to its supporting study.

The first study investigates the post-merger dynamics of organizational *knowledge transfer*. It discovers the extent to which the relative differences in the pre-merger characteristics of Alpha and Beta explain the amount of knowledge that is transferred by members of Alpha and Beta in NewCo. Formally stated:

Research Question (Q1): What are the effects of the initial differences between Alpha and Beta on *Knowledge Transfer* in NewCo, with respect to the relative degrees of their organization complexity, team complexity, infrastructure support, team interdependence, and actor specialization-orientation?

The second study investigates the post-merger dynamics of *cultural transmission*. It discovers the extent to which the relative differences in the pre-merger characteristics of Alpha and Beta explain the amount of culture that is transmitted by members of Alpha and Beta in NewCo. Formally stated:

Research Question (Q2): What are the effects of the initial differences between Alpha and Beta on *Cultural Transmission* in NewCo, with respect to the relative degrees of their organization complexity, team complexity, cultural complexity, adaptation pressure, fit tolerance?

The third study investigates the post-merger dynamics of *organizational performance*. It discovers the extent to which the relative differences in the pre-merger characteristics of Alpha and Beta, coupled NewCo's knowledge transfer and cultural transmission levels, explain the level of NewCo's organizational performance. Formally stated:

Research Question (Q3): What are the effects of the initial differences between Alpha and Beta on *Organizational Performance* in NewCo, with respect to the relative degrees of their organization complexity, team complexity, infrastructure support, team interdependence, actor specialization-orientation, cultural complexity, adaptation pressure, fit tolerance, knowledge transfer and cultural transmission on the organization performance in a newly merged organization?

Virtual Merger Script

This section describes a realistic script and the synthesized scenarios to which the computer simulation is guided and from which the virtual experiments are designed. Elucidation is important both as an aid for the reader to carry forth a mental model of the virtual world in which the experiments are designed and run, and as means to articulate the designed-in assumptions that will delineate which situations the findings of this thesis may ultimately be appropriate for. For each of the three experiments, the same script takes place within the computer simulation laboratory: two independent organizations, Alpha and Beta, are thrust into a merger to form NewCo. Alpha and Beta provide similar products and services that complete in the same market and thus it is a horizontal merger. Alpha (the acquirer) is seeking to gain a larger share of its market and hopes to gain economies of scale through various synergies by combining with Beta. Cost-cutting is not part of NewCo's forward strategy; moreover, workforce redundancies are not of concern and therefore layoffs not part of the virtual script.

Since they compete in the same industry, there are many similarities between Alpha and Beta. Both are demographically stable organizations and each has matured into a coherent and industrious group of individual actors working with a purpose towards maximizing their organization's performance. There exists a tight intra-team social network among the actors with inter-team ties forming a united organization. As is the case in the real-world, there are also a few random social-ties between members of Alpha and Beta. Both organizations are organized by work teams that, through the efforts of individuals within the team, aim to accomplish a specific set of virtual tasks. The individual actors and their super-ordinate teams master their assigned tasks by accumulating local tacit knowledge that is diffused to all members of the same team in due course. Moreover, the two organizations also have a specific virtual culture that can be supposed as global knowledge and is transmitted to members of the same organization.

However, though they navigate in the same environment, because of their unique histories there is the prospect of numerous differences--or possibly further similarities--between Alpha and Beta, e.g. the number of employees, the number of work teams, the level of teamwork within the teams, the level of technological support, the norms and paradigms embedded in their work culture, et cetera. These pre-merger characteristics formulate the explicitly designed scenarios that will be implemented as the virtual experiments' control variables, which are later described in detail and substantiated in depth.

At the start of the virtual experiment, when Alpha and Beta are actually merged, the components of each are commingled at the team-level task under the NewCo umbrella. Consequently NewCo consists entirely of the pre-merger characteristics and pre-existing social networks of Alpha and Beta. This situates NewCo as a possibly eclectic mixture of socio-technical sub-networks that have become intermingled and must now interact according to the proscribed social behavior theories contained in the computational model, i.e., Construct.

The Computational Model

This research is conducted in a computational laboratory (cf. Burton, 2003); where computer simulations are to create data for the statistical modeling and analysis that provide support to the research. The organizational computational model used for all experiments in this study is the Construct model of social behavior as implemented in Construct, which is software developed and maintained by CASOS. Agent based models, and Construct in particular, consists of two interrelated aspects: the representation model, and the behavioral model. Moreover, in this special case of a merger, an additional third aspect is necessary to define: the notion of the merger event. The three aspects are described below.

