Facilitating Communication in the Interdisciplinary Design Process

A thesis submitted to

the Faculty of Graduate Studies and Research

in partial fulfillment of the requirements for the degree of

Master of Design

By

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September 22, 2010

Your file Votre référence
ISBN: 978-0-494-71544-4
Our file Notre référence
ISBN: 978-0-494-71544-4

Abstract

From a designer perspective, how does an interdisciplinary design process facilitate communication for large-scale projects, and can insights be drawn from such a process by comparing it to Turner's anthropological model of rites of passage? This study is based on anecdotal evidence derived from a single-case ethnography, a review of a company's internal documents, and a survey of 41 participants – all undertaken in a corporate environment in which design is an integral part of the development process. In a professional environment such as this, designers experience a temporary change in status during their interaction with stakeholders. The design team temporarily unites with the communities of the respective stakeholders to form a single entity. An interdisciplinary design process fosters collaboration, increases the efficiency of communication, aligns objectives with expectations, and gives stakeholders the opportunity to share knowledge and provide valuable feedback, all contributing to the creation of a better product.

Acknowledgements

It would be extremely difficult for me to thank everyone who has helped me on this rather challenging journey. Without their support and encouragement every step along the way, it would have been impossible to get to where I am now. Thank you Prof Brian Given, Prof Thomas Garvey and in particular Prof HeungRyong Woo who has supported and challenged me from the beginning.

One of my biggest regrets in life is failing to thank a good friend of mine during a high school graduation speech. Now that there is a second chance, I would like to take this opportunity to do so. I cannot express in words how thankful I am to have this wonderful person as a friend –someone who has done so much for me and for this paper – thank you Nishu.

To Stela: Thanks for all the things that you have done for me as I tried my best to plan and sort out matters through hectic times. Without your help I would never have accomplished my goals in a timely and professional manner.

To my family and Mel: Thanks for being so patient and encouraging every step of the way. I know it must have been difficult for the past two years with so much going on - thank you for your understanding and undying support.

Table of Contents

List of Tables

List of Figures

List of Appendices

Introduction

From a designer perspective, how does an interdisciplinary design process facilitate communication for large-scale projects, and can insights be drawn from such a process by comparing it to Turner's (1969) anthropological model of *rites of passage*? This research aims to answer these questions by investigating whether communication is better facilitated in an interdisciplinary design process, thus making it more appropriate for large-scale projects, and by comparing the design process models (traditional and interdisciplinary) to Turner's anthropological model, which is used to examine rituals and phases that an individual progresses through in ceremonialism, religious practices, cultural behaviors, and rituals. The research is presented from the perspective of a designer[1] who is attempting to understand the potential benefit(s) and disadvantage(s) of an interdisciplinary design process and focuses on what it means to work collaboratively with individuals who have an interdisciplinary background beyond design. Specifically, this research seeks to answer two questions: first, whether an interdisciplinary design process (from the designer's perspective) facilitates communication for large-scale projects and second, can insights be drawn from an interdisciplinary design process by comparing it to rites of passage.

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[1] Although, the definition of a designer remains debatable within the field of design (Matchett, 1968; Gregory, 1966; Lawson, 1997), for the purposes of this paper, a designer's role is defined as "problem-finding, and problem solving, deduction and the drawing of inferences, induction and the creating of new ideas, analysis and synthesis. Above all, design requires the making of judgments and the taking of balanced decisions often in an ethical and moral context." (Lawson, 1997, p. 251)

The term interdisciplinary is not an easy concept to define and carries a different meaning for various academics. For the purposes of this research, interdisciplinary design is defined according to Rhoten and Pfirman's (2007) interpersonal approach to interdisciplinary practice where by collaboration occurs between teams or networks spanning a variety of fields and/or disciplines. As this research focuses on a corporate environment, interdisciplinary is defined as the combination of efforts from two or more discrete disciplines, such as engineering, product management, and marketing, applying their respective domain knowledge to solve problems through homogenizing various design decisions/proficiencies into a product. Interdisciplinary design, as Augsburg (2005) explains, crosses traditional boundaries between professional disciplines involving a shared disciplinary relationship to be "interactive" (p. 56).

Answering the two questions will shed light on key implications that pertain to the relationship of activities during an interdisciplinary design process in comparison to the rites of passage. Furthermore, conducting research in the areas outlined above will result in recommendations for changes to the current design process by removing at least some communication barriers for large-scale projects carried in interdisciplinary settings.

In the context of a large-scale design project, the design process requires collaborative interaction between stakeholders[2] who are involved in all aspects of the design process. This includes complex projects, such as the production of automobiles,

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[2] The definition of a stakeholder for the purpose of this research is a company employee who has an interest in the success of an organization and who is involved in the context of large projects at the corporate scale (which typically entails global operations with hundreds or possibly thousands of employees functioning simultaneously and developing multiple products concurrently) (O'Donovan, Eckert, Clarkson & Browning, 2005).

mobile phones, computer software, and more. These projects comprise of intricacies that require continual interaction between stakeholders to ensure that communication is: 1) efficient, in terms of being accurate and up-to-date, and 2) being contributed equally to establish design solutions that are holistic.

As a result, the recurring collaborative aspect that is inherently necessary in a large corporate environment requires that the activities of design be a social process. Unlike the traditional design process, which is practiced in small-scale projects whereby interaction between the designer and stakeholders is limited (Lawson, 1994), an interdisciplinary design process permits greater opportunity for interactivity. This interactivity between the stakeholders is a social process that is crucial for the design of large-scale products as it allows communication to occur at multiple levels (Eckert and Maier, 2005). In other words, large-scale design cannot be practiced in isolation as it is practiced within the traditional design process. The assumption is that an interdisciplinary design process facilitates communication in large-scale environments by creating numerous possibilities for stakeholders to interact, align to common goals, and provide continuous feedback. As large corporate environments have professionals that typically carry specific skill specializations, it is likely that that there is a high degree of territoriality amongst them. As a result, the level of communication pertaining to efficiency must be ensured and encouraged between stakeholders in order for a large corporate environment to function properly in coordination. Therefore, from a designer's perspective, the mindset of territoriality must change. On the contrary, the roles of those in a small design studio are relatively broader, and it is common for a designer to be a

"jack-of-all-trades" since resources are limited. Thus, an interdisciplinary level of communication is not required for small-scale projects.

As such, this paper aims to show that there is a requirement on behalf of the designer functioning in a large corporate environment to have a change in mindset and to realize that design ownership, although present, must be shared with others. It will go on to explore whether designers can benefit from the social process of negotiation and even argumentation with other stakeholders. The notion that a designer's role is to merely seek casual input before the project is complete, and to communicate the results externally only once the project is completed, could be a grave mistake and lead to a less than optimal product (Eckert, Maier & McMahon, 2005).

The research framework for this paper is summarized in Figure 1 and shows the order in which the paper is presented (research review, research methodology, discussion then concluding remarks). The first section of the paper provides an overview of design education as a discipline and how it impacts the mindset of designers who practice design within a traditional setting by following a general design process model. The design process model is based upon descriptions and methodologies identified in literature (Grieves, 2006; Medland, 1992; Ullman, 1992; French, 1999; Pahl & Beitz, 1996; ElMaraghy & ElMaraghy, 2006; Reijers, 2003). The model provides a glimpse of the traditional thinking surrounding the discipline of design, which is fundamental to comprehend when speaking about interdisciplinary models of design. The next section of this paper provides greater background on the contextual nature of design as a social process in a large-scale environment and demonstrates the advantages of using an

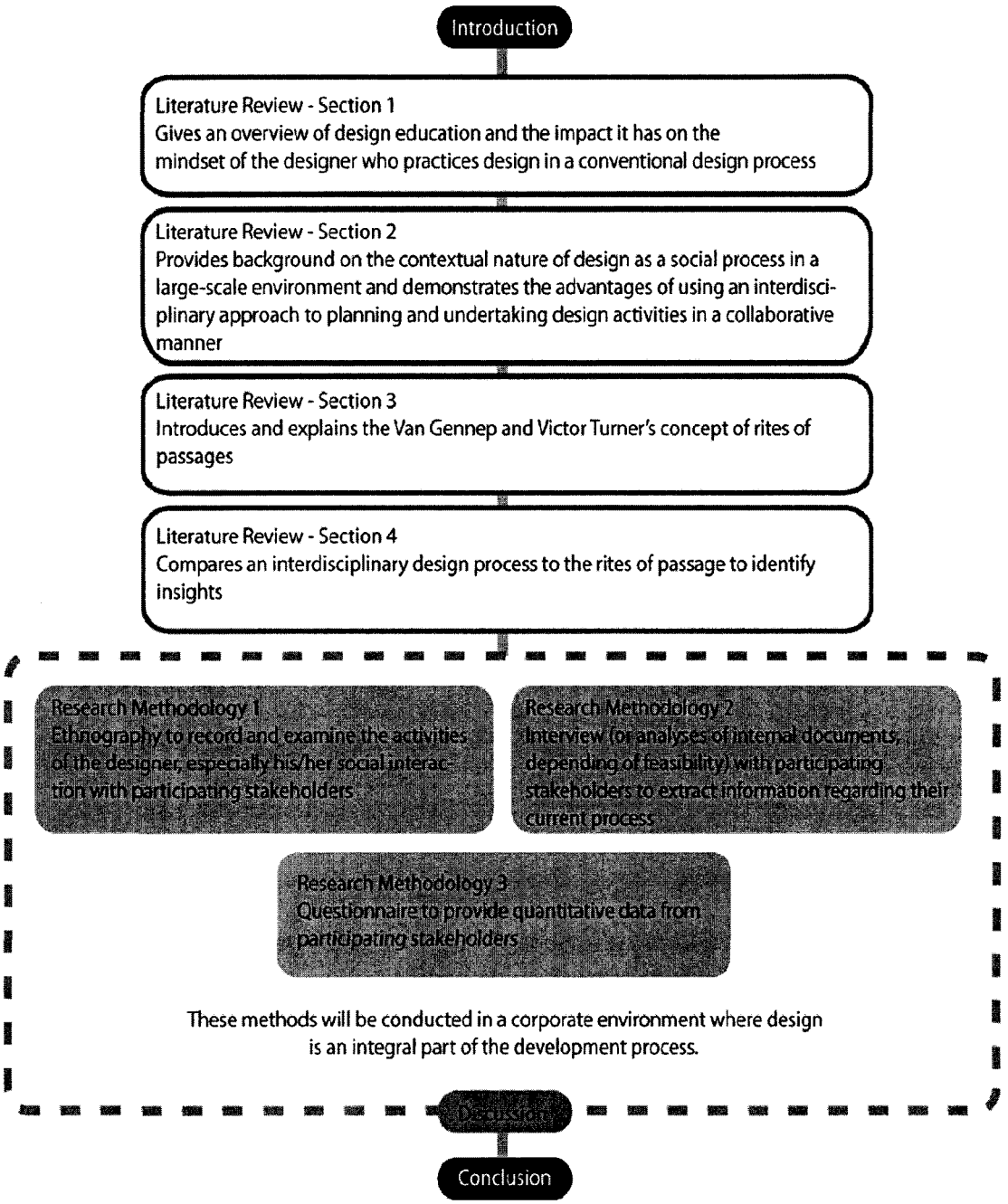
interdisciplinary approach to planning and undertaking design activities in a collaborative manner. Research results have shown that the creation of innovative ideas has resulted from the exchange of critical information typically originating from outside the active workplace but within the organization (Allen, 1977). Acknowledging this, it is imperative for designers to make a conscious effort to interact with other stakeholders in an interdisciplinary design process. To explore whether communication is better facilitated in an interdisciplinary design process, the activities of the designer will be compared to rites of passage. In doing so, an assumption needs to be made that the activities of the designer can be classified using the phases of rites of passage. This classification will provide different perspectives in understanding how communication is better facilitated in an interdisciplinary design process.

Section three will seek to go in depth and explain the concept of the rites of passage. Rites of passage is an anthropological concept that was formulated by Arnold Van Gennep (1960) and grounded ethnographically by Victor Turner (1969, 1979). The contribution of these two scholars has great significance to the studies of anthropology, particularly in the analyses of rituals and the phases that an individual progresses through in social processes. Since the inception of rites of passage, countless scholars have utilized this model to analyze ceremonialism, religious practices, cultural behavior, and rituals (Wallace, 1966; Wallace, 1970; Lavenda & Schultz, 2007; Turner E., 1987). As such, section four compares the activities of a designer and the interaction he/she makes with other stakeholders during the interdisciplinary design process with the phases of rites of passage. Klein explains (1996), the difficulty in practicing an interdisciplinary

approach is that it requires individuals to breach boundaries in order to advance through "no man's land" (Weingart, 2000, p. 28) between disciplines and challenge the status quo. The similarities of "no man's land" in the context of an interdisciplinary design process can be identified and compared through the three phases of rites of passage: separation, transition (or liminality), and incorporation. In particular, it can be noted that the liminal phase is crucial as it signifies the suspension of social relationships, statuses, and traditional roles. This period, also known as "communitas," plays an important role in the change of social status as it is at this stage where an individual is outside of their social structure (Turner, 1975). For the designer, a change in social status permits a change in mindset, which is extremely important for the facilitation of teamwork with other stakeholders. This traditional mindset includes the thinking that design is a solitary act, or "individual," as Lawson (1994, p. 23) describes it, and that ownership to design decision-making inherently belongs to the designer (Alexander, 1964).

Consequently, it would be advantageous for the designer to encourage the opportunity for equal input of all stakeholders. This can be done by fostering a collaborative work process for large-scale projects and would allow negotiation and argumentation, typically activities that a designer tries to avoid. As these activities become a part of the design process, they open up possibilities for other stakeholders to provide design solutions during collaboration.

Figure 1. The research framework



This study was based on anecdotal evidence derived from a single-case ethnography, a review of internal documents, and a survey of participants - all undertaken in a corporate environment in which design is an integral part of the development process. The duration of the study was eight days. The activities of the designer, and in particular, his/her social interaction with stakeholders was closely examined and recorded using a structural framework adapted by Robson (2002) and Crabtree (2003). This framework consisted of a guideline to assist the researcher in recording data accurately and effectively. It included eight important headings to help the researcher take notes: spaces, actors, activities, objects, events, time, goals, and feelings. The raw data collected, in the form of notes and sketches were analyzed using an adaptation of Jorgesen's (1989, p. 108-109) three analytic strategies:

1. Identification of features and elements as insight by assessing the importance of the information
2. Identification of patterns by filtering through the data and aligning them with the research questions
3. Comparison of the identified insight to patterns found in the first and second strategies

The benefit of utilizing the three analytic strategies is that it allowed the researcher to clearly identify important characteristics without being overwhelmed by the abundance of notes typically obtained from ethnography.

In addition to this, the analyses of past design processes and related activities through the review of internal company documents allowed a direct comparison of the

organization's past to its current practice (Flick, 2007). The analyses of archival information were mainly taken in the form of written notes examining computer files and formal documents. The survey provided quantitative information, including nominal, ordinal, and ratio data.

Through the combination of the literature review and primary research, including ethnography, analyses of internal documents, and a survey, it was shown how the designer progresses through rites of passage (i.e. the rites of separation, transition, and incorporation) in a corporate environment and interacts with other stakeholders. In a conventional design process, whereby interdisciplinary interaction is typically limited to short information exchange, the designer assumes the responsibility of decision making, thus filtering crucial information provided by other important stakeholders prior to applying it to the design. However, effective and fluid interdisciplinary collaboration is imperative in large-scale work environments where each individual stakeholder should have the opportunity to openly discuss their ideas with designers. Ideas from stakeholders, who are trained as engineers, managers, quality assurance specialists and so forth, are beneficial to the final design solution as these people could be just as likely to be able to provide ideas that are collectively more holistic[3]. It is reasonable to make this assumption since each individual stakeholder has disciplinary training that can provide logic and reasoning based on their domain knowledge, personal, and professional experience.

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[3] It is important to note that although a more holistic approach may not always produce products that are focused for a specific consumer group, it does cater to a wider audience by providing a more encompassing reach.