The Representation Model

The representational model implemented within Construct is based on the meta-network construct (Carley, 2002), which is a primary feature of Dynamic Network Analysis (Carley, 2003). Numerous networks are formed from three basic entity types: actors, knowledge and tasks. Broadly, the representation model is consistent with the PCANS model (Krackhardt & Carley, 1998). Table 1.1 lists these entity types and provides a summary of the type of networks that form the basis of the representation model. From the three entity types, four types of networks are utilized. The first is the social network, which is an actor-to-actor relationship. The second is an assignment network consisting of actor-to-task relationships. The third is a task-to-knowledge network which represents the concepts that are necessary to perform each task. The fourth is the knowledge network which is an agent-to-task network representing what concepts each agent knows.

Table 1.1 Organizational Representation: Ontologically coded socio-technical networks.

	Entity Types		
Entity Type	*Actor*	*Knowledge*	*Tasks*
Actor	Social network	Knowledge network	Assignment network
Knowledge			Knowledge requirement network
Task			---

The Behavioral Model

The behavioral model that controls how agents operate in the simulations is an operationalization of the Construct model (Carley, 1991). Construct theory, or constructuralism, has its underpinnings in social theories such as symbolic interactionism (Blumer, 1969), structural interactionism (Stryker, 1980), and structural differentiation theory (Blau, 1970). In the Construct model, the information-processing perspective of the Carnegie School (Simon, 1957; March & Simon, 1958; Cyert & March, 1963), i.e., people are information seeking, is integrated with social-information-processing theory (Salancik & Pfeffer, 1978; Rice & Aydin, 1991), i.e., what knowledge a person has is dependent on what information they have access to via their social network. In Construct, agents purposefully interact through complex discourse (Dooley, Corman, McPhee, & Kuhn, 2003) and social interaction (Carley, 1986) to exchange knowledge and frequently seek out others who have knowledge that they do not yet hold, and are sought out by others seeking their knowledge. Moreover, Construct incorporates the notion of Transactive Memory (Wegner, Giuliano, & Hertel, 1985) into its the processing model. This interaction dynamic is played out numerous times within an organization. When coupled with the organizational membership changes, e.g., hiring and firing, the emerging micro-interaction dynamics result in complex dynamics that have been validated by comparing to real-world social dynamics.

The Merger Transaction

The organizational merger transaction is a single point-in-time event that involves combining the various socio-technical networks of Alpha and Beta to form NewCo. The respective organizational teams from Alpha and Beta are paired and combined at the start of the simulation run. Once NewCo is setup, as a facet of the simulation initialization process, the behavioral model described above is in full authority of the behaviors occurring within the simulation. This simulation does not differentiate any behaviors between running in an ordinary or a post-merger situation.

CHAPTER 2 – KNOWLEDGE TRANSFER

Introduction

In the ordinary course, the management of knowledge and its transfer between groups within an organization is a critical determinant of organizational performance (Kane, Argote & Levine, 2005), but it direct control and effectual exchange can be difficult to achieve (Argote, 1999;

Priestley & Subhashish, 2006; Szulanski, 2000). Moreover, in the special case of a merger, knowledge-based synergies can be the chief purpose of the transaction and thus its transfer between newly wedded individuals takes on even greater import (Haunschild & Miner, 1997). While the determinants of successful knowledge transfer is well-studied from numerous standpoints by scholars (cf. Argote, McEvily & Reagans, 2003), there remains much unknown about the phenomenon during the multifaceted period of a post-merger integration. This study is focuses on pre-merger organizational characteristics as possible antecedents of post-merger organizational knowledge transfer.

To explore the dynamics of post-merger knowledge transfer, this study carries out a virtual experiment. The experiment is designed to provide data that will be used to estimate the effects of the pre-existing, pre-merger characteristics of the partnered organizations on the post-merger knowledge transfer. The factorial-designed experiment manipulates numerous variables that reflect the organizational differences between Alpha and Beta at the time of the merger. These variables compose several higher-level constructs that may be used by integration managers to characterize and assess the initial merger situation and design integration strategies.

The research question for this study is:

> **Research Question (Q1):** What are the effects of the differences between Alpha and Beta on *Knowledge Transfer* in NewCo, with respect to the relative degrees of their initial levels of organization complexity, team complexity, infrastructure support, team interdependence, and actor specialization-orientation?

Details of the constructs that form Q1 and the detailed methodology of the experiment are provided in the next section, which is then followed by an elaboration on how the simulation output data will be analyzed.

Methodology

To explore post-merger knowledge transfer, a virtual factorial-designed experiment, using computer simulation, is conducted to generate extensive amounts of detailed data that can be later analyzed. The simulation software is based on CONSTRUCT.[1] The experiment involves 1,458 unique cells, each consisting of 100 independent replications (cf. March, 1991). Five organizational constructs are represented by seven control variables and three fixed parameters (among numerous other non-relevant parameters that are required input to the simulation software). The details of the independent variables and parameters, as well as for the dependent variables, are presented separately in the sub-sections that follow.

Independent Variables

From Q1, there are five high-level, organizational constructs that organize the seven variables and three parameters making up the set of controlled variables for this experiment. These controls quantify the characteristics of Alpha and Beta at the point of the merger event, and thus are indicative of the initial settings for NewCo, and thus indicate the initial values for each of the simulation runs. These constructs, variables and parameters are summarized in Table 2.1; also, each construct is explained and reasoned below.

[1] Construct's basic representational and behavioral aspects, as well as a description of the merger transaction, are described in Chapter 1.

Table 2.1. Independent control variables for Knowledge Transfer experiment

Input Parameter	*Domain Values*	*Number of values*	*Source*
Organization Complexity			Dooley, 2002; Luhmann, 1995; Anderson, 1999
Teams/Org Alpha & Beta	1,5,10	3	
Team Complexity			Ren, Carley, Argote, 2006; Cording, Christmann & King, 2008
Actor/Team, Alpha	3,9,15,21,27,33	6	
Team size ratio; Alpha-to-Beta	0.5,1.0,2.0	3	
Infrastructure Support			
Knowledge/Team, Alpha	12	1	Lin, 1994; Thompson, 1967
Local-task complexity ratio; Alpha-to-Beta	0.5, 1.0, 2.0	3	
Team Interdependence			
Tasks/Team, Alpha & Beta	12	1	Lin, 1994
Task/actor, Alpha org	4	1	
Local-Task assignment-sharing ratio; Alpha-to-Beta (Actor workload)	0.5, 1.0, 2.0	3	
Actor specialization-orientation			
Knowledge/Actor Alpha (% of group knowledge)	17%,33%, 50%	1	Ren, Carley, Argote, 2006
Local knowledge/Actor ratio; Alpha-to-Beta	0.5,1.0,2.0	3	
Number of experimental cells	3x6x3x1x3x1x1x3x1x3 =1,458		March, 1991, p75
Time periods	1,000		Estimated
Total number of independent runs	1,458x100 = 145,800		

Organization Complexity (OC) is a construct that can be partially manifested by the number of sub-parts of an organization, which implies the amount of complex interactions that are designed into the organizational structure.[2] For the purposes here, the number of sub-parts in the organization are manifest as the number of teams in the organization. For this study,

[2] The number of sub-parts of a system, i.e., teams, departments, silos, business units, etc, and that make up an organization, are an indication of the requisite amount of interaction necessary to function and thus can serve as a measure of the complexity of the organization.

the underlying variable for OC, teams/org can take on a value of 1, 5, 10, which are arbitrary settings as real-world organizations can vary greatly in the number of teams, departments, silos, etc. A value of 1 is reasoned to allow for these experiments to address an organizational merger between two organizations that do not have any sub-parts; for example, two teams themselves merging. Unlike most other variables in this experiment, the teams/org variable is the same for Alpha and Beta; structural similarity has been found to be relevant in intra-firm knowledge transfer (Mowery, Oxley, Silverman, 1996) and this identity feature is necessary because the integration of NewCo is consummated at the team level. This is to say that at the time of the merger event, the teams in Alpha are paired 1-to-1 with teams in Beta, resulting in the same teams in NewCo, just with more members. This phenomenon of matching teams is consistent with a horizontal merger, whereas to organizations in same businesses merge. Moreover, it is largely safe to assume that Alpha and Beta will be structured somewhat similarly as organization design theory suggests that organizations are structured to best thrive in their environment and two competitors, therefore, compete within the same environment. The structural design of the organization, in this case how many teams in the organization, is central to the performance of the organization (Burton & Obel, 2004).

Team Complexity (TC) is a construct, as with OC, that is a function of the number team members and is indicative of the number of interactions within a team for the team to function. This can indicate the amount of coordination and communications (among individuals) that must take place for the team to perform its assigned tasks and is an important determinant of complexity (Carroll & Burton, 2000). In a manner comparable to Axelrod's (1986) metanorms virtual experiments, Beta's team size varies *relative* to the fixed Alpha's team size; herein at a factor of 0.5 times, 1.0 times, or 2.0 times (c.f. Cording, Christmann & King, 2008). It therefore follows that the team size for NewCo will be Alpha's team size plus Beta's team size since the teams are combined at the time of the merger (as mentioned in the discussion on the OC construct). Furthermore, the total size of an organization—the number of workers in its workforce—is determined by multiplying the values for OC and TC for a given organization.