To ensure that an interdisciplinary collaboration is possible, the designer must have an open mindset and be willing to engage in negotiation and argumentation processes with other stakeholders. The designers are to realize that design ownership, although existent, should be shared and that this mutual respect for ideas should be encouraged in the design process to promote interaction among stakeholders without boundaries. In an environment where interdisciplinary collaboration is administered in the design process, this study found that the designer experiences a gradual but temporary transformation in status and role during the liminal period. The liminal period temporarily unites the design team with the-respective stakeholders into a single entity by breaking the conventional social structure and allowing each individual to share equal design ownership. In other words, although the designer does not experience a permanent change in status (as one would expect from rites of passage), this is a process whereby a symbolically mediated transition occurs as a temporary subculture has been created. Keeping an open mindset during this collaborative working context, in which ideas were developed and shared, realized the existence of synchronicity among the stakeholders whereby the individuals were in the mode of *spontaneous communitas*.[4] The research has found a very powerful method of creating a symbolic context in which the design team and other disciplines can work together where new patterns of behavior become mandated.

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[4] According to Turner (1969), spontaneous communitas is concerned with the amalgamation of disengaged persons who are outside their native social structure that experience liminality in a fluid and synchronized manner.

Another major advantage of having an interdisciplinary collaboration is having the ability to increase the efficiency of communication among stakeholders by keeping objectives aligned with expectations and by giving stakeholders an opportunity to provide valuable knowledge to facilitate the planning of a design process. This is especially true for large corporate environments where communication is typically segregated between disciplines. An interdisciplinary approach to design process planning can ensure that any vital information pertaining to resources, drawbacks from previous experiences, or any details that may be beneficial, is brought to the attention of all stakeholders. Such an approach is likely to increase the transparency of communication because key components (for example, product objectives, design specifications, and budget constraints) are clearly identified to ensure that different roles of responsibilities are understood among stakeholders. This is important for the successful change of the design process and for ensuring error prevention, efficiency gains, and effectiveness.

It was also found that although the designer and other stakeholders are able to unite to work collaboratively, an interdisciplinary design process has a few shortcomings. Those stakeholders who are enculturated in the interdisciplinary setting are able to join and conform to the norms of the team, thus given the opportunity to share responsibilities, accomplishments, and the benefit of membership as rewards. On the other hand, the drawback is created by those who take advantage of teamwork by not contributing, being aware that others will complete the task despite their absence of input. As a result, the reward structure for teamwork to address this problem should be explored in future research.

Literature Review

Overview of traditional design education and its influence on a traditional design process

To understand the interdisciplinary design process, it is necessary to comprehend the traditional design process as depicted in the traditional design model. This allows one to grasp the shift of design thinking. Traditionally, design was portrayed through a personal relationship between the teacher and the student whereby the student learned how to replicate projects and repeat tasks over a certain period of time in order to gain the required skill set (Lawson, 1994). Cross (2007) explains:

> Traditionally, design teachers have been practicing designers who pass on their knowledge, skills and values through a process of apprenticeship. Design students "act out" the role of the designer in small projects, and are tutored in the process by more experienced designers. These design teachers tend to be firstly designers and only secondly and incidentally teachers. (p. 19)

As a result, it was rare for design as a discipline to be appreciated for academic purposes as the importance and benefits of design were limited to those who practiced it, essentially the designers themselves. Design was a form of task-related activity, which never gained attention in the mainstream literature. In fact, it is only as of the past four decades by the contribution of Bruce Archer and John Christopher Jones's work that design has gradually been considered a "discipline" (although this topic is still debatable) and thus taught to students in the same way as other disciplines, such as the physical and

social sciences (Cross, 2007). Nowadays the application and methodology of design is particularly useful and adaptable to all sorts of fields (Burdek, 2005).

Currently, the utility of design is being explored within all sorts of fields, such as engineering, marketing, and management, as its ability to directly influence material culture is undeniable since virtually every tangible object within modern day society has been "designed" in one way or another (Julier, 2008; Burdek, 2005; Lawson, 1994). Unfortunately, even if design and its potential are apparent, design as a process remains ill-understood and unclear to specialists within other disciplines who are trained in alternative thinking with regards to problem solving (Cross, 2007):

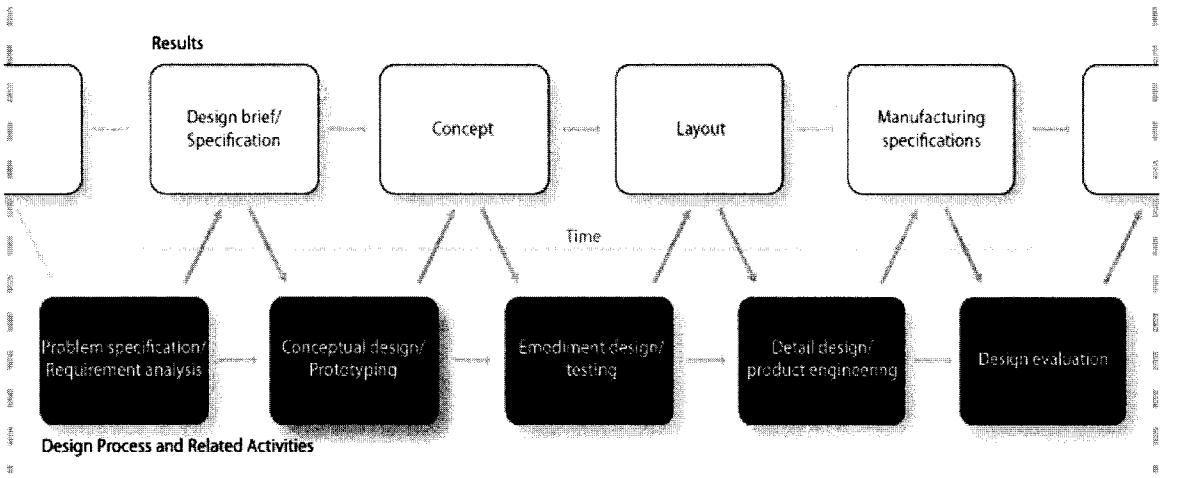
> Essentially, we can say that designerly ways of knowing rest on the manipulation of non-verbal codes in the material culture; these codes translate "messages" either way between concrete objects and abstract requirements; they facilitate the constructive, solution-focused thinking of the designer, in the same way that other (e.g., verbal and numerical) codes facilitate analytic, problem-focused thinking; they are probably the most effective means of tackling the characteristically ill-defined problems of planning, designing and inventing new things. (p. 27)

This translation and manipulation of non-verbal codes requires designers to obtain skills that are uncommon in other disciplines where one finds the focus to be primarily on verbal and numerical skills. Consequently, designers were trained to believe that design is an inherent skill which is specific only to designers. Design education progressively became available through art colleges, has now gained wider acceptance from academia, and is being included within universities (Cross, 2007). Design is practiced and taught in

similar ways, carrying out the practitioner-student relationship and teaching design by repetition through "hands-on" training.

General model of the traditional design process. In an effort to decipher the design process and make it useful for the greater population and other disciplines, practitioners who became teachers began to generalize the design process in order to make it more applicable for the production of products and make it more "teachable." One key objective of this was to pass these skill sets on to a wider audience (Oxman, 1999). Although these generalizations of the design process are modeled in an abstract form, they can be simplified by the commonalities across the different variations (French, 1999; Pahl & Beitz, 1996; Grieves, 2006; Medland, 1992; Ullman, 1992; ElMaraghy & ElMaraghy, 2006; Reijers, 2003). The typicality that best exemplifies the Traditional Design Process Model begins with the problem specification/requirements analysis, followed by conceptual design/prototyping, then embodiment design/testing, next detail design/product engineering, and lastly design evaluation. This is illustrated in Figure 2 below (Grieves, 2006; Scallan, 2003). In many cases, the duration of the design process varies tremendously, but key determinants of time may include the complexity of the product and resource limitations (Wynn, Eckert & Clarkson, 2007).

Figure 2. Traditional Design Process Model



Problem specification/requirements analysis. In general, the problem specification/requirements analysis stage is composed of a collection of information given to the design team. This information could be regarding the market analysis, product specification, or contain other important guidance informing project management[5]. For example, within large corporations, this information can be given in the form of written documents, charts, graphs, and more (Lahiff, Penrose & Huseman, 1996). The information is collated to identify design objectives and aims to shed light on the formation of metrics systems that are used to help the designer create an obtainable product specification requirement that would satisfy various product objectives set out by the project management team. Performance metrics can be related to financial, operational, growth, environmental, economical, or other indicators that an organization identifies (Fiksel, 2009). This is typically the initial phase of the design process whereby

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[5] Project management in this research is defined as directors, leaders, project supervisors, and managers of projects within an organization.

the analysis of problems allows one to plan ahead, which can be crucial to the success of the end product (Pugh, 1991).

Conceptual design/prototyping. This phase is an explorative exercise allowing the designer to generate as many ideas as possible through techniques such as brainstorming, rapid idea development tools, sketching, rendering, and preliminary model production using low fidelity *ready-made* materials (Van Der Lugt, 2005; Stapper & Sanders, 2003). This phase of the design process is an important area for the designer to explore creative ideas to build suggestive design propositions. Ideas that are considered to be illogical, unreasonable, and impossible are encouraged as long as the design proposition can be justified through the benefit of value creation (Keinonen, 2006). For example, an idea may at first appear completely unobtainable; however, it may inspire other designers to bridge gaps between the unobtainable image to potentially realistic design concepts (or inspire other ideas that can be used for other project initiatives) that are both feasible from the standpoint of manufacturability and usability (Kroll, Condoor & Jansson, 2001).

Embodiment design/testing. The embodiment design/testing stage includes those concepts that were identified to have potential from the previous phase and are subsequently developed to test models. These tests models provide guidance to the usability of design through user testing in a laboratory and its overall contextual nature by field testing in its environment of use. The designer will need to learn about the "actual" usability of its design concept from these user tests as the extent of this development in

previous phases is limited to visual images. Both advantages and disadvantages are compared to evaluate the pros and cons of the design proposition.

Detail design/product engineering. After taking an iterative approach to strengthen design features, designers and engineers will frequently start to consider tradeoffs relating to cost, functionality, and other crucial attributes (Keeney & Raiffa, 1976). These elements are examined in the detail design/product engineering stage. Furthermore, this stage determines the manufacturability of the product and thus designs may require modification upon approval from the engineer to determine whether the proposed Bill of Materials (BOM) and General Assembly (GA) is obtainable without sacrificing structural integrity, and without adding costs (Andrews, Mancebo, Runeson & France, 2005). Once the design specification has been determined, it will be ready to be sent off for manufacturing.

Design evaluation/assessment. The designs can be evaluated at this point according to the performance metrics created at the problem specifications/requirement analysis phase (Takala, Keinonen & Mantere, 2006). Similarly to the embodiment/testing phase, the design is now tested by its users in a variety of unforeseen contexts. It is valuable to obtain feedback as a lesson for future projects in order to prevent similar problems from reoccurring. Furthermore, it may be a wise and conscious decision for the designer to use their past and current products in the long term to identify weaknesses for future reference that would otherwise be overlooked.

Responsibilities of the designer within the traditional design process and its impact on design decisions. The responsibilities of the designer are to complete the tasks throughout the phases of the design process in a non-systematic and non-linear approach (Lopez-Meza & Thompson, 2003). As each of these phases call for expertise beyond the scope and knowledge of the designer, it is imperative that active engagement occurs across disciplines in an effective manner. The retrieval of this information is traditionally sought out by the designer to seek help from other disciplines; however, the engagement is typically short as it is simply relevant for the designer to obtain information (Yang, Wood & Cutkosky, 2005; Baya et al., 1992). This information can pertain to manufacturing technicalities, ergonomics and usability specifics, and data involving anthropometrics (Jaasko & Keinonen, 2006). This list is by no means exhaustive, merely it is a list to demonstrate the breadth of knowledge required for product design. Once the necessary information is retrieved, the designer returns to his/her team of designers to feed information in order to implement the information obtained and knowledge gained. Although the designer is encouraged to develop ideas without creative boundaries during the conceptual design/prototyping phase, it is beneficial to seek the opportunity for greater interaction with engineers at this juncture for their expertise and opinions regarding technical knowledge and to identify any manufacturability limitations and/or environmental hazards.

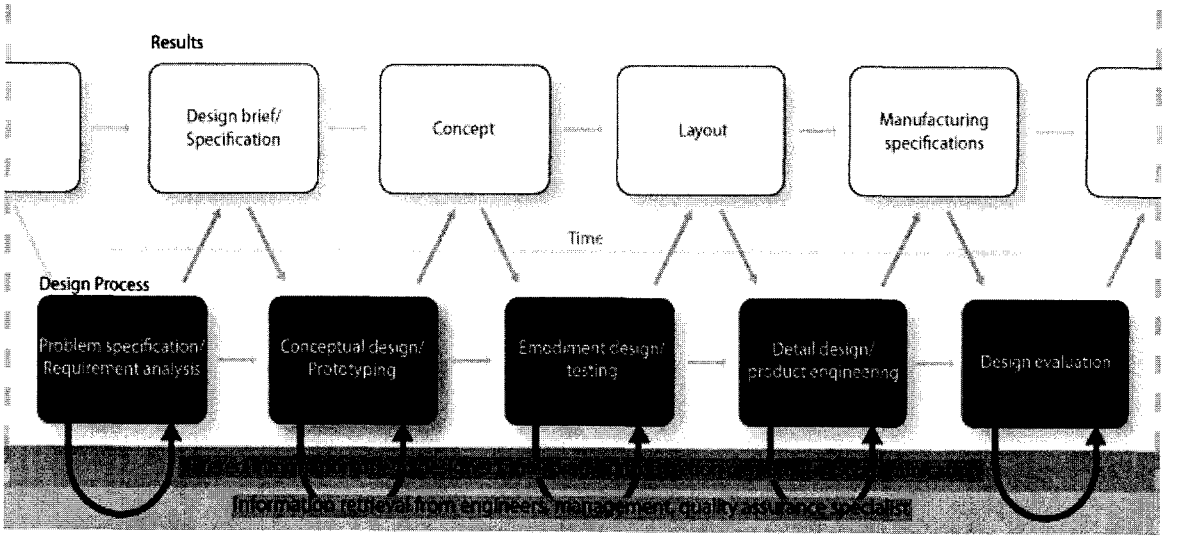
In spite of the fact that creative ideas can be produced during conceptual design/prototyping phase of the design process, it is invaluable to learn the feasibility of core materials and its related applications. This is because time constraints play a large

role in limiting product success (Thiele & Willhelm, 2004). Furthermore, knowledge inquiry early in the design process makes it possible to prevent and/or reduce potential errors that can severely damage the reputation of the product and reduce the quality of its design (Murphy & Blischke, 2006; Moir, 1988). Information retrieval may also occur during the embodiment design/testing phase. As previously mentioned, to test the usability of a particular design or its features, it is conventional practice to conduct usability testing with specific target user groups (Hackos & Reddish, 1998). Depending on the educational training (art college, university or other), the designer may or may not have the knowledge to conduct effective usability tests. To exploit the full potential of the resources required to conduct usability tests, it would be beneficial to carry out pilot tests with the help of research experts prior to administering the actual tests where data will be collected. This is to prevent potential wasted levels of efforts (time and compensation for participants). These additional costs are in addition to wasted time for the conductor. Subsequently, the data are collected and analyzed by the design team in hopes of discovering insights that may be useful. Potential ideas are further explored through an iterative process whereby the most optimal solutions are implemented into the final design (Cross, 1997).

Evidently, it is vital for the designer to retrieve information from multiple disciplines in order to obtain the required information to complete the design process in an effective manner. Unfortunately, communication is insufficient since the role of the designer is to interpret the retrieved information from other disciplines and effectively

translate these depictions into creative results that are meaningful (Goel, 1997; Umeda & Tomiyama, 1997). This process is shown in Figure 3.