Infrastructure Support (IS) is a construct that indicates the level of infrastructure support[3] that each team has available to it that aids it in performing its assigned tasks. An appropriate fit of technology to the needs of the task and team is important for the group's performance (Keller, 1994). This construct is represented by the amount of knowledge concepts necessary for the team to perform their assigned task. The less infrastructure support available to the team the more *relative* knowledge the team will require to perform its assigned tasks. This also can be thought of as cognitive demand required of the team. The notion of knowledge per team should be thought of as a relative differential between two teams. Considering that two teams being combined perform the same tasks, thus must hold the same knowledge to perform the task, for example two teams of accountants. However, one team has access to a sophisticated accounting system that can create targeted reports that answer a specific question. On the other hand, the other team does not have the benefit of such technology and therefore, to answer the exact same question, needs to have knowledge of what data is relevant and important, and how to combine facts to construct a

[3] This support can consist of technology, tools, resources, et cetera.

reply. The first team simply has an individual push a button. It is knowledge concepts such as this that IS represents. The less knowledge needed to perform the same task, is generally considered more efficient and better for the team and broader organization. This construct has a fixed parameter setting for Alpha and a variable setting for Beta because it is the relative differences between Alpha and Beta that are being modeled in this experiment.

Team Interdependence (TI) is a construct that reflects the level of individual task-sharing that is embedded in the team assignment structure. The number of tasks assigned per team is a fixed parameter, set to 12. Also fixed, is the number of assigned tasks per individual for Alpha—set to 4 concepts per actor. The tasks assigned per actor variable for Beta is set relative to the Alpha setting and reflects the relative difference of TI between the two organizations. In the case of Alpha, each actor in a team will be assigned 3 of the 12 teams tasks. Beta's values will result in actors working on some tasks together as the tasks/actor value increases.

Actor Specialization-Orientation (AS) is a construct consisting of two variables indicating the percentage of team knowledge concepts that each member of a team holds. One variable specifies this percentage for Alpha {17%, 33%, 50%}, and the other variable specifies this value for Beta {x0.5, x1.0, x2.0}, relative to the setting for Alpha. The AS construct characterizes the specialist-generalist nature of the individuals in the given team. In some teams, individuals are specialists which suggest that they hold team knowledge that others in the team do not. Otherwise, some teams have a great deal of shared knowledge which is indicative of a team that has its membership consisting of more generalist individuals.

Dependent Variables

This experiment involves two dependent variables: knowledge transfer and the time it takes for all members of the organization to hold all information. Both are measures computed on NewCo. Table 2.2 provides a summarization of these variables and following is a full description and substantiation for their implications to the study.

Knowledge Transfer (KD) is an output variable that indicates the amount of knowledge that is spread throughout the entire organization. This broadly indicates both a level of organizational maturity and may be considered a mediator for cooperation within the organization. The KD is computed according to equation 2.1. Where, A is the number of actors, K is the number of knowledge concepts. And $AK_{ij} = 1$ if actor i is linked to, i.e., holds, knowledge concept j; $AK_{ij} = 0$ otherwise.

$$KD = \frac{\sum_{i=0}^{N} \sum_{j=0}^{K} AK_{ij}}{NK} \qquad (2.1)$$

Time to Full Knowledge (FK) is an output variable that indicates the time period in which all knowledge is known by all actors in NewCo. While this metric is not something that is possible in the real-world, in this experiment it is used as an indication of the speed in which knowledge is diffused throughout the organization. This is a mechanism, in effect, to compute the average speed of KD throughout the entire time period of the experiment.

Table 2.2. Dependent variables for Knowledge Transfer experiment

Variable	*Possible Values*
Knowledge Transfer	0-1.0
Time to full knowledge	0-1000 (estimated)

Data Analysis

Initially, single variable analysis (i.e., frequency tables and graphs of central tendency, variability, skew and kurtosis of the distribution) will be conducted on the outcome variable for selected experiment-cells. This will be followed by a through sensitivity analysis of the simulated data to determine how the response variable varies according to changes in the factor variables. Since the response data arises from a computer simulation, it can be safely assumed that the factors indeed have an affect on the response, but to what degree is not known, which is essentially the scientific question herein. The sensitivity analysis will have three main components according to technique: (a) create simple 2-dimensional scatter plots to visually explore the extent and linearity of any two-part correlations, (b) compute correlations mathematically for the entire variable set, (c) fit standardized, forward stepwise regression models to the response variable (both first- and second-order quadratic models). Beyond determining the main effect for each factor, interactions associated with each relationship among factors will be incorporated into regression modeling. Moreover, a set of contour plots will be constructed to visually explore and report any interactions. Checks for colinearity and multicollinearity between explanatory variables will be conducted and remedies made to the models if necessary. These standard analytic procedures are expected to provide evidence that increases the confidence in the analysis as all aspects of the experiment are entirely transparent through the input parameters and the output data produced from the simulation methodology. This experiment and the analysis procedures will determine the sensitivity of knowledge transfer values over time, according to the initial setting of the pre-merger characteristics and provide a basis for a rich and extensive discussion pertaining to the research question.

CHAPTER 3 – CULTURAL TRANSMISSION

Introduction

Like knowledge transfer, culture is a critical determinate of organization performance and during post-merger integration it is often a traumatic change for some participants (Zueva & Ghauri, 2007) and critical to the outcome of a merger. To explore the dynamics of post-merger cultural transmission, this study carries out a virtual experiment. The experiment is designed to provide data that will be used to estimate the effects of the pre-existing, pre-merger characteristics of the partnered organizations on the post-merger cultural transmission. The factorial-designed experiment manipulates numerous variables that reflect the organizational differences between Alpha and Beta at the time of the merger. These variables compose several higher-level constructs that may be used by integration managers to characterize and assess the initial merger situation and design integration strategies.

The research question for this study is:

Research Question (Q2): What are the effects of the initial differences between Alpha and Beta on *Cultural Transmission* in NewCo, with respect to the relative degrees of their organization complexity, team complexity, cultural complexity, adaptation pressure, fit tolerance?

Details of the constructs that form Q2 and the detailed methodology of the experiment are provided in the next section, which is then followed by an elaboration on how the resulting data will be analyzed.

Methodology

To explore post-merger cultural transmission, a virtual factorial-designed experiment, using computer simulation, is conducted to generate extensive amounts of detailed data that can be later analyzed. The simulation software is based on CONSTRUCT.[4] The experiment involves 1,458 unique cells, each consisting of 100 independent replications (cf. March, 1991, 75). Five organizational constructs are represented by six control variables and three fixed parameters (among numerous other non-relevant parameters that are required input to the simulation software). The details of the independent variables and parameters, as well as for the dependent variables, are presented separately in the sub-sections that follow.

Independent Variables

From Q2, there are five high-level, organizational constructs that organize the six variables and three parameters making up the set of controlled variables for this experiment. These controls quantify the characteristics of Alpha and Beta at the point of the merger event, and thus are indicative of the initial settings for NewCo, and thus indicate the initial values for each of the simulation runs. These constructs, variables and parameters are summarized in Table 3.1; Also, each construct is individually explained and reasoned below.

Organization Complexity (OC) is a construct consisting of a variable indicating the number of teams in each of the organizations, Alpha and Beta. This is the same as described in Chapter 2.

Team Complexity (TC) is a construct consisting of two variables indicating the number of actors in each team within each of the organizations, Alpha and Beta. This is the same as described in Chapter 2.

Cultural Complexity (CS) is a construct consisting of one parameter and one variable indicating the number of cultural concepts for each of Alpha and Beta. The number of cultural concepts is an indication of the complexity of the culture and suggests the amount of re-learning and adaptation that individuals in the other organization must adhere to in order to assimilate into the other's culture. Alpha's cultural complexity parameter is fixed at 1,000 concepts and Beta's number is varied relative to Alpha's value at x0.5, x1.0, and x2.0, thus

[4] Construct's basic representational and behavioral aspects, as well as a description of the merger transaction, are described in Chapter 1.

as minimal as 500 concepts and as many as 2,000 for Beta. Individuals in Beta will need to unlearn their concepts and learn and adopt Alpha's.

Adaptation Pressure (AP) is a construct consisting of one parameter and one variable indicating the number of willingness of individuals to self-adapt to the other's culture, for each of Alpha and Beta. The value of this parameter is an indication of the willingness for an individual in Alpha to adapt to Beta's culture—a parameter that is fixed in these experiments. The value for Beta varies relative to Alpha's value at x0.5, x1.0, and x2.0.

Fit Tolerance (FT) is a construct consisting of one parameter and one variable indicating the number of willingness of individuals within a team to tolerate others' (within the same team) differences according to their cultural adoption. This value deteriorates according to the variable, the deterioration rate.

Table 3.1. Independent control variables for Cultural Transmission experiment

Input Parameter	*Domain Values*	*Number of values*	*Source*
Organization Complexity			Dooley, 2002; Luhmann, 1995; Anderson, 1999
Teams/Org Alpha & Beta	1,5,10	3	
Team Complexity			Ren, Carley, Argote, 2006; Cording, Christmann & King, 2008
Actor/Team, Alpha	3,9,15,21,27,33	6	
Team size ratio; Alpha-to-Beta	0.5,1.0,2.0	3	
Cultural Complexity			
Knowledge/Org, Alpha	1000	1	
Knowledge/Org, Alpha	0.5, 1.0, 2.0	3	
Adaptation Pressure (willingness to self-adopt)			
Tendency for individual to adapt to others' culture, Alpha	1.0	1	
Tendency ratio, Beta	0.5, 1.0, 2.0	3	
Fit Tolerance (Team-level deteriorate rate over time)			
Initial level of fit tolerance	1.0	1	
Deterioration rate, per simulation time period	0.001, 0.002, 0.01	3	
Number of experimental cells	3x6x3x1x3x1x3x 1x3 =1,458		March, 1991, p75
Time periods	1,000		Estimated
Total number of independent runs	1,458x100 = 145,800		

Dependent Variables

This experiment involves three dependent variables: Acceptance Level, Cultural Stability and the time it takes for cultural change to stabilize. Both are measures computed on NewCo. Table 3.2 provides a summarization of these variables and following is a full description and substantiation for their implications to the study.