Figure 3. The related activities that occur in the design process model and its results



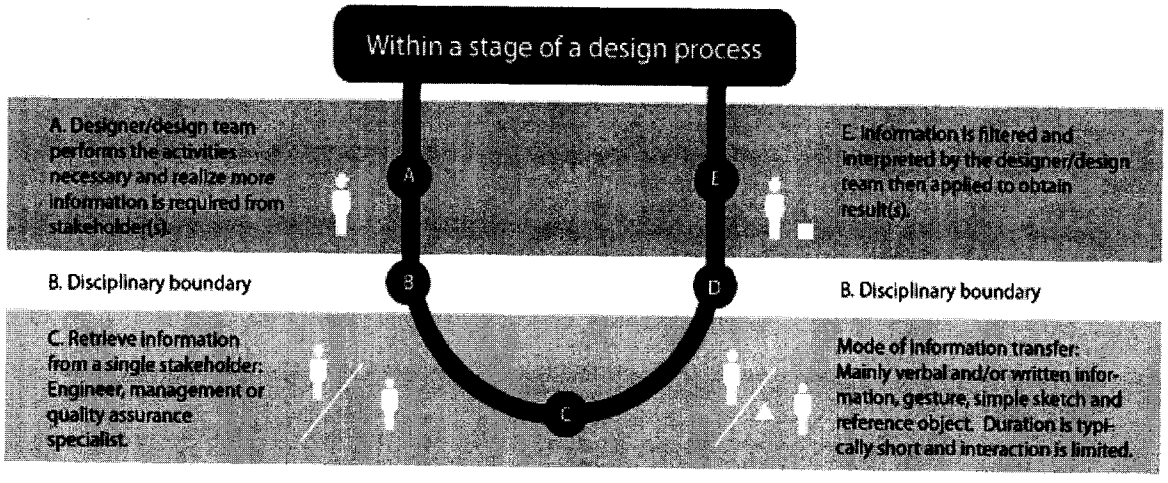
As a result, the success of the product, in regards to its design, is highly dependent on this communication process between disciplines (Hurley, 1995). However, a high dependency of communication presents a challenge as the value of the information transferred from one discipline to another is limited to the designer's effectiveness in incorporating that information to the design as it is determined by experience and skill (Jaasko & Keinonen, 2006; Christiaans & Dorst, 1994; Cross, 2007; Pugh, 1991). With different disciplines often using different forms of jargon or possessing varying degrees of background knowledge, information loss and misinterpretation can potentially occur and create further challenges (Eckert et al., 2005).

Based on this design process model, the designer has a tremendous influence on the final stage of designs; thus, the designer can be perceived as the main contributor to

the fate and design of a product. According to Fabrycky (1987), the activity that takes place during a design process leads to critical judgments taking place such as; for example, appearance, material selection, environmental impact, performance, and cost, all of which account for 70 percent of the final design.

Consequently, it is reasonable for the designer to assume that the design process is naturally inherent to the designer's domain and that the decision-making on design specifications is solely limited to the discretion of the designer (Hellstrom, 2007). This is captured in Figure 4. As a result, the designer very often believes that the information retrieval across disciplinary boundaries is part of the knowledge-sharing process that assists in the completion of design tasks, as opposed to thinking of it within the collaborative design process method (Hellstrom, 2007). Moreover, since the translation of information from verbal or written codes obtained from consultations does not involve specialists from other disciplines, it may encourage the designer to feel as though he/she is the originator and main contributor of the design work, creating a sense of ownership to the design (Von Stamm, 2003).

Figure 4. The filtering of information due to the designer's interpretation, discretion, and failed communication during a cross-disciplinary information retrieval process



Unfortunately, the sense of ownership that the designer holds on to his/her design decisions has the potential to limit outcomes. Furthermore, design critiques that are expressed in the form of written or verbal communication are limited in scope. Design communication is most effective when reference to objects or artifacts can be made since it helps bring a more visual context to the subject matter (Eckert, Stacey & Earl, 2003).

As shown above, the traditional design process that can be effective for small projects is not as effective for large projects where collaborative communication between disciplines is necessary (Hurley, 1995). Within the traditional design process model, there may be a lack of communication due to the designer's attachment to the product. Hence, it is beneficial to explore the merits of an interdisciplinary design process to show its effectiveness to facilitating communication for large-scale projects.

Recognizing interdisciplinary design process as a driver to facilitating communication for large-scale projects

The interdisciplinary design process emerged as advanced technology and global competition called (and continues to call) for a greater degree of knowledge in solving problems with great complexity. As Klein (2000) explains, "problem complexity, economic competition, costs of instrumentation and facilities, the desire to transfer knowledge rapidly… and the interchange of applied and basic research have heightened the legitimacy of hybrid organization and modes of knowledge production" (p. 15).

In the context of a large-scale design project, the design process requires the continual collaborative interaction between stakeholders (Franke, 2007). As a result, the recurring collaborative aspect that is necessary in a large-corporate environment mandates that the activities of design will be a social process. Unlike the traditional design process as practiced in small-scale projects whereby design is carried out in a solitary manner by the designer (as described in Section *Overview of Traditional Education and Its Influence on a Traditional Design Process* of Literature Review), the flow of communication between the designer and the stakeholders determines the success of complex projects in a large-scale environment. As such, the term "communication," as used in this paper, seeks to 1) determine the efficiency of information to channel through all relevant stakeholders ensuring that design requirements are up-to-date which would allow the various teams to understand their roles within the process, and 2) allow the opportunity for all stakeholders to input ideas that they bring from their respective domains to contribute to design solutions in order to achieve a holistic approach. In order

to harness these two aspects of communication, the social aspect of the design process must be encouraged in the work environment to build strong relationships among stakeholders. Moreover, the status and roles that each stakeholder brings along with them must be non-existent during collaborative sessions to allow ideas to be generated.

Design as a social process. Successful design processes must rely on communication; therefore, it is necessary to encourage design as a sort of social process, especially for large-scale projects where complex communication processes are required (Eckert & Maier, 2005):

> Design is never a solitary activity. It is a social interactive process. Complex products are designed by teams of people, perhaps in single companies... Communication can happen between many different people or groups, such as different engineers, project teams, different departments within one company, or between the company, the supplier and the end customer. It has different directions, such as top-down ...bottom-up or in-between. (p. 233)

According to Clark and Fujimoto (1991), good communication that takes place early is an intricate part of the planning process and is able to dramatically speed up design changes by reducing errors and preventing incremental costs. By the same token, in order to harness the collaborative and communicative approach to the design of large-scale projects, the environment in which processes take place must be created to facilitate communication. In other words, it must be organized to promote social interactions, such as negotiation (Henderson, 1999). This is significant as the physical environment of the work setting can encourage or discourage the communal ties of people and create social

experiences within a workspace (Mills, 1977). Furthermore, positive moods can increase the efficiency of decision-making, resulting in quicker turnaround and productivity (Bless et al., 1996; George & Brief, 1992). Applebaum (1987) states, the understanding of social cohesion within a workspace can be organized to facilitate mutual exchange, "the nature of the workplace and the physical arrangements are crucial considerations in establishing consensus and communication at work" (p. 399).

Interdisciplinary involvement in design process planning. The most important aspect of improving the design process is the planning of product development activities, which occurs before the design process itself. Typically, planning activities only involve senior management, which can then limit the amount of communication that is essential to improving the transparency of information (Cheng & Mattor, 2006). Since a significant percentage (approximately 70%) of the costs are determined by strategic and conceptual design consideration (in which the designer plays a major role), it would be particularly beneficial for designers, engineers, and other stakeholders to get involved in the process of planning (Wiendahl, 1970). Although it may be difficult to bring all representatives from all the fields along with the senior management and involve them in the planning of activities, it is vital that work be done in an inclusive environment so that communication can be enhanced between teams to prevent errors (Dean, Schachter, Vincent & Barber, 2002).

Since the design of a product involves solving a series of ill-defined problems (Cross, 2007), there is no specific set of guidelines or definitive solutions. Therefore, it may be particularly useful for experienced individuals from all disciplinary backgrounds

to share information whenever possible. This share of knowledge from experts can help novices and other stakeholders who are not familiar with the process understand and solve problems appropriately by obtaining information that is (Wallace, Saeema & Bracewell, 2005):

- contextual to specific situations
- rational and trustworthy
- precise and based on prior knowledge related to the process and the company

As a result, the involvement of all stakeholders in the planning of the design process and the application of an interdisciplinary approach can also help identify goals and clarify expectations. Hence, it can help better assign tasks that are appropriate for each individual within the design process (Cockburn, 1995). Furthermore, identifying key components and ensuring that the understanding of goals is aligned among stakeholders are two important components for successful changes in the design process and for ensuring error prevention. It also ensures that efficiency and effectiveness can be accomplished (Fricke, Gebhard, Negele & Igenbergs, 2000). Effectively, the interdisciplinary design model's ability to facilitate communication can be readily compared to the phases of rites of passage.

Interpreting the design process as rites of passage

The design process models that are used to teach the designer consist of various stages where techniques and methodologies are applied to complete each stage. The actions that form the design process involve sketching, conversing, and moving between disciplinary boundaries. These are practiced, repeated, and refined to transform one's

skill to a higher level where the designer essentially becomes trained at each stage. These prescribed actions can be compared to the practice of rituals. In this sense, ritual refers to individuals playing roles to "compensate or complement routine social status, not only in the sense of idealized behaviors but in the sense of moment of license and anti-structural activities" (Paden, 2003, p. 36). This approach is parallel to that of the study of ritual undertaken by Victor Turner (1982). Close examination reveals that such stages of activities carried out by the designer are comparable to rituals as practiced in religious ceremonies (Van Gennep, 1960):

> The life of an individual in any society is a series of passages from one age to another and from one occupation to another. Wherever there are fine distinctions among age or occupational groups, progression from one group to the next is accompanied by special acts, like those which make up apprenticeship in trades... Transitions from group to group and from one social situation to the next are looked on as implicit in the very fact of existence, so that a man's life comes to be made up of a succession of stages with similar ends and beginnings... advancement to a higher class, occupational specialization... (p. 2- 3)

By drawing a simple comparison, the designer must make the transition from one distinction to another because every stage of the design process model is accompanied by special acts and roles in which the individual must partake, (Van Gennep, 1960, p. 3): "For every one of these events there are ceremonies whose essential purpose is to enable the individual to pass from one defined position to another which is equally well

defined." These special acts and roles are "prescribed formal behavior" (Van Gennep, 1960, p. 19).

Specifically, rituals can be looked at as rites of passage concerning movement, liminality, and orientation. According to Van Gennep (1960), in his unique contribution to the anthropology study of rituals, the activities associated with such religious ceremonies can be categorized in three major phases known as rites of passage. Similarly to the design process model, rites of passage include successive phases of separation, transition, and incorporation (Van Gennep, 1960). Although there are many rites and even more ways to explain rites of passage, it is best to explain this approach using examples of territorial passage compared with the context provided by the design process model:

Rites of separation. In the simplest form, the rites of separation can be explained by the boundaries that distinguish one territory from another. Just as countries are separated by boundaries and each neighborhood is divided by streets, rites of separation can be viewed as landmarks, objects, social classes, or domain knowledge. This is evident in schools where grades are separated by different classrooms and sometimes situated in complex structural buildings isolated by walls, doors, or are be located on different levels. As Van Gennep (1960) describes:

> The frontier, an imaginary line connecting milestones or stakes, is visible–in an exaggerated fashion–only on maps. But not so long ago the passage from one country to another, from one province to another within each country, and,

> still earlier, even from one manorial domain to another was accompanied by various formalities. (p. 15)

Similarly in the complex social structure of modern society, although not as readily apparent, social class can be identified by district or region. Within the context of the design process in a corporate environment, rites of separation can occur at different stages of the design process and can be identified in multiple occasions. Although the boundaries that separate one design process from another are not always evident or defined, there are distinct separations between each stage (as illustrated in section *Overview of Traditional Design Education and Its Influence on a Traditional Design Process* of Literature Review). Most importantly, there are also boundaries that separate the different disciplines (or social communities) that help an organization function. Each discipline (within a company) can be located and physically distinguished by departments. As a result, in order for a member of one discipline, such as a design team, to acquire information from another team with a different knowledge domain, he or she must pass through doors and attempt to learn and become aware of the lexicon of a language carried by the foreign team. From their perspective, these separations symbolize barriers towards the outside world.

Rites of transition. Rite of transition is the area of neutrality, where according to Van Gennep (1960), there are neutral areas present that separate territories, similarly to the way that streets or halls are pathways that are open to everyone:

> The territories on either side of the neutral zone are sacred in relation to whoever is in the zone, but the zone, in turn, is sacred for the inhabitants of the adjacent

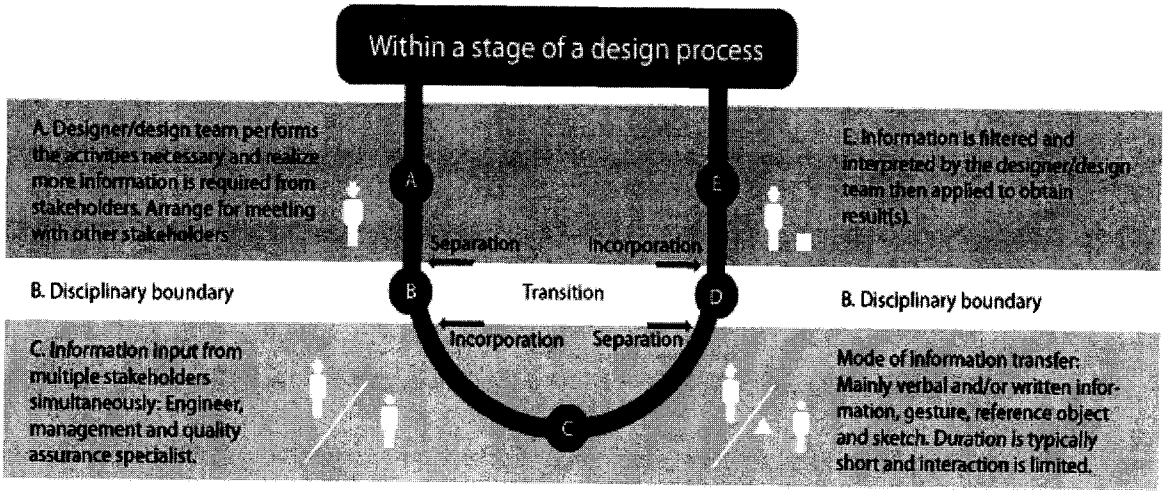
> territories. Whoever passes from one to the other finds himself physically and magico-religiously in a special situation for a certain length of time: he wavers between two worlds. (p. 18)

This may be true; however, as Turner (1969) explains, the liminal period is a type of passage of "betwixt and between" (p. 95) state that plays a major role in allowing for either positive or negative change in social relationships as it is beyond the bounds of social structure. The liminal phase is crucial as it signifies the suspension of social relationships, statuses, and traditional roles. During this period, as time is suspended, one's identity is also in abeyance where their old status is left behind in the domestic world but has not yet established a new status–the one in the foreign world (Turner, 1964). In this regard, the activities, thought process, and decision-making in the liminal period have profound implications as they have the potential to affect the dynamics of social creation as one enters into a new territory.

In the context of the design process, a rite of transition can be described in several ways. This is evident during the traditional design process whereby the designer makes the transition from one department (territory) that could be located in a different building (object), to another department (territory) in order to retrieve information from other disciplines, as shown in Figure 5. In other words, one must separate from their "domain world" (or their own domain of knowledge) and explore the "foreign world." The transition that one (the designer) makes in this example is an important one as this phase determines the designer's status as he or she enters the territory of another discipline to inquire information. If the designer should enter another discipline with a reticent

mindset and unwillingness to accept design suggestions, then this reserved behavior can arguably influence the type of information that can be retrieved and filtered into the final design. This concept is explored in greater detail in section *A Comparison of Interdisciplinary Design Process to Rites of Passage* of the Literature Review.

Figure 5. The three phases as characterized in rites of passage relative to the design activities within a stage of a design process.



Rite of incorporation. The simple operation of the rite of incorporation can be observed as one enters a territory other than his/her own. This territory can be in many different forms, both physical and/or spiritual as Van Gennep (1960) explains:

> The door is the boundary between the foreign and domestic worlds in the case of an ordinary dwelling, between the profane and sacred worlds in the case of a temple. Therefore to cross the threshold is to unite oneself with a new world. (p. 20)

In other words, for a stranger to be transformed into a new and foreign world is in a sense equivalent to gaining acceptance and to be united. It is a sign of a successful

social transformation, becoming a part of a new community, much like the Kipling Ritual whereby students successfully receive an iron ring upon graduation from an engineering program at a Canadian University. The iron ring symbolizes the permanent inclusion into another social status and successful social transformation.

For rites of passage to be complete, one must be accepted and successfully incorporate themselves into a new territory or normative structure. In regards to the process of information retrieval as evident in the traditional design process, rites of incorporation can take place as the designer communicates with specialists from other disciplines to obtain knowledge. This gain in knowledge can be interpreted as a type of offering from the other discipline to the designer. Unfortunately, this social union is limited in that the individuals are united by a mere encounter of information exchange, which is typically short and not desired by the designer (Eckert et al., 2005). Since the information exchange can affect many aspects of a particular design, negotiation is a type of distinctive behavior the designer should not avoid. The implications are important and will be discussed in greater detail in the subsequent section.