Acceptance Level (AL) is an output variable that indicates the amount of acceptance there is in NewCo for the Alpha culture.

Cultural Stability (CS) is an output variable that indicates the level of cultural change in NewCo.

Time to Reach Stabilization (RS) is an output variable that indicates the time period in which the changes to the culture have stabilized and has a zero slope.

Table 3.2. Dependent variables for Cultural Transmission experiment

Variable	*Possible Values*
NewCo's Acceptance Level of Alpha's Culture	0-1.0
Cultural Stability	0 – 1.0
Time to reach Stabilization	0-1000 (estimated)

Data Analysis

In a process alike that described previously in Chapter 2: a through sensitivity analysis of the simulated data will be conducted to determine how the response variable varies according to changes in the factor variables. This analysis includes visual scatter plots, mathematical correlations, stepwise regression, and 3-dimensional response surface plots.

CHAPTER 4 – ORGANIZATION PERFORMANCE

Introduction

Even more so that knowledge transfer and culture transmission, organizational performance is the zenith of importance to the management of an organization. To explore the dynamics of post-merger organization performance, this study carries out a virtual experiment. The experiment is designed to provide data that will be used to estimate the effects of the pre-existing, pre-merger characteristics of the partnered organizations on the post-merger cultural transmission. The factorial-designed experiment manipulates numerous variables that reflect the organizational differences between Alpha and Beta at the time of the merger. These variables compose several higher-level constructs that may be used by integration managers to characterize and assess the initial merger situation and design integration strategies.

The research question for this chapter is:

Research Question (Q3): What are the effects of the initial differences between Alpha and Beta on *Organizational Performance* in NewCo, with respect to the relative degrees of their organization complexity, team complexity, infrastructure support, team interdependence, actor specialization-orientation, cultural complexity, adaptation pressure, fit tolerance, knowledge transfer and cultural transmission on the organization performance in a newly merged organization?

Details of the constructs that form Q3 and the detailed methodology of the experiment are provided in the next section, which is then followed by an elaboration on how the resulting data will be analyzed.

Methodology

To explore post-merger cultural transmission, a virtual factorial-designed experiment, using computer simulation, is conducted to generate extensive amounts of detailed data that can be later analyzed. The simulation software is based on CONSTRUCT.[5] The experiment involves 10,022 unique cells, each consisting of 100 independent replications (cf. March, 1991, 75). Eight organizational constructs are represented by ten control variables and six fixed parameters (among numerous other non-relevant parameters that are required input to the simulation software). These elements consist of the elements of the first two experiments, but combined herein. The details of the independent variables and parameters, as well as for the dependent variables, are presented separately in the sub-sections that follow.

Independent Variables

There are eight constructs making up the set of control variables for this experiment. This is a combination of the constructs in the first experiment (Chapter 2) and the constructs in the second experiment (Chapter 3). These constructs are listed in Table 4.1 and a summarization is below.

Organization Complexity (OC) is a construct consisting of a variable indicating the number of teams in each of the organizations, Alpha and Beta. This is the same as described in Chapter 2.

Team Complexity (TC) is a construct consisting of two variables indicating the number of actors in each team within each of the organizations, Alpha and Beta. This is the same as described in Chapter 2.

Infrastructure Support (IS) is a construct consisting of a fixed parameter and a variable indicating the number of knowledge concepts necessary for each team within each of the organizations, Alpha and Beta This is the same as described in Chapter 2.

Team Interdependence (TI) is a construct consisting of two fixed parameters and a variable indicating the level of shared tasks that members of the team work together on. This is the same as described in Chapter 2.

Actor Specialization-Orientation (AS) is a construct consisting of two variables indicating the percentage of team knowledge concepts that each member of a team holds. This is the same as described in Chapter 2.

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[5] Construct's basic representational and behavioral aspects, as well as a description of the merger transaction, are described in Chapter 1.

Table 4.1. Independent control variables for Organization Performance experiment

Input Parameter	*Domain Values*	*Number of values*	*Source*
Organization Complexity			Dooley, 2002; Luhmann, 1995; Anderson, 1999
Teams/Org Alpha & Beta	1,5,10	3	
Team Complexity			Ren, Carley, Argote, 2006; Cording, Christmann & King, 2008
Actor/Team, Alpha	3,9,15,21,27,33	6	
Team size ratio; Alpha-to-Beta	0.5,1.0,2.0	3	
Infrastructure Support			
Knowledge/Team, Alpha	12	1	Lin, 1994; Thompson, 1967
Local-task complexity ratio; Alpha-to-Beta	0.5, 1.0, 2.0	3	
Team Interdependence			
Tasks/Team, Alpha & Beta	12	1	Lin, 1994
Task/actor, Alpha org	4	1	
Local-Task assignment-sharing ratio; Alpha-to-Beta (Actor workload)	0.5, 1.0, 2.0	3	
Actor specialization-orientation			
Knowledge/Actor Alpha (% of group knowledge)	17%,33%, 50%	1	Ren, Carley, Argote, 2006
Local knowledge/Actor ratio; Alpha-to-Beta	0.5,1.0,2.0	3	
Cultural Complexity			
Knowledge/Org, Alpha	1000	1	
Knowledge/Org, Alpha	0.5, 1.0, 2.0	3	
Adaptation Pressure (willingness to self-adopt)			
Tendency for individual to adapt to others' culture, Alpha	1.0	1	
Tendency ratio, Beta	0.5, 1.0, 2.0	3	
Fit Tolerance (Team-level deteriorate rate over time)			
Initial level of fit tolerance	1.0	1	
Deterioration rate, per simulation time period	0.001, 0.002, 0.01	3	
Number of experimental cells	3x6x3x1x3x1x1x3 x1x3x1x3x1x3x1x 3 =10,022		March, 1991, p75
Time periods	1,000		Estimated
Total number of independent runs	10,022x100 = 1,002,200		

Cultural Complexity (CS) is a construct consisting of one parameter and one variable indicating the number of cultural concepts for each of Alpha and Beta. This is the same as described in Chapter 3.

Adaptation Pressure (AP) is a construct consisting of one parameter and one variable indicating the number of willingness of individuals to self-adapt to the other's culture, for each of Alpha and Beta. This is the same as described in Chapter 3.

Fit Tolerance (FT) is a construct consisting of one parameter and one variable indicating the number of willingness of individuals within a team to tolerate others' (within the same team) differences according to their cultural adoption. This is the same as described in Chapter 3.

Mediating Variables

There are four mediating variables for this experiment. Each measure is computed on NewCo and is a dependent variables from one of the first two experiments. Table 4.2 provides a summarization of these descriptions.

Knowledge Transfer (KD) is a mediating variable that indicates the amount of knowledge that is spread throughout the entire organization. This is fully explained in Chapter 2.

Time to Full Knowledge (FK) is a mediating variable that indicates the time period in which all knowledge is known by all actors in NewCo. This is fully explained in Chapter 2.

Acceptance Level (AL) is an output variable that indicates the amount of acceptance there is in NewCo for the Alpha culture. This is fully explained in Chapter 3.

Time to Reach Stabilization (RS) is an output variable that indicates the time period in which the changes to the culture have stabilized and has a zero slope. This is fully explained in Chapter 3.

Table 4.2. Mediating variables for Organization Performance experiment

Variable	*Possible Values*
Knowledge Transfer	0-1.0
Time to full knowledge	0-1000 (estimated)
NewCo's Acceptance Level of Alpha's Culture	0-1.0
Cultural Stability	0 – 1.0
Time to reach Stabilization	0-1000 (estimated)

Dependent Variables

This experiment involves one dependent variable: Organization Performance; it is computed on NewCo. Table 4.3 provides a summarization of this variable and following is a full description and substantiation for its implications to the study.

Organization Performance (OP) is an output variable that indicates the accuracy in the binary decision tasks performed by NewCo.

Table 4.3. Dependent variables for Organization Performance experiment

Variable	*Possible Values*
Organization Performance (Binary Task Accuracy)	0 – 1.0

Data Analysis

In a process alike that described previously in Chapters 2 and 3: a through sensitivity analysis of the simulated data will be conducted to determine how the response variable varies according to changes in the factor variables. This analysis includes visual scatter plots, mathematical correlations, stepwise regression, and 3-dimensional response surface plots.

CHAPTER 5 - VALIDATION

The Construct model of social theory has been validated numerous times, so this proposal will appropriately rely on the prior validation of the behavioral model, although the values of the variables and the parameters will still require formal substantiation. Moreover, an extensive face validity process is planned for this study. Subject matter experts from both the academic and practitioner communities will be engaged in the process. For both the model validation and face validity, the procedures will be conducted one-time for the combined three experiments. The particulars about these two procedures are presented below.