A comparison of the interdisciplinary design process to rites of passage

There exist commonalities that can be identified within a design process model using rites of passage. The faithful practice of rituals can be viewed as actions that are taken allowing oneself to move forward on to the next step of his/her life, something which clearly has a sacred significance behind it (Turner, 1968). Similarly, for a designer, exercising the necessary stages of a design process model is like a rite of passage in that it is practiced in a way to make incremental gains to a product that he or she is

responsible for producing. Undeniably, the result of repetitive ritual practice is comparable to exercising a design process that leads to personal and professional growth. This is done by carrying out problem specifications and analyzing and reviewing objectives of the design problem and progressing through with conceptual ideas. These ideas are tested using low fidelity models and video recordings that are then generally utilized for documentation purposes. As such, these observations are analyzed in order to refine and transform the products for practical use and to develop them further with potential production materials.

Likewise, comparing the design process model to rites of passage identifies that territories/barriers/borders are to be passed in order to make progress, gain new insight, and inquire key knowledge that the designer might not have experienced before. As mentioned above, within the traditional design process model, the designer is entrenched into thinking that the design process is limited to his or her control as most of the design decisions are first filtered and interpreted by them before applying this knowledge towards the design. This behavior is apparent as the designer tries to avoid negotiation processes with other disciplines as they feel that their role is to communicate their results externally after the design is complete (Eckert et al., 2005). In this context, it is evident that design is practiced in solitary where decisions are generally made by the designer (or design team as a single entity), and thus, this can potentially place limits for other viable solutions to materialize (Brereton, Cannon, Mabogunje & Leifer, 1996).

Although, this design process model has been practiced and proven to be an effective guideline, there are limitations that arise due to the scope and scale of the

project. This problem could potentially increase with respect to the overall complexity pertaining to communication, which is directly influenced by the increase in number of stakeholders and the complexity of the product (Saariluoma & Isomäki, 2005; Franke, 2007).

Although communication plays a vital role in the success of product development, it is often segregated, and key information is not shared with the appropriate contributors of the design process (Tomiyama & Amelio, 2007). Therefore, it is critical that the designer and the stakeholders progress through the design process as collegially as possible to establish a common discourse and narrative. Otherwise, the information that is identified can directly influence the quality and the overall understanding of that information, as the following contextual information can potentially be missing (Eckert et al., 2005):

- completion of tasks
- history and context of information
- application of information
- modification to processes

These limitations are direct results of segregation of communication and are major risk factors that can create disastrous results in large-scale projects. Moreover, it has the potential to prevent the successful design process planning, which requires the effort and involvement of all stakeholders (Brennan, Gupta & Taleb, 1994). Therefore, the transparency of information is heightened and can prevent the loss of information,

which generally occurs as design specifications created by the designer are passed on to other stakeholders at the end of the design process (Yang et al., 2005).

Problem specification/requirements analysis. As mentioned in section, *Overview of Traditional Design Education and its Influence on a Design Process* of Literature Review, problem specification is perhaps the most important stage in a design process; it has the ability to set critical paths that determine the proceeding activities during the respective design process model. Although product objectives and its target market are generally determined by management, which in turn are highly influenced by marketers, the designer or the design team leader should still be present at these meetings to prevent any miscommunication or a possibility in a lack of contextual nature for product objectives (Eckert et al., 2005). Clarity of product objectives can assist in the accurate analysis of problem requirements or constraints that can guide the designer to formulate problem-solving procedures (Stacey & Lauche, 2005).

Interdisciplinarity is essential in this stage of the design process as the intermingling of disciplines can establish a common understanding of product objectives and thus, work towards the product requirements more cohesively across an organization. Expectations can be clarified when jargon language can be understood by all stakeholders in order to align them and to ensure that all have an equal understanding of the development process (Brown, 2001). Furthermore, although the design process model is non-systematic and non-linear, problem specification/requirement analysis typically occurs at the beginning of a design process, making it even more critical to establish trust and understanding for all stakeholders who are involved (Ellis & Wainer, 1994).

Conceptual design/prototyping. Designers rely heavily on visual representations, such as sketches, drawings, or reference objects as a form of communication (Arnheim, 1969; Ferguson, 1977). Although speech and hand gestures can be used to communicate basic ideas, visual representations, such as sketches, remain crucial to illustrate details (Goldschmidt, 1996). Consequently, sketching and drawing are the main means of idea generation for the designer, making this design stage the most difficult to work on collaboratively with other stakeholders. The exchange of sketches can facilitate communication as a form of visual dialogue allowing viewers to draw inspirations and insights (Schon, 1983; Vincenti, 1990; Latour, 1990). On the contrary, the absence of sketching may limit the depth and breadth of discovery for conjecture solutions for a design problem (Lawson, 1994).

Although sketching plays an important role in the conceptual design stage, stakeholders can otherwise support the generation of ideas by researching existing designs for the designer or find other means of communication (Ahmed & Wallace, 2004). One of the most practical methods of communicating without the use of sketches is by developing low-fidelity models, such as cardboard, foam, or from other ready-made materials (Ivey & Sanders, 2006; Stappers & Sanders, 2003). Research has shown that this type of engagement is especially effective in large-scale projects that allow design intentions to be communicated while breaking disciplinary boundaries in the design process that would otherwise be practiced exclusively by designers (Tuikka & Kuutti, 2001). Concepts that involve the input of all stakeholders have shown to be more holistic

and are able to cover a level of depth that is normally unobtainable by designers (Christiaans & Venselaar, 2005).

Embodiment design/testing. With more input from various stakeholders to evaluate concepts, the benefits of designs are more realistic and advantageous when planning subsequent design stages and post design activities (Makino, Barkan & Pfaff, 1989). Design flaws can be quickly corrected and potential ideas that are otherwise not feasible in high volumes are resolved for mass manufacturability early in the design process (Fiksel, 2009). Moreover, clarifying uncertainties can have the benefit of improving long-term efficiency during the hand-over of information for post design activities (Fiksel, 2009). As a result, significant time savings can be quickly realized which are typically caused by the delay of information transfer or the absence of communication causing unknown uncertainties (Suh, 1999).

Design and testing involving an interdisciplinary approach has the potential of being more inclusive, allowing the knowledge gap to be covered by diverse skills and techniques that are specialized by specific disciplines (Keates & Clarkson, 2003). Furthermore, the various disciplines, along with user-testing, can apply these techniques to assess the full potential of the product pertaining to its utilitarian nature or usability requirements (Wilson & Corlett, 1995; Nielsen, 1993).

Detail design/product engineering. In the preparation of a design specification hand-over, the designer typically works together with engineers to figure out details for manufacturing purposes (Pugh, 1991). Engineers can work with the designer collaboratively to analyze choice of assembly and selection of materials to meet cost

targets that are beyond the realm of the designer's expertise. This has a profound effect on influencing the overall quality to the final design and its retail cost (Boothroyd & Dewhurst, 1987). To ensure the clarity of information prior to the transfer of information, it is imperative that the designer learn manufacturing details or stress limitations as to prevent future problems that may occur later in the design process (Pugh, 1991). Problems that are typically found later in the design process, or closer to manufacturing, are the most costly to repair and may not even be corrected until the next release of the product. Unfortunately, this means that users may be exposed to the problems, and thus it can potentially harm the reputation of the product (Thompson, 2005). According to Nevins and Whitney (1989), problems pertaining to manufacturing due to design faults are extremely costly and should be detected as "teardown at final assembly," which can "cost as much as half the total manufacturing cost" and is the main reason that "companies put considerable emphasis on detecting faults before product is completely assembled" (p. 221).

Another important aspect is the communication with quality assurance teams to put forth a quality control strategy to ensure that the design result matches the design intent. The involvement and participation of a quality assurance specialist during the design process has been found particularly beneficial in the planning for a quality control strategy, greatly reducing long-term cost and detecting problems by proper inspection (Nevins & Whitney, 1989). It allows the transition of information to be clear and predictable and thus preventing communication issues. Moreover, it gives the opportunity for the quality assurance specialist to provide feedback to the designer from previous

designs (Li, Ross, King, Staples & Jing, 2004). This information is essential to the incremental improvements that the designer can reiterate for future designs, which are rarely documented due to time constraints (Valtanen, Ahonen & Savolainen, 2009).

Design evaluation/assessment. Design evaluation is crucial for information gathering in future design projects and process optimization. As the designer is typically rushed into work on other projects, new product designs are assessed only after the production. This is done by utilizing the feedback received from focus groups and customer service associates. As such, important information can be missed, which could be used for future purposes to assist other disciplines, such as engineers, quality assurance specialists, and senior management, all of whom play major roles in overseeing risk prevention within the product development process (Jones, 1992).

Newer and older designs can be used as reference objects to effectively permit communication for design evaluation. Communication with the designer can be made using reference objects making past designs crucial for conveying design problems that require special attention (Eckert et al., 2003).

Interpreting the interdisciplinary design process. It has been observed that highly intricate designs are advanced through social encounters and frequent exchanges of information by means of negotiation between the designer and the other stakeholders (Bucciarelli, 1994). Communication can be in the form of speech, gestures, sketches, low or high-fidelity models, reference objects or a combination to get across core information as clearly and effectively as possible (Bly, 1988; Eckert & Stacey, 2001). As a result of the improved communication that occurs on a frequent basis, the designer and

stakeholders can work together towards common goals and establish common parameters to accomplish objectives (Goodwin, 2000).

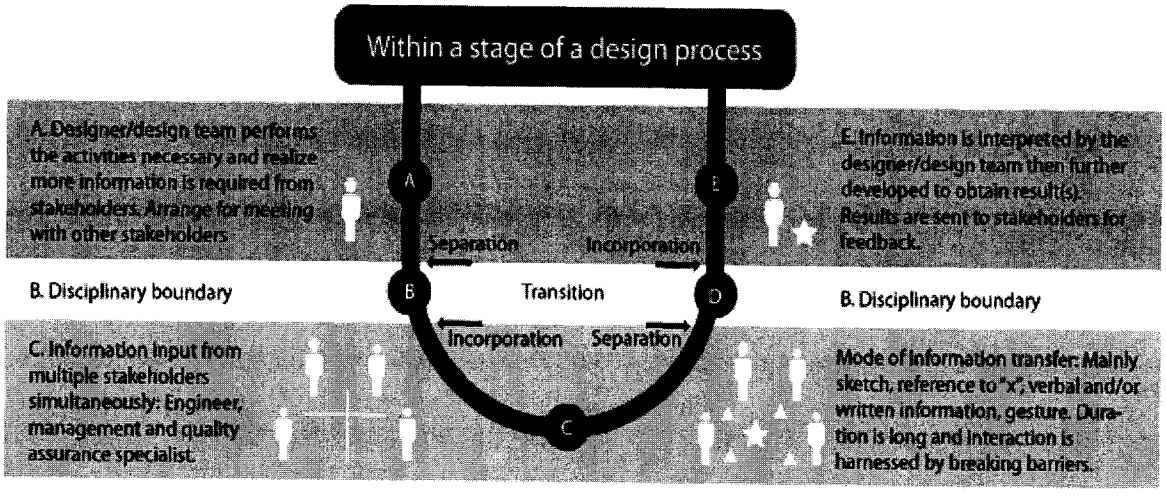
It is imperative that the designer recognize that the design process model, in which he/she has been trained in and currently practices, has now changed. This shift is vital to the success of large-scale design projects. Moreover, the implication is that communication can no longer be segregated in the design process model. This design process model, when compared to a form of ritual, is more effective if taken in a collaborative and communicative approach along side stakeholders in large-scale design projects. The collaborative approach is more effective than the alternative where the designer is used to the continual practice of the traditional design process, which is largely practiced in solitude and is limited in its ability to communicate across the organization (Eckert et al., 2005). The traditional design process can be compared to the purpose of repetitive ritual practices with the primary goal to perfect the existing set of activities. This ideology, or utopia, as Mannheim (1936) distinguishes is the revolutionary transformation that brings the practitioners of a set of rituals towards a new and relatively superior state. Thus, this superior state would ensure that the successful collaborative effort which is required to ensure that communication is efficient and that the flow of ideas from all stakeholders are reflected in the final design solution.

Rites of separation. In an interdisciplinary design process, the designer is encouraged to brainstorm for ideas with specialists from disciplines to solve specific problems that can arise pertaining to design-related activities. This can be compared to a recent graduate who now must depart from his/her educational institute and enter a new

phase of his/her life–an environment that is more uncertain. The recent graduate prepares for his or her transition from one state to a new state similarly to a designer who is in preparation for transition from one state, which is the state of designing in solitude, to another, which is the state of designing collaboratively.

Rites of transition and incorporation. As mentioned in the Literature Review, once the designer leaves their territorial unit, in this case the departure from their design team, the designer is in the midst of a period of transition. These transitions, or otherwise known as liminal periods, are important in social structure of society as they signify a change in social relationships (Turner, 1985). The liminal period, highlights the change that the designer is making by attempting to enter a different social structure other than his/her own. In other words, it is an entry into a temporary subculture. This transition is much like Turner's (1979) view on liminal social relationships that are evident in pilgrimages. In this context, a pilgrimage is symbolized in the design world by the path that the designer takes from his domestic community to another, as such producing a social process that links the two communities. The linkage between the two communities is only possible during pilgrimages as it is a phase where social structural qualities are not present - according to Turner's list of binary opposition, communitas is the antithesis of structure (Turner, 1974). As a result, this pilgrimage that the designer makes during the liminal period unites the two communities into a single entity by breaking the traditional social structure that separates the two (Turner, 1969; Moore, 2009.)

Figure 6. The three phases as characterized in rites of passage relative to the interdisciplinary design activities within a stage of a design process



This communitas (anti-structure) during the period of liminality within the context of rites of passage is critical as social relationships are suspended and thus allow the unity of the two communities. Therefore, the traditional design process and the interdisciplinary process differ in the following two respects:

1. In the traditional design process, the designer assumes the role of key decision-maker and information retrieved from other disciplines is subject to change based on the designer's discretion.
2. In the interdisciplinary design process, the designer (and other disciplines) are encouraged to keep an open mindset and prepare to engage in negotiation and argumentation processes that are intended to help generate ideas for product development in a holistic sense.

The collaborative engagement can allow ideas to be generated in a manner that crosses multiple disciplinary boundaries. The result could be ideas that the designer, or a

design team itself, could not generate as illustrated in Figure 6. Hence, it is imperative that the design process is planned strategically to encourage this interactivity between disciplines, and the practice of social design behaviors (for those who are in the collaborative engagement) by breaking formalities of structural boundaries to immerse into a mode of spontaneous communitas. This spontaneous communitas, according to Turner (1969), are concerned with the amalgamation of disengaged persons who are outside their native social structure:

> Subjectively there is in it a feeling of endless power. Is there any of us who has not known this moment when compatible people–friends, congeners–obtain a flash of lucid mutual understanding on the existential level, when they feel emotional or cognitive, if only the group which is felt (in the first person) as "essentially us" could sustain its inter-subjective illumination. This illumination may succumb to the dry light of next day's disjunction, the application of singular and personal reason to the "glory" of communal understanding. But when the mood, style, or "fit" of spontaneous communitas is upon us, we place a high value on personal honesty, openness, and lack of pretentions or pretentiousness. (p. 45)

Hence, the open mindset (or "openness" as Turner describes it) and willingness to work in unity by putting aside former status are essential in creating a bond among those disciplines that are taking part in an interdisciplinary collaborative process (Turner, 1969):

> We feel that it is important to relate directly to another person as he presents himself in the here-and-now to understand him in a sympathetic (not an

> empathetic–which implies some withholding, some non-giving of the self) way, free from the culturally defined encumbrances of his role, status, reputation, class, caste, sex or other structural niche. Individuals who interact with one another in the mode of spontaneous communitas become totally absorbed into a single synchronized, fluid event. (p. 45)

As the designer completes the transition period, the subsequent stage is to reenter a social structure. Prior to being incorporated into a new community, the individual designer may have to establish oneself during the initial encounter with the new community. This can be in the form of a handshake, sharing a meal, or even as simple as a polite greeting, all of which are forms of friendly hospitality that are also basic procedures for incorporative rites. This will allow the designer to first establish a personable relationship, then proceed with an opportunity to continue demonstrating that their unique skills are beneficial to the overall project, which is part of the purpose of an interdisciplinary design process. Furthermore, if teams are encouraged by management to keep an open mind and become receptive to ideas generated from different disciplinary backgrounds, this foreign community may find the designer being able to offer knowledge that is unobtainable otherwise. As Van Gennep (1960) points out, "for a great many peoples a stranger is sacred, endowed with magico-religious powers and supernaturally benevolent…" and "he is outside a given group or society… he is also strong, since he is in the sacred realm with respect to the group's members, for whom their society constitutes the secular world" (p. 26).