Model Validation

Before a computational model can be used with confidence, it must first be validated (Thomsen, Levitt, Kunz, Nass & Frisma, 1999). Since Construct has been validated numerous times (c.f., Carley, 1990; Carley & Hill, 2001; Carley & Krackhardt, 1996; Schreiber & Carley, 2004, 2007), and used extensively for organizational research, the model validation will consist of software review and verification that the variables and parameter values are correctly implemented in the software. Each of the input values for the three experiments (all summarized in Table 4.1) will be verified for correct implementation in the software.

Face Validity of Integration Model

The face validity of the outcome variables and the integration model produced from the data analysis will be reviewed by subject-matter experts from the academic community. In addition, a process of review will be conducted that queries practicing integration managers for their judgment of the outcome from the simulations. Moreover, a thorough review of the outcome variables will be made against the extant literature specific to the variable. Table 5.2 lists some of the scholarly literature that may be used for this evaluation and a template for auditing the concordance between the scholarly theory and the output of the simulations.

Table 5.2. Face validity for Knowledge Transfer experiment

Literature	*Evaluation*	*Agreement Level*
Knowledge acquisition is social (Carley, 1986)		
Knowledge acquisition strategies in mergers (Zollo,1997)		
Mergers cause discontinuities in org learning (Bijlsma-Frankema, Prins, & Weber, 1999)		
Knowledge transfer is key to acquisitions (Bresman, Birkinshaw, & Nobel, 1999)		
Learning through strategic combinations (Inkpen, 2000)		

CHAPTER 6 - GENERAL

Contributions of thesis

From the substantive perspective, this thesis will provide a basis for developing fresh theory on the dynamics of the integration process. This research takes an attribute-based view of the merger integration and takes a look at the phenomenon using an extraordinary number of variables and datapoints that are not available in other post-merger integration studies (cf. Datta & Grant, 1990; Hitt, Harrison, Ireland & Best, 1998). Moreover, this research will unify previous research from several separate scholarly streams beyond that specific to post-merger integration. The experiments that support the three research questions will provide either new or stronger evidence about the behavior dynamics of the merger from the perspective of the integration process with a fidelity of data previously unseen. From this advance, the statistical models developed will provide a rich understanding of the integration process and provide a further strong basis for later empirical-based post-merger integration research

Moreover, from the methodological perspective, this proposal will be the first known published study to fully utilize and validate computational modeling techniques for the purpose of investigating broad-based merger integration dynamics. It will produce the first database of fully tractable metrics about the phenomena at a level of detail never before captured and with precision unavailable previously. The theoretic outcomes of this study will be supported by an enormous amount data samples at levels never before available to earlier merger integration researchers.

Limitations

While computational models and simulations are a rich resource in the pursuit of theory development and testing, the findings from this methodology must be confirmed by empirical and case study. As such, since there are several aspects of organizational behavior that are not captured in the Construct model--for example, actor incentive and reward systems (cf. Burton & Obel, 1984)--, the findings from this research should not yet be construed as being necessarily predictive (DeGreene, 1973), at this stage. Moreover, the critical issue of trust and its relationship with organization performance (Prietula & Carley, 1999) is not addressed in the model. Furthermore, organizational unlearning (Tsang, & Zahra, 2008), both from perspective of knowledge transfer or cultural transmission, is not implemented. There are many more behavioral aspects of organizational behavior that are not captured in the model should be identified as limitations to the study from numerous other perspectives not taken in this research design.

Critically, this study does not account for management's integration strategy that often accompanies a merger. Although, some real-world managers do indeed take a laissez faire approach to integration management--purposely or otherwise--, herein the affect of the how the integration process is managed is left unexplored and therefore limits the applicability of the study from some operational perspectives. However, this study can adequately be considered a theoretical experiment and one in which a baseline scenario is established for later and more complex research and investigations that may include integration management strategies into the process.

Thesis document outline

- Introduction
  - Scholarly gaps
  - Objective of research
  - Research Questions
  - Computational model
- Research area 1: Knowledge transfer
  - Articulate the problem
  - What we already know
  - Methodology
  - Results
- Research area 2: Cultural transmission
  - Articulate the problem
  - Methodology
  - Detail the experiments
  - Results
- Research area 3: Organizational performance
  - Articulate the problem
  - What we already know
  - Methodology
  - Results
- Validation and Verification
- Discussion
- Scholarly contributions
- Limitations
- Future work
- References

Thesis timetable

Month		Activity
2009	March	Thesis proposal presentation
	March	Software development tasks: Construct, experiment & data analysis utilities
	April	Run full-trial of all experiments (10 replications) & debug process and procedures
	May	Run live experiments Full alpha-draft of non-results sections of thesis (Ch. 1, 2, 3, limitations, etc)
	June	Results analysis & validation
	July	Defense presentation (consider, during week of CASOS Summer Institute?)
	August	Document revisions

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