During the rites of incorporation where the designer and the other disciplines are engaging negotiation process as a form of design activity, the designer may be able to gain deep intuitive understanding regarding design characteristics that they have never thought of before (Schon, 1983). These characteristics stem from expertise and perspectives that are unique to disciplines that enable a particular skill set or knowledge to be built up (Ponzi, 2002; Blacker, 1995). Likewise, the designer is trained to solve problems in a "solution-focused" manner and think "constructively" towards the culture of an artificial world and other disciplines; for example, the sciences and humanities have their own methods and values of culture, as shown respectively (Cross, 2007, p. 29):

- In the sciences:
    - Methods: controlled experiment, classification, analysis
    - Values: objectivity, rationality, neutrality, concern for "truth"
- In the humanities:
    - Methods: analogy, metaphor, evaluation
    - Values: subjectivity, imagination, commitment, concern for "justice"
- In design:
    - Methods: modeling, pattern-formation, synthesis
    - Values: practicality, ingenuity, empathy, concern for "appropriateness"

It is evident that the education and training elements found in other disciplines are quite different from these in the design discipline. This education, as a result, has a profound affect on influencing perspectives of disciplines and concern over the many attributes of design. By taking an interdisciplinary approach to design, one can apply an

open mind that can enable negotiation and argumentation to take place. It is perceptible and reasonable to argue that the resulting ideas will help build a more holistic design. Moreover, a higher form of efficiency can be obtained since all stakeholders are present to establish discourse and goals are commonly understood. To ensure that this positive flow of communication is possible, the designer and other stakeholders must adapt an open mindset whereby design ownership is shared by permitting everyone to participate. By the same token, a friendly and open relationship between stakeholders must be fostered to allow the activities of design, which are an inherently a social process, to be undertaken in a synchronized manner as in the mode of spontaneous communitas. This mode, which occurs in a liminal period when status and structure are suspended in time, was found to be particularly important when an interdisciplinary design process was compared to rites of passage.

In comparison to the traditional design process where the interaction between the designer and specialists from other disciplines is relatively short and individualistic, the collaborative nature of an interdisciplinary design process is typically interactive and ideally informal. After the social engagement of negotiation and argumentation, the designer is to return to his/her ordinary or domestic environment by going through the rites of reincorporation. However, unlike the traditional design process whereby the designer will return to his design team with knowledge retrieved from this visit, he/she returns with a variety of holistic ideas (Hernandez & Hernandez, 2009). As a result, this return from the other disciplines, the sacred world, allows the designer to retain magico-

religious powers beyond what he/she is ordinarily capable of as it brings along a breadth of knowledge acquired from the visit.

The main objective of this research was to examine the activities of the designer and compare these with the three phases of rites of passage: separation, transition, and incorporation. In doing so, this paper makes an effort to examine the possibility that communication can be improved in an interdisciplinary process from the perspective of the designer. Firstly, the designer is encouraged to separate from their design team to practice idea generation and problem-solving collaboratively with specialists from other disciplines. Once the designer leaves his/her design team, the designer is in the midst of transition, thus not belonging to any formal social structure. In other words, this anti-structure, or communitas, is where social relationships are suspended eliminating all roles, statuses, and previously defined mindsets. Breaking formalities permits the designer to become totally immersed into a mode of spontaneous communitas with other stakeholders. Although this collaborative exchange of information between the designer and stakeholders is a form of temporary engagement, one of the greatest advantages is that it allows both the designer and the stakeholders an equal opportunity to contribute to the idea generation and problem solving process. Thus, the range of input contributed by the collective whole may influence the final design to be richer and more holistic. Moreover, since the information generated from the collaborative exchange would be shared openly among the designer and stakeholders, it is reasonable to assume that it allows communication to be more transparent and accurate, thus sharing a common narrative and discourse. Subsequently, as the designer and stakeholders return to their

respective teams, the relatively accurate information gained from the collaborative exchange would then be transferred and will ensure a greater level of efficiency. However, this efficiency rests on the designer and stakeholder's interpretive ability to share the information in an accurate manner.

In order to gain a better understanding of the real-life practice of an interdisciplinary design process, the methodologies chosen for this research allowed the researcher to take in-depth participant observations, analyses of internal materials, and surveys in a corporate environment where large-scale projects were undertaken.

Research Methodology

Rationale for the research method

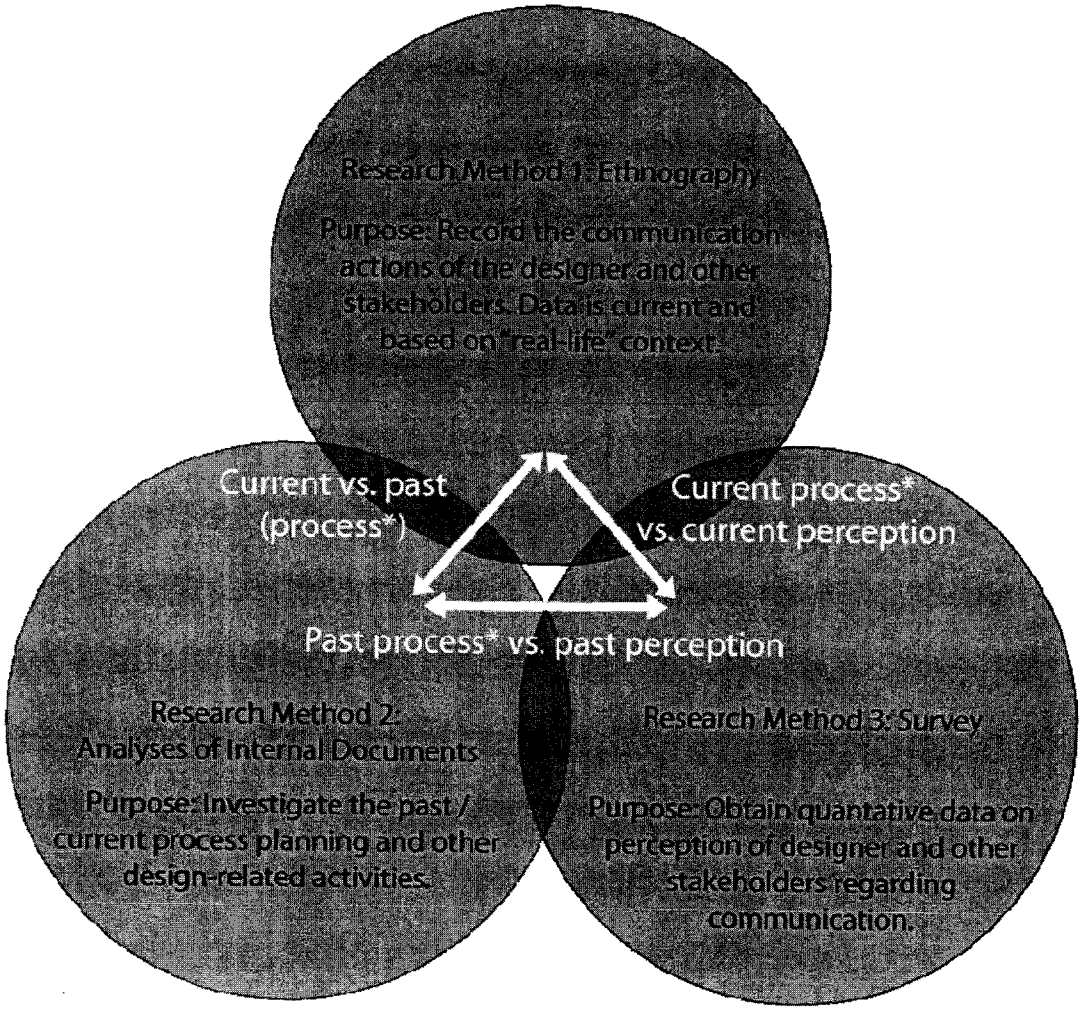
The research methodology used in this research makes an effort to explore the importance of understanding an interdisciplinary approach in the design process and planning for large-scale projects. As such, the research methods were multifactorial in order to triangulate on possible conclusions and implications for the research hypotheses (Flick, 2007):

- Whether an interdisciplinary design process (from the designer's perspective) facilitates communication in large-scale projects?
- Can insights be drawn from an interdisciplinary design process by comparing it to rites of passage?

The research took place in a corporate environment where photographs, audio, and video recordings are prohibited. Consequently, this means raw data were limited to note records and simplified hand-drawn sketches. Since the main goal of the research was to capture the communication actions of the designer and other stakeholders during the activities of a design process, ethnography was an appropriate fit to accomplish these research objectives. This allowed the data collected to be based on "real-life" context that otherwise would be unobtainable by other methods means. Analyses of archival materials pertaining to past and current process planning and other design-related activities of the organization were closely examined (under supervision). Data were retrieved through unstructured interviews whereby the design director gave explanations of their benefits or drawbacks of applying a traditional design process and how communication has changed

by implementing an interdisciplinary design process in achieving long-term goals. Lastly, quantitative data were retrieved through a survey, with a total of 41 respondents who participated in the study. The survey was beneficial as it provided background information on the perception of communication of the corporate employees. Figure 7 illustrates how the three research methods can help the researcher gain an understanding of the corporate environment in which the study was undertaken.

Figure 7. Triangulation for the research methods.



*(Processes/activities/methods are examined and only the information relevant to this research is presented)

Ethnography. The duration of the ethnography took place over eight days to gain familiarity with the designers, their communication methods, and design activities. The researcher recorded all the necessary information including, but not limited to, the physical structure of the departments, the activities that the designers must undertake to communicate with stakeholders, frequency in communication, the methods of communication, the results of each communication, the artifacts used for brainstorming, etc. Despite the benefits of this research, there are two major shortcomings for the participant observations:

1. The degree of participation was limited as the researcher did not have the proficiency or the technical knowledge required to take part in their activities. As a result, participation was only possible dependent upon the skills required for the tasks, and the researcher made clear that observation notes were objective.
2. The researcher was only in the corporate environment for eight days, so it was impossible to observe all activities undertaken through each and every phase of the design process model. During the course of the participant observations, the researcher was able to capture the initial design planning and the conceptual design phase, which were occurring in parallel.

Each observation session was four to seven and a half hours long, enabling the researcher to observe the activities and to truly capture the essence of their daily design and design-related activities. Notes were taken during the observation sessions and were summarized at the end of day, or as time permitted.

The particular difficulty of this short ethnographic research is the restrictive corporate environment in which this study was conducted. Information that was obtained is highly confidential and thus could not be presented in audio recording, video recording, photograph or illustration. All written materials involving the experiments related to the organization (both directly and indirectly) were reviewed by an internal representative for approval. Unreleased products could not be presented in any fashion. Due to this, it was difficult to present results as employees of the organization screened all documentation as a security procedure. Furthermore, the company floor plan and meeting room names have been modified to ensure anonymity.

Data analyses of Ethnography. The structural framework for the purpose of note taking during the observation sessions was guided by an adaptation of Robson (2002) and Crabtree (2003):

1. Space. What is the physical space like and how is it laid out?
2. Actors. What are their roles and relevant details of the stakeholders involved?
3. Activities. What are the actors doing and why?
4. Objects. What physical objects are present?
5. Events. Is what you observe part of a special event?
6. Time. What is the sequence of events?
7. Goals. What are the actors trying to accomplish?
8. Feelings. What is the mood of the group and of individuals?

The framework was adopted to ensure consistency and reliability of results (Jorgensen, 1989; Miles & Huberman, 1994). The focus was on the way people interact

with each other and their environment, as opposed to the minute actions of individuals in a controlled setting (Sharp, Rogers & Preece, 2007). This guideline listed above was extremely helpful to the collection of data as the observation sessions were not in controlled environments. The raw data collected, in the form of notes and sketches, was analyzed using three analytic strategies (Jorgensen, 1989, p. 108-109):

1. Identification of features and elements as insight by assessing the importance of information. The collected notes after an observation session were reviewed immediately to make sure that they make sense and are contextual. Any feature, or element, that was considered of significance to the research was noted. This included information from room size in which the design sessions took place to the seating arrangements and gestures that the stakeholders made while negotiating and (to note precisely when individuals) going through rites of passage.
2. Identification of patterns by filtering through the data and aligning it with the research questions. To accomplish this, the data were examined with scrutiny with the research questions in mind. The structural framework for participant observations was useful in organizing the large amount of notes that were obtained in the field observations. This allowed the ease of comparing each section of the observation sessions to another; for example, the activities regarding first day of the design session can be easily put against other days.
3. The comparison of the identified insight to pattern found in the first and second strategies. Collating the data, and making comparisons of the identified insight to

pattern, shed light on information based on their consistency and frequency. If relationships are identified to occur more frequently, then it is reasonable for the researcher to make assumptions based on these findings.

Archival materials. Fortunately, the organization where the research took place made extensive efforts to document their past design process related activities for reference purposes. The information that was available was abundant and detailed; however, much of it was highly confidential and intended for internal use only. Analyses of past design process and related activities was a vital part to this research as it allowed a direct comparison to the organization's past and current practice (Flick, 2007). Furthermore, it permitted the researcher to ask questions that are contextual and that were directly relevant to the organization process change over the years.

The analyses of archival information were mainly in the form of written notes, computer files, and formal documents. The organization in which this research took place had an extensive inventory of data outlining design and related activities for each product line. In some circumstances, the director of the design team had to explain to the researcher what certain esoteric information meant, especially for jargon and technical terms.

Survey. Respondents had the opportunity to express their opinions (in addition to the choices provided) in designated areas of the survey. This is to ensure that the participants do not feel restricted by having to express their viewpoints with limited options.

The sample of respondents was conducted to recognize two different categories in the organization where the ethnography and analysis of internal documents were undertaken. The first group was composed of the organization's internal stakeholders with disciplinary specialization in industrial design, architectural design, and graphic design. The second group included professionals with non-design specific backgrounds, such as engineering, quality assurance, project management, and project directions. The survey was conducted with 41 respondents.

Results and Discussion

Banks is a major leader in manufacturing computer software technology for graphics tools.[6] The organization has operations around the world that meet the needs of millions of users. In the midst of a poor economic situation, and with a growing competition in the organization's core market, Banks is undertaking reforms to strategize its product development process to become more agile and efficient. The objective is to reduce the turnaround time of a new product, known as "Cloud Project," from the problem specification/requirement analysis stage to product evaluation/assessment stage by 60% in comparison to their current product development cycle. While this is a major milestone to achieve, other criteria such as product quality and usability must be maintained to ensure that the organization's reputation is not compromised.

Analysis of Internal Documents (Supported by Observation Notes) – Background Information on Banks' Current Design Process

It was apparent that after analyzing company documentation, Banks has been practicing a traditional and consistent design process for over 20 years. Similar to the general design process model, as presented in section *Overview of Traditional Design Education and its Influence on a Traditional Design Process* in the Literature Review, Banks' design process begins with the problem specification/requirements analysis,

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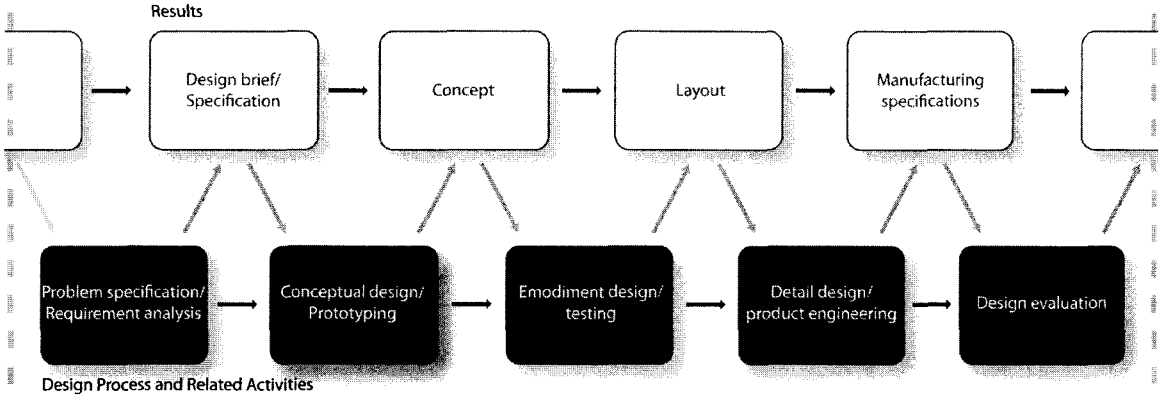
[6] For ethical and confidentiality reasons, the organization in which this research took place, will be represented by a pseudo name known as "Banks." Moreover, the participants, project names, and any information regarding Banks' development cycle will be codified and generalized in order to disguise identities and internal data.

followed by conceptual design/prototyping, embodiment design/testing, detail design/product engineering, and then design evaluation. This is illustrated in Figure 8 (Grieves, 2006; Scallan, 2003).

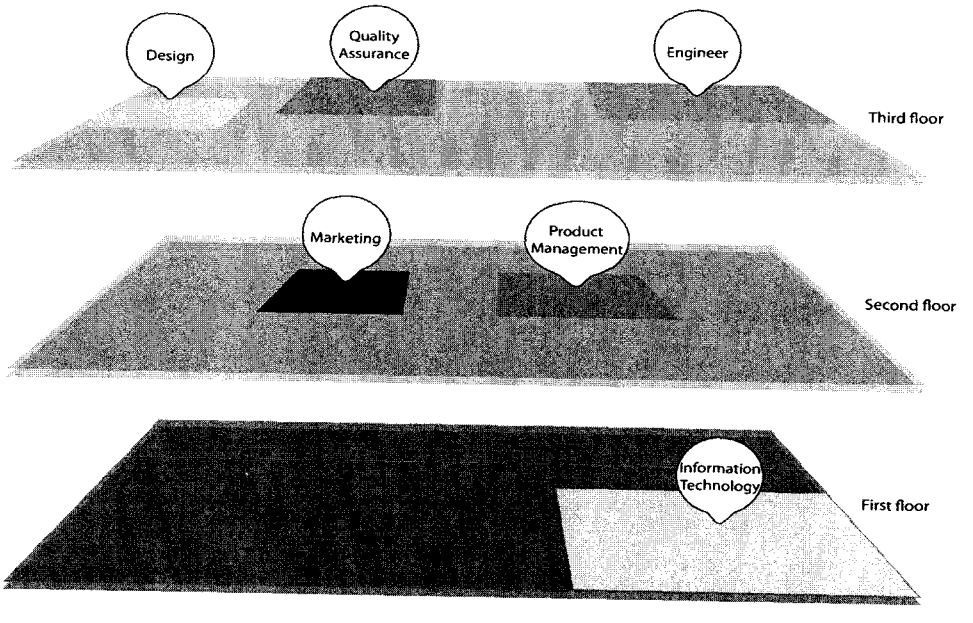
Figure 8. Banks' design process is similar to the traditional design process model.



The collaborative aspect between stakeholders was limited to a sort of information retrieval whereby interaction between stakeholders during the design process was minimal and confrontational. Tension between the stakeholders, especially between the designers and the engineers, occurred frequently in an intense and perceptibly negative manner. This negativity was demonstrated by the tone and unenthusiastic nature of the conversations. In the opinion of the design director, the reason for this negativity was due to a clash of personalities and the self-interest that each individual brought along. Furthermore, people's self interest stems from their intentions and can include their own ideas of what is beneficial to the product, how a design feature should function and even what the behavior of design features should be. According to internal documents, the designer determines the final attributes of design features, which means that the responsibility of the definitive design decision lies with the designer. Unfortunately as speculated, this upsets the rest of the stakeholders and hinders the

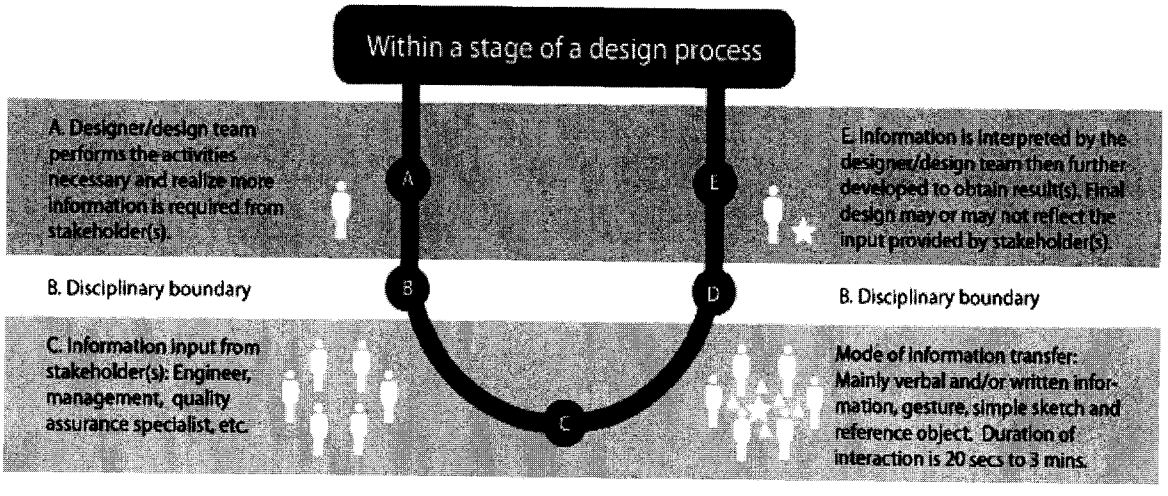
efficiency of communication, as well as the ability to share ideas. This lack of efficiency was evident during the researcher's eight-day observation sessions of one of Banks' design departments, which will be discussed in greater detail in section *Observations – Adapting an Interdisciplinary Design Process for the Cloud Project* of Results and Conclusion. Collaboration between stakeholders was limited to e-mails and brief meetings. Stakeholders included project managers, project directors, architects, design teams, engineering teams, research teams, and quality assurance teams. Each team was scattered over a large building complex. As confirmed by the researcher, traveling from one department to another would mean a two-to-five minute walk through doors, requiring the use of elevators or stairs and making appointments in advance. The physical location is illustrated in Figure 9 below.

Figure 9. A simplified floor plan indicating the location of each department relative to each other.



Consequently, relatively longer meetings (30 minutes to 1 hour–requiring more than four stakeholders from varying departments) were held occasionally as they were challenging to arrange. As a result, much of the communication took place through e-mail or by phone. On the other hand, when technical or additional information was needed pertaining to design decisions, relatively short meetings were preferred where a designer would first e-mail or call by phone to ask for accessibility, wait for confirmation, and then proceed by walking to the respective stakeholder's department. For example, to obtain input from an engineering department, the designer must leave his/her design department, travel through a series of hallways, and then enter the engineering workspace.

Figure 10. The typical activities undertaken by a designer to retrieve information from other stakeholders.



Person-to-person meetings were typically short (between 20 seconds to 3 minutes) as they involved only one designer and in most cases one other stakeholder. The general mood of the encounter can be at best described as awkward, with no acknowledgement

nor greeting of the designer's presence from the engineers who work in nearby cubicles. The pattern seemed to be that questions were asked and answered verbally, making references to existing designs, and only on one occasion did the use of simple sketches ever arise as it was necessary to relate questions and answers into the context of the existing product. The sketches appeared to be a series of user interface wireframes of a product the team has been working on, which were drawn with a pen and a scrap piece of paper. The goal was to indicate the exact location of a new button, its size, and functionality. After the discussion was over, the scrap paper containing the sketches was disposed of in the trash. On three occasions, the meeting resulted in frustration without any resolution. As a result, it was common for the designer to make the final decision. Consequently, this decision did not take into account the input that was provided by the engineer. In many cases, communication problems occurred in this manner because the designer had to inform all the stakeholders after making the final decision to ensure that expectations were aligned. This is illustrated in Figure 10. According to the design director, keeping all stakeholders informed and up-to-date was extremely difficult, since multiple projects involving various levels of stakeholders were being worked on simultaneously. Furthermore, the design director claims that "everyone had to know what is happening or problems with resources and milestones [project-related] will be missed."

Over the course of the eight days, observations of Banks' current design process demonstrated that there were three specific problems with their current processes. These issues were reiterated under the guidance of the design director and summarized below:

1. Due to the difficulties involved with arranging frequent meetings in which a large number of relevant stakeholders can attend, shorter meetings are more practical and preferred by everyone. As a result, the interaction between the designer and other stakeholders was short and static.
2. During these short meetings, the designer has assumed responsibility of the final design decisions, regardless of the input he/she received from the other stakeholders. This clearly prevents ideas from being shared.
3. As a result, the efficiency of communication was poor, as keeping all stakeholders up-to-date and aligned with changes to the final design decisions was not achieved.

Evidently, there are communication problems that exist within Banks' traditional design process. The following section attempts to further capture this by summarizing the responses of the 41 Banks' employees who filled out the survey.

Survey Results Summary - Banks' Current Communication Problems

The survey summary, which is divided into three sections, has helped to provide some background information on the perception of communication of Banks' employees. The first section explained the respondents' perception towards the efficiency of communication between stakeholders. The second section aimed to look at the respondents' perception on the holistic quality of design solutions. Lastly, the third section attempted to find some key patterns that are revealed from participant observation data. Respondents had the option to not answer any of the survey question(s) by selecting "not applicable" as an answer. This option was available for the following two reasons:

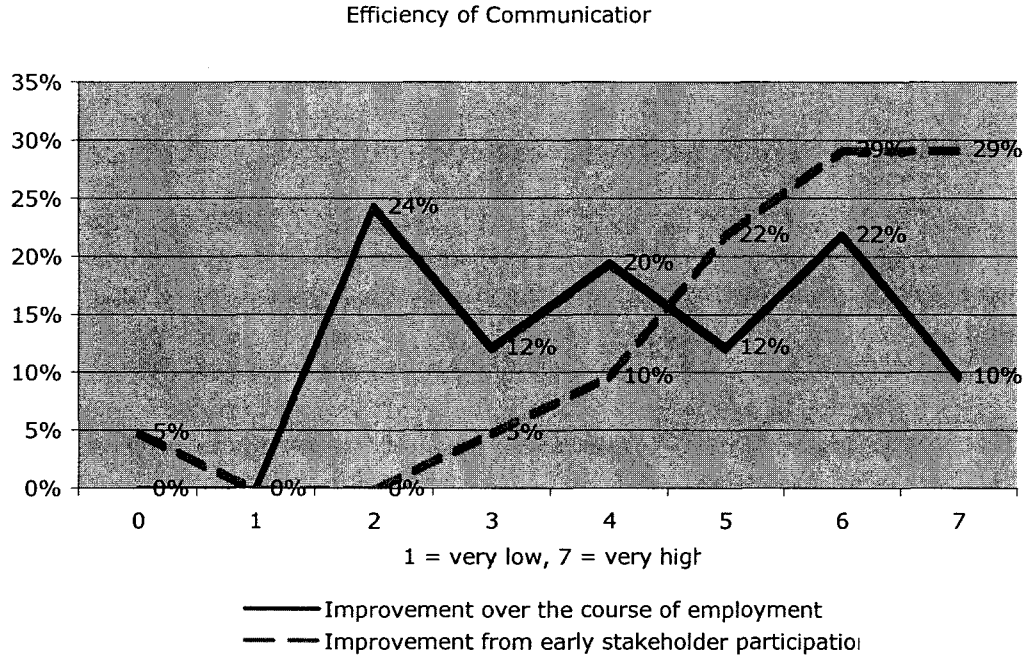
1) respondents may not want to answer the question for any particular reason, and 2) perhaps the question is not applicable to the respondents.

A total of 41 respondents participated, including the employees who engaged in the participant observation sessions (which will be discussed in the subsequent section) - 5 members from the design team, 15 quality assurance specialists, 18 engineers, 2 product managers, and a product director at Banks. An electronic copy of the survey was distributed to a correspondent of Banks who reviewed the survey content and then made it available to employees via e-mail. The employees of Banks have never been subject to previous surveys or studies over the period of their employment, thus this survey provided a new venue for employees to express their opinions. Out of the 41 respondents, 41% have been employed with Banks for over 10 years, 29% for 5 to 10 years, and 27% for 1 to 3 years.

Efficiency of communication. The survey clearly stated the definition of efficiency as the accuracy in the exchange of information and the ability for information to be kept up-to-date among stakeholders. Based on this understanding, respondents were firstly asked to name all of the stakeholders that should be involved in the design process to ensure that the efficiency of communication can successfully take place. Since 41% of respondents had worked with Banks for over 10 years, it was important to see whether communication had improved among stakeholders during the course of their employment. The graph in Figure 10 shows that a significant portion of respondents (80%) felt that communication had improved by having all stakeholders take part early in the design process. Most importantly, the majority of respondents believe that it is critical

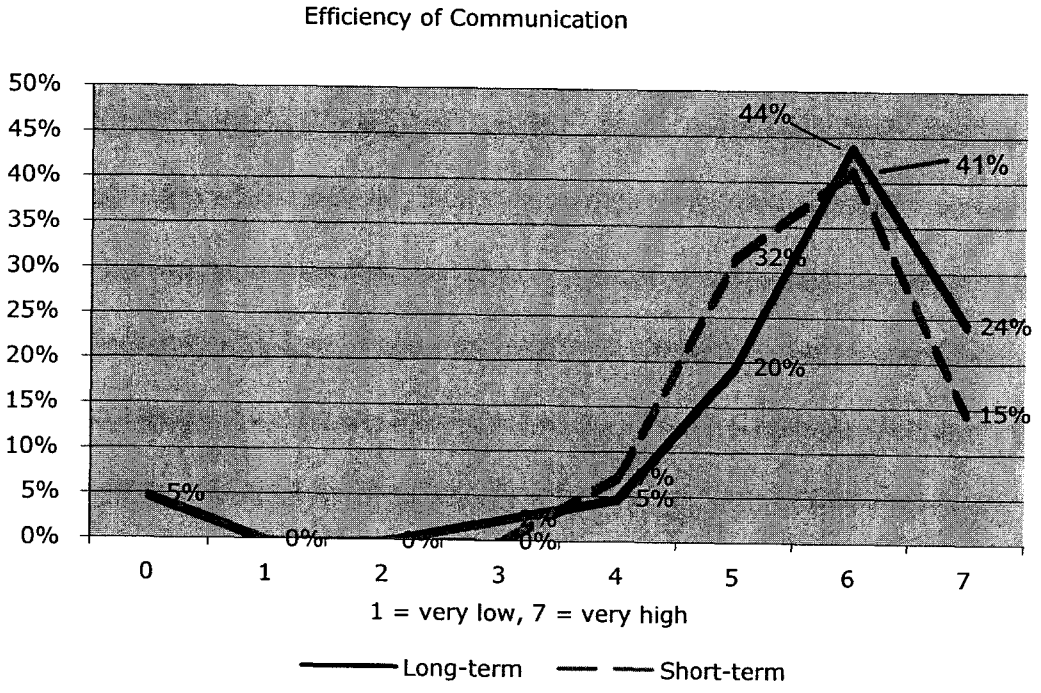
for all of the stakeholders to be involved in the process to ensure that efficient long and short-term communication takes place as illustrated in Figure 11 (88% and 88%, respectively). Non-designers feel that their inputs are not being taken into consideration. As expressed by one survey respondent, "if others [stakeholders] feel that their ideas will immediately be shut down, they will tend to shy away from offering suggestions." This is further reflected from the survey results as 24% of respondents felt that the efficiency of communication among stakeholders has not shown noticeable improvements over the course of their employment while the percentages of the other responses were evenly distributed (Figure 11).[7]

Figure 11. Improvement in efficiency of communication.



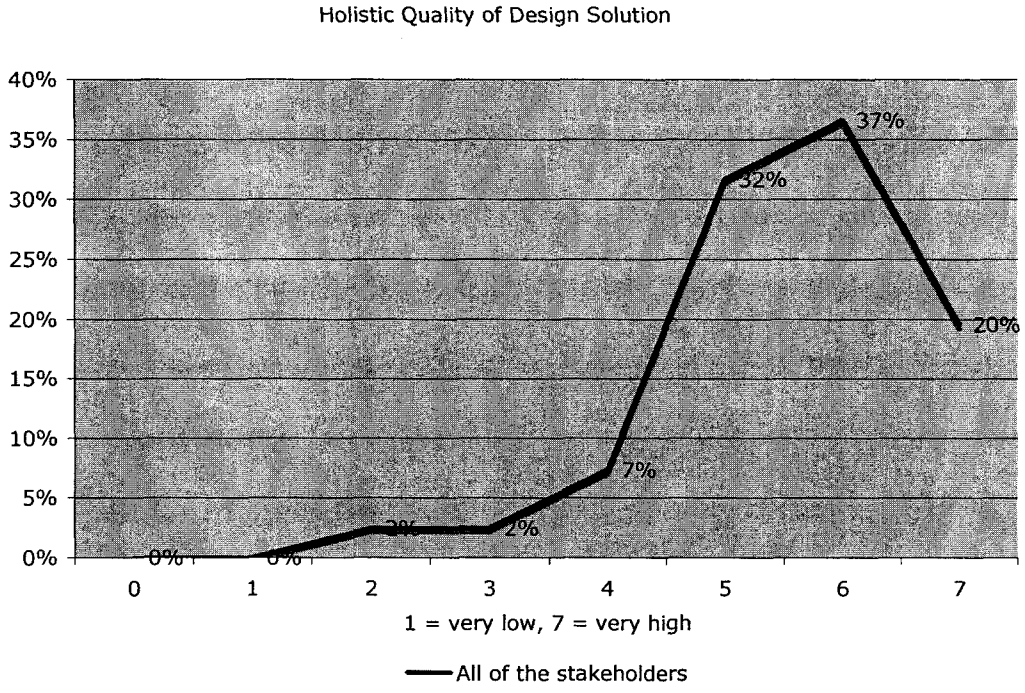
[7] On a scale of 1 to 7 where 1 represents not important and 7 represents very important, 24% of respondents responded with 2.

Figure 12. Stakeholder involvement for long-term and short-term communication.



Design solution. This section of the survey attempts to note the involvement of stakeholders and how this can impact the holistic quality of design solutions. Similar to the previous section of the survey, a series of questions asked the respondents to list all of the stakeholders who should be involved in the design process to foster design solutions that are as holistic as possible and whether they have noticed communication improvements over the course of their employment. Results were similar to the previous section. A high majority of respondents (89%) felt the involvement of stakeholders is able to influence the quality of design solutions in a critical manner. Figure 13 shows the results.

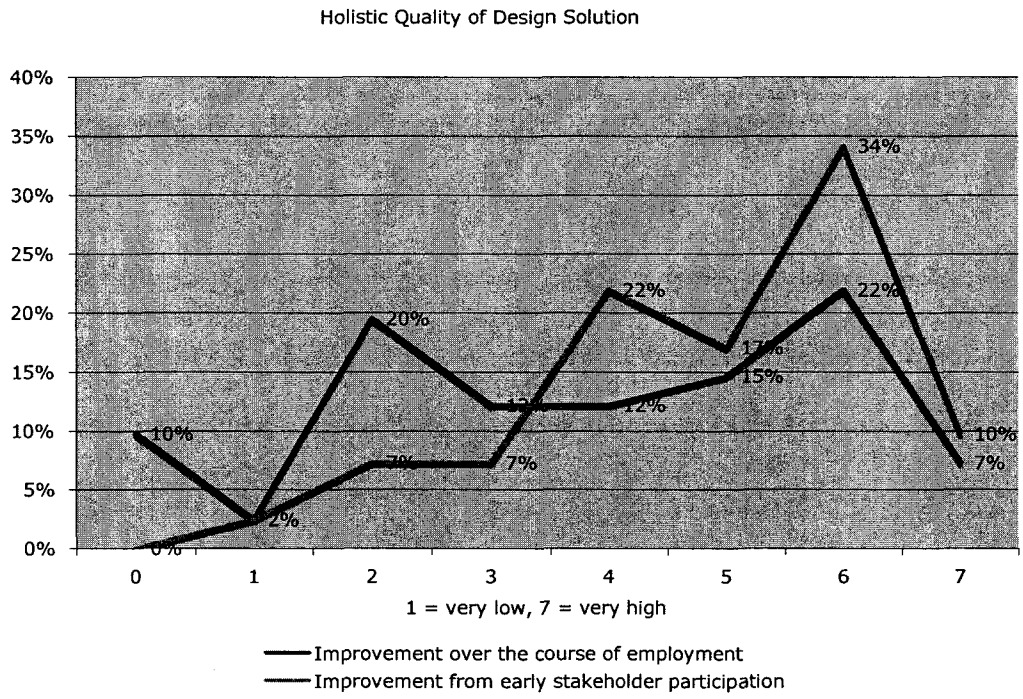
Figure 13. Stakeholder involvement in effecting the holistic quality of design solutions.



It is also interesting to note that there was a relatively even distribution of among the participants' responses when asked whether communication has improved among stakeholders over the course of their employment (Figure 14).[8] However, a significant portion of respondents felt that communication has improved by having all stakeholders participate early in the design process.[9] This increase is important as it signifies an improvement in communication in the perception of respondents.

On a scale of 1 to 7 where 1 represents not important and 7 represents very important:
[8] 10%, 2%, 20%, 12%, 12%, 15%, 22%, and 7% of respondents responded with NA, 1, 2, 3, 4, 5, 6, and 7, respectively.
[9] 17%, 34%, and 10% of respondents responded with 5, 6, and 7, respectively.

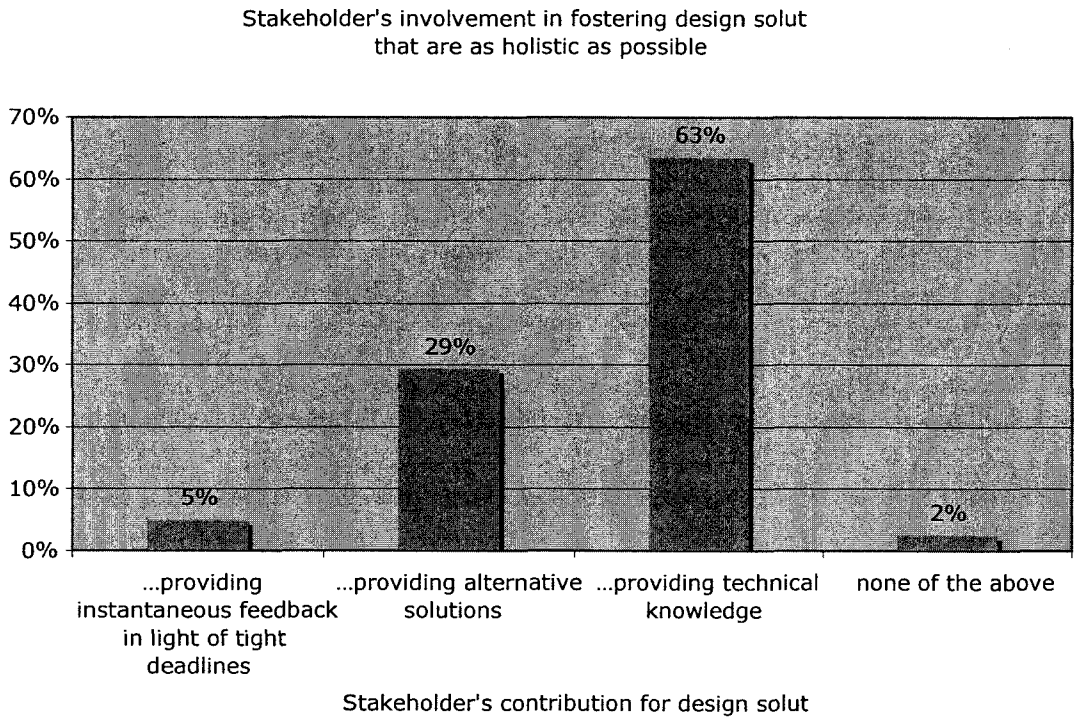
Figure 14. Improvement in holistic quality of design solutions.



Interestingly, Figure 15 shows that the two main attributes cited by respondents were that stakeholders are able to provide the design team technical knowledge (63%) and that the involvement of stakeholders is able to provide alternative solutions (29%). Perhaps, one may infer from this that the design team can benefit from the additional technical knowledge that is provided by other stakeholders because the design team alone is lacking the technical knowledge that is required when thinking of alternative design solutions. Furthermore, a very high percentage of respondents (95%) cited that designers have tendencies that prevent other stakeholders in becoming involved in idea development of the design process. This is to be expected given that one respondent's comment implied that a dominating behavior was needed as "conviction is necessary in the discipline and translates into power struggles with those who are unable to manage

their own conviction or have none of their own." Another respondent pointed out that designers' tendencies to prevent other stakeholders in becoming involved depends on "individual egos" which can impact the design process "by preventing stakeholders from contributing as much as possible. Also it prevents them [stakeholders] from getting familiarized with the product from early on which would beneficial at a later time."

Figure 15. How the involvement of stakeholders can help foster design solutions.



Miscellaneous. This section of the survey looked to confirm some of the details that were identified as significant to the rites of passage from the participant observation. A very high proportion of respondents felt that meetings taking place in common

meetings rooms would encourage open discussion for equal contribution[10] and that the presence of a member of authority would encourage equal contribution among stakeholders (70% and 68% respectively).[11] The implication is that designers have been preventing other stakeholder from participating in design-related activities; as a result, it was expressed by the majority of respondents that it was very important for designers to encourage open discussion (83%)[12]. Moreover, a respondent commented that "the designers tend to make it clear that the design work is their responsibility, which can disempower others who are making suggestions." While it may be difficult to encourage open discussion, it is important to do so as a very high proportion of respondents (53%) show likelihood to provide suggestions when equal contribution is expected among stakeholders.[13] This implies that all stakeholders, despite their disciplinary background should be given equal opportunity to provide design-related suggestions. Furthermore, where equal contribution is expected, 81% of respondents felt that the likelihood for their suggestions to be taken into consideration by other stakeholders is greater.[14]

Not surprisingly, the survey results reinforce some of the key problems that were expressed by the design director and the analysis of past internal document. However, the main issue, as brought up by many of the respondents' comments, is related to the way designers prevent other stakeholders from participating in the design process, which

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On a scale of 1 to 7 where 1 represents not important and 7 represents very important:
[10] 13%, 39%, and 18% of respondents responded with 5, 6 and 7, respectively.
[11] 45% and 23% of respondents responded with 6 and 7, respectively.
[12] 13%, 30% and 40% of respondents responded with 5, 6 and 7, respectively.
[13] 28% and 25% of respondents responded with 6 and 7, respectively.
[14] 18%, 20% and 43% of respondents responded with 5, 6 and 7, respectively.

clearly prevents ideas from being shared. Ninety-five percent of respondents replied with "yes" when asked whether designers have tendencies to prevent other stakeholders from becoming involved in the idea development stage of the design process. It is reasonable to assume that the reason for this is due to the designer's responsibility of the final design decisions, regardless of the input he/she received from the other stakeholders.

Observations: Adapting an interdisciplinary design process for the Cloud Project. Introducing the "Kick-Off" Process Meeting and Design Idea Development Sessions.

Realizing that there were major communication problems within the design process that Banks was employing, the design director of the Cloud Project had decided to implement a new strategy to improve the efficiency of communication. The objective was to reduce the turnaround time of a new product, known as Cloud Project, from the problem specification/requirement analysis stage to product evaluation/assessment stage by 60% in comparison to their current product development cycle. Instead of dividing the teams by departments (i.e., design department, engineer department, quality assurance department, etc.) where processes are typically separate, the teams were now divided into three levels of stakeholders for the Cloud Project. The tertiary stakeholders included those stakeholders that represent all other internal functions that supplement resources outside the immediate development team. The secondary stakeholders included the executives, which oversaw the entire operation of the product. Finally, the primary stakeholders (otherwise, referred to as the development team) consisted of a core member from project management, the design director, design team, engineering team, and quality assurance team. This group was directly involved in producing the "tangible" aspects of

the product. According to the design director, the primary stakeholders were arranged in such a fashion to make everyone on the team more accessible regardless of team and position.

In an attempt to further increase the efficiency of communication and define boundaries within the group, the primary stakeholders were expected to participate in a series of *"kick-off" process meetings* and *design idea development sessions*. The purpose for the "kick-off" process meetings was to allow the project management and design director to introduce the members of Cloud Project to the rest of the development team and to strategically plan the design process to ensure that the Cloud Project meets the unconventionally short turnaround for public release. The purpose of the design idea development sessions were to create preliminary design specifications by ensuring that the technology chosen for the Cloud Project can meet both short and long-term objectives. Collectively, the "kick-off" process meetings and design idea development sessions were symbolic mediation of group formation as these activities were attempts to bring a new order to the relatively young group. Evidently, the importance of encouraging open participation was significant (and well received by the stakeholders) as not all stakeholders were previously involved in these activities. This was indicative of an attempt to adapt an interdisciplinary approach to design decision-making and is also reflected in the survey results. Approximately 81% of stakeholders were likely to provide suggestions where equal contribution was expected.[15]

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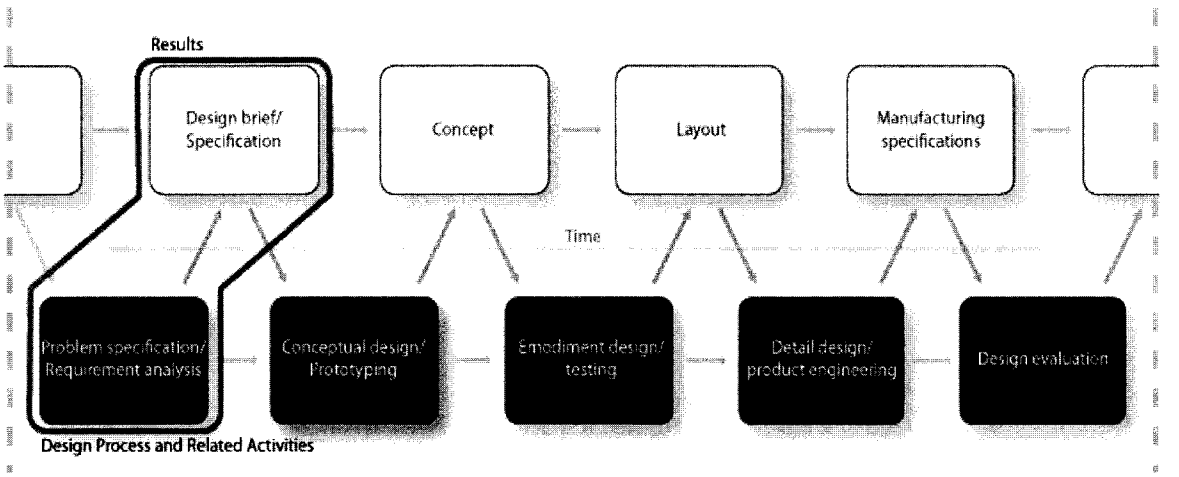
[15] On a scale of 1 to 7 where 1 represents not likely and 7 represents very likely, 18%, 20% and 43% of respondents responded with 5, 6 and 7, respectively.

The "kick-off" process meeting and the design idea development sessions were undertaken in a manner that was very similar to the interdisciplinary design process model as described in the Literature Review. It permitted all the stakeholders to collaboratively: 1) help plan for the subsequent activities of the design process and 2) participate in contributing to design decisions.

In regards to the design process model, the "kick-off" process meeting and the design idea development session were part of Banks' problem specification/requirement analysis phase. This is illustrated in Figure 16.

Figure 16. The "kick-off" process meeting and design idea development session were part of Banks' problem specification/requirement analysis activities for the Cloud Project.



Observations from the "kick-off" process meeting for the Cloud Project. According to a brief discussion with one of the participating designers whose role in the Cloud Project was to extrapolate research information, the "kick-off" process meetings were a significant "first-step" in establishing "trust and personal relationships." This never existed before as the design process that was practiced by Banks for over two

decades was followed religiously with minimal modification. As a result, Banks' traditional process has not allowed relationships to be established. The participating designer elaborated that alteration to the process would have required a complex restructuring of the entire functioning of the corporation. Furthermore, the designer continued to explain the difficulty by emphasizing the territorial aspect of the large corporate environment.

The designer's facial expression and hand gesture revealed moments of frustration and defeat, especially when the designer talked about the initial "kick-off" process meeting. Complete silence was the response given when the topic of design process planning was brought up. It was apparent that any sort of discussion regarding the modification of the current design process was considered taboo as the participating designers and others who were present appeared strongly resistant to modifications. Non-verbal cues included direct eye contact between members of each team while other members looked down at the immediate space in front of them in apparent disbelief. As shown, although no direct hesitations were expressed, the non-verbal communication and reaction spoke highly of resistance. The silence of those who were present persisted until the project manager and the design director proclaimed that the Cloud Project was an experimentation to test new development processes to increase the competitive edge of Banks. Moments after, one of the participating designers had dramatically taken out a piece of paper, which he/she claimed to be an existing design process map of Banks, tore it, and threw the pieces on the table while grabbing a dry-erase marker from the nearby whiteboard to prepare taking notes for the meeting. Although this action appeared

dramatic, no one seemed surprised or reacted unusually, and the silence persisted. Seconds later, the mood started to change as the participating engineers began to suggest a variety of product development processes that are popular but not typically practiced by the company. Another moment of silence broke out minutes later due challenges among people in attempting to understand the product development terminologies. To overcome this problem, one of the participating engineers started drawing a flow-chart on the whiteboard to explain the intricacies of the product development process involved while another engineer connected his laptop to a projector to display supplementary information from the Internet. It was evident at this point that the moods and outlooks of the individuals were beginning to be more positive. Excitement and interest increased significantly as demonstrated by increased participation and volume. Subsequently, the participating designer raised minor concerns that the development processes were merely guidelines and that the team must adapt and modify them substantially for internal use in order to fulfill the resource requirements. The design team then elaborated on the concerns by using the whiteboard to illustrate their points. It was followed by a series of intense arguments between different primary stakeholders. These concerns were important within each department and would otherwise not be known to primary stakeholders. Everyone present appeared to be surprised and a newfound appreciation for communication used to overcome inter-departmental difficulties was achieved. From the enthusiasm and the concerns of those who were present, it was obvious that change was inevitable for the success of the Cloud Project and that it was extremely difficult to achieve this change without communicating more effectively and frequently.

From this point on, the "kick-off" process meetings (total of three, average of two hours each) continued with the inclusion and engagement of all primary stakeholders over the course of three days in three different large meeting rooms away from each of the primary stakeholder's individual departments. The meeting rooms were spacious, providing large rectilinear conference tables in the centre and more than sufficient chairs for all stakeholders. Writing materials, such as paper, pen, whiteboards, dry-erase markers, were readily available and a multimedia system was accessible for computer projection. One factor that was surprising was the seating arrangement as it appeared to be in a random order. Right from the first meeting, the stakeholders arrived to the meeting rooms individually and independently selected seats that were available; as a result, the teams were segregated around the centre conference table without any conspicuous division between teams. By the same token, although all stakeholders participated in the meeting, it was noticeable that a number of participants were more active in participating than others. However, perhaps this could be indicative of the personalities in the rooms, where it is inevitable for some extrovert individuals to be more outspoken than others. Those who were less active opted to volunteer for other tasks; for example, a participating engineer was responsible for creating a summary of the meetings to send out to all the primary stakeholders to ensure that the minutes were captured for documentation purposes. At the end of the last "kick-off" process meeting, a document was produced that outlined the entire product development "roadmap" for the Cloud Project. It included the roles of all levels of stakeholders and the how, what, when, where, why of the high-level activities pertaining to each stage of the development

process. This document was then made accessible to primary, secondary, and tertiary stakeholders through a shared internal network which will be revised in the future if necessary to keep everyone updated. As a result, all primary stakeholders were able to act independently but were well aware of the activities pertaining to the Cloud Project. In a brief discussion, the design director claimed that, "this form of communication is critical as it allows functions [stakeholders] of all levels to plan accordingly based on resource, especially since there are other projects that are being developed simultaneously."

The implication is that this sort of communication was far more efficient as the team was able to accomplish three complicated logistics: 1) design process planning, 2) distribution of information, and 3) ability to confirm the accuracy of the information from the "kick-off" process meetings. Although the design director insisted that the planning was far from complete, it had already improved the communication between the primary stakeholders to produce a draft of the product development roadmap that would have otherwise taken weeks to produce. Furthermore, the range of ideas and knowledge that was present at the meetings from the various disciplinary backgrounds were more copious and thought-provoking than its predecessor.

Observations from the Design Idea Development Sessions for the Cloud Project. Soon after the "kick-off" process meeting, the design director arranged for a series of team design idea development sessions through e-mail. The team openly discussed the details of the e-mail. The design director set the stage by explicitly asking all participating stakeholders to contribute regardless of their own, or others', perception of the quality of ideas. The objective was to produce specifications which involved

ideating to generate an inventory of available technologies and suitable product solutions for the Cloud Project's design platform.

According to one of the participating designers, these design idea development sessions were different compared to past idea development sessions in that: 1) all primary stakeholders were present and were expected to contribute as opposed to being restricted to the design team and 2) the idea development environment took place in common meeting rooms that did not belong to any of the departments. According to the survey, these two factors are important as results reveal that 89% of respondents thought it was critical for all stakeholders to be present to ensure that design solutions were as holistic as possible.[16] More than half of the respondents felt that common meeting rooms were critical to encourage equal contribution among stakeholders.

Similarly to the "kick-off" process meetings, there was a long period of silence in the beginning of the design idea development session. In fact, discussion among the primary stakeholders became initiated only once the quality assurance team brought a bag of chocolates along. This ultimately changed the quiet mood to a relatively casual environment full of jokes and sarcastic remarks. The jokes and remarks related to the calorie intake of the chocolate and the danger of eating more junk food. Everyone present took at least one piece of chocolate. Comparing this observation to the "kick-off" process meetings, it appears that those participants who were quiet remained to be so even in a casual affair, such as sharing chocolate and chatting, making it reasonable to assume that

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[16] On a scale of 1 to 7 where 1 represents not critical and 7 represents very critical, 32%, 37% and 20% of respondents responded with 5, 6 and 7, evenly.

the difference in the level of participation as observed in the recent meetings was due to the personalities of the individuals - those who appeared to be relatively introverted spoke minimally and vice versa. The session finally begun as one of the participating designers asked for general impressions of viable technologies that can be used for the Cloud Project. The information was presented on a projector screen. Without hesitating, the participating engineers joined in the discussion by explaining that certain technologies would not permit the Cloud Project to obtain compatibility with other technologies in the long-term. Shortly after, the participating designers and engineers became engaged in a lengthy negotiation process using the whiteboard and through speech. In the duration of two hours, there were occasional moments of frustration demonstrated by facial expressions and hand gestures as members from one discipline did not understand the technical jargons of the others; there were also moments when the discussions were misinterpreted. For example, the terms *proof of concept* and *prototype* were misinterpreted on two occasions during this session between the designer and the engineer. According to the designer, a prototype can also be considered as a concept, which is a representational model of a design that is neither definitive nor functional. On the other hand, the engineer argued that a prototype, which is also known as Alpha or Beta, must be functional for testing purposes and resembling the final design. However, overall in the end, the first idea development session was productive from a relationship-building and communication perspective (despite not appearing productive towards the development of the project). Stakeholders across teams were beginning to acknowledge

each other by such comments like, "that was a good question," "what does everyone think," and "that sounds great."

Over the course of the next couple days, the subsequent meetings began with a relatively casual tone, mostly filled with jokes and sarcastic remarks. Surprisingly, all primary stakeholders had agreed that the first design development session was unproductive. In an attempt to prevent this from happening again, the participating engineers, designers, and quality assurance specialists agreed to build a list of key objectives together and then prioritized the items with the rule of no critique allowed. The mood changed gradually, and it became evident that the frustration level lowered. There was laughter in the negotiation process and technical jargons were replaced by casual conversation and frequent immature jokes. The topic of these jokes mainly concerned some deficiencies of Banks' past products. Interestingly, this topic was frequently brought up throughout the meetings, serving as the main topic of casual conversation where the more experienced stakeholders would share their past experiences with those who were interested. From then on, the team had created an architectural blue print for the Cloud Project weighing both the pros and cons of each technology. In this regard, every option that was available was evaluated collectively as a team. The participating designers evaluated the implications of the technology from the user's perspective while the participating engineers evaluated them from a technical standpoint. The product manager assessed the marketability of the results and the quality assurance specialist documented the results in preparation for a test plan. A total of five design sessions were observed with each approximately two hours long. It was only at the third meeting that

the general mood began to change as arguments were constructed into meaning and individuality evolved into synchronicity.

Similar to the design "kick-off" meeting, one member of the idea development session documented the activities and collated the results. Later, this was distributed to all the primary stakeholders. This has demonstrated to be an important aspect of communication since secondary stakeholders began to ask questions regarding the decision-making process that occurred with the selection of technology and future forecast. All primary, secondary, and tertiary stakeholders were included in the e-mail thread to encourage interaction and ensure transparent communication.

Analyses of Observation Notes – Summarizing the "kick-off" Process Meetings and Design Session Within the Form of Rites of Passage

By undertaking participant observations, the researcher was able to record the design activities in a corporate environment where a large-scale project was produced. This following section has made an effort to explain how an interdisciplinary design process (from the designer's perspective) facilitates communication for a large-scale project by drawing comparisons to rites of passage. For the purposes of this research, two aspects of communication were being investigated: 1) efficiency, in terms of being accurate, up-to-date and 2) contribution to establishing holistic design solutions.

Through the three "kick-off" process meetings and the five design idea development sessions, the researcher was able to observe changing attitudes demonstrated by the participating designers and other stakeholders. From the static and short meetings, typically ranging from 20 seconds to 3 minutes in duration, in which

design information used to be exchanged between two to three stakeholders, meetings were now much longer (average two hours). Moreover, interaction between stakeholders had visibly increased. The result coming out of the "kick-off" process meetings and the design idea development sessions was collaborative effort from all stakeholders. The major influence for this change was the design director's initiative to increase the efficiency of communication in order to reduce the product development time by 60%. To accomplish this, his/her attempt was to have as many stakeholders participate in the design process planning and related activities as early in the development cycle as possible. The goal was to get as much feedback on the Cloud Project as possible from the primary stakeholders and to leverage their past experiences and technical knowledge. This proved to be an important step towards improving communication since 88% of stakeholders agreed that it was critical for a collaborative involvement to ensure the efficiency of communication for long-term projects.[17] Moreover, another 88% of stakeholders felt that it was critical for a collaborative involvement to ensure efficiency for short-term projects.[18] Consequently, the endeavor to move the project forward had the design director believe that the collective input from all primary stakeholders was of great value.

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[17] Long-term communication: On a scale of 1 to 7, where 1 represents not critical and 7 represents very critical 30%, 43%, and 15% of respondents responded 5, 6, and 7 respectively.

[18] Short-term communication: On a scale of 1 to 7, where 1 represents not critical and 7 represents very critical 20%, 44%, and 24% of respondents responded 5, 6, and 7 respectively.

Initially, the participating designer and the primary stakeholders appeared to experience difficulty in openly contributing ideas, which may have been influenced by their past restrictive rules. These old rules permitted the designer to have full responsibility to make final design decisions limiting other stakeholders from attempting to contribute realizing that opinions may be neglected.

By closely examining the "kick-off" process meeting and the design idea development sessions, it became clear that there was a more efficient way of communication, as demonstrated by the activities undertaken by the designer and his/her interaction with the stakeholders. As an effort to clearly identify the patterns of activities, an analysis of the "kick-off" process meeting and the design idea development sessions was done independently using the three phases of the rites of passage (Van Gennep, 1960). Subsequently, the patterns of activities and insights identified are compared and summarized in Table 1 using an adaptation of Jorgesen analytic strategies as a guideline.

"Kick-Off" Process Meeting. It was especially important that these meetings took place in common meetings rooms that did not belong to the designer or any of the stakeholders. By doing so, the designer was able to depart from his/her domestic territory and separated himself/herself from the rest of the design team (leaving his/her normal social structure). This separation of the designer from his immediate environment created the opportunity to unite all stakeholders and encouraged them to leave behind their previously prescribed roles. As a result, 70% of stakeholders[19] felt that it was important

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On a scale of 1 to 7, where 1 represents not important and 7 represents very important:
[19] 13%, 39%, and 18% of respondents responded with 5, 6, and 7, respectively.

for the meetings to take place in common meeting rooms to encourage open discussion and form new work relationships.

Secondly, it was crucial for the design manager and the design director to proclaim that the "kick-off" process meeting was an experimentation to test new development processes to increase the competitive edge of Banks. This gave the liberty to all stakeholders of the meeting to openly provide ideas without having to worry about any repercussions. Up to 73% of stakeholders[20] believe that it was important for a member of authority to encourage open discussion for equal contribution among stakeholders. Furthermore, 68% of stakeholders would very likely provide suggestions during a meeting where equal contribution is expected[21]; thus, this further demonstrates the significance of encouraging interdisciplinary collaboration by an authoritative figure.

Thirdly, the act of the designer tearing the existing design process map can be compared to the elimination/separation of past ideals, such as caste, class, roles, status, or hierarchical ranks, in order to welcome new ideas. During this period as time is suspended, the designer's identity is in abeyance where his/her old status is left behind in the domestic world but he/she has not yet established a new status–the one in the foreign world. Elimination of the designer's past ideals is important so that the designer could enter into the meeting with an open mind and willingness to accept design suggestions. Otherwise, his/her reserved behavior can arguably influence the type of information that can be gathered and processed. As many as 29% of the stakeholders felt that the

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On a scale of 1 to 7, where 1 represents not important and 7 represents very important:
[20] 5%, 45%, and 23% of respondents responded with 5, 6, and 7, respectively.
[21] 15%, 28%, and 25% of respondents responded with 5, 6, and 7, respectively.

involvement of other stakeholders can help foster design solutions that are as holistic as possible due to providing alternative perspectives to the designers. It is at this precise moment that all stakeholders are transitioning through a period of liminality. It is important to emphasize that the elimination of the past process sets up new opportunities for change; thus, this transition, during which the stakeholders are seeking a new process, can be characterized as being outside of the normal structure. In addition, the stakeholders being equal in status enables the sharing of ideas since the previously defined and distinct responsibilities are not as relevant anymore. This is precisely the communitas, as defined in Turner's (1969) study of rituals, whereby the sense of togetherness is created when individuals are undifferentiated.

Table 1

A summary of patterns and insights that were identified by comparing the "kick-off" process meeting and the design idea development session to the rites of passage.

Rite of Separation	
"Kick-off" Process Meeting	Design Idea Development Session
• Meeting took place in unconventional rooms outside of the departments of the primary stakeholders. • The design director's proclaimed that the "kick-off" process meeting was an experiment to test new development process to increase the competitive edge of Banks. This provides all primary stakeholders the opportunity to contribute equally. • The opportunity to contribute equally was reinforced by the designer's action of tearing a previous design process map. It also symbolizes the death of previously defined rules and roles, thus, eliminating the normal social structure.	• Meeting took place in unconventional rooms outside of the departments of the primary stakeholders. • The design director's e-mail stating explicitly that all attendees at the session were expected to contribute created the opportunity for all primary stakeholders to contribute ideas.

Rite of Transition (Liminal Period)	
"Kick-off" Process Meeting	Design Idea Development Session
• Duration of the meeting was on average two hours. • Static conversation was eventually replaced with jokes. • Problem-solving was performed together. Although the effectiveness of the communication was slow in the beginning, this eventually changed by the second meeting. • Technical jargon was replaced with casual language supplemented with diagrams drawn on the whiteboard. • By the third day, communication was relatively synchronized, and the designer/stakeholders shared a common experience working in social equality. • This social union among the designer and the primary stakeholders is transient, making it a form of spontaneous communitas.	• Duration of the meeting was on average two hours. • Mockery toward one another was eventually replaced with jokes. • Problem-solving pertaining to design was performed together only after the participating designer and the primary stakeholder agreed that previous meetings were unproductive. • Technical jargon was replaced with casual language supplemented with diagrams drawn on the whiteboard. • By the end of the second day and the beginning of the third day, communication was fluid and conversation was casual. The designer and stakeholders share a common experience working in social equality. • This social union among the designer and the primary stakeholder was short and temporary making it a form of spontaneous communitas.

Rite of Reincorporation
"Kick-off" Process Meeting and Design Idea Development Session
• After the meeting, the participating designer and primary stakeholders return to their respective departments. Since all primary stakeholders were present at the meeting, changes were e-mailed to keep everyone up-to-date. The information transferred through e-mail is also more accurate due to the contextual nature of the information.

Design Idea Development Session. Similar to the "kick-off" meeting, it was important that the design idea development session meetings took place in common meeting rooms that did not belong to any of the stakeholders. As a result, each stakeholder was outside their normal social structure, thus, enabling the possibility for collaboration between stakeholders to take place. With interdisciplinary collaboration as part of a development requirement (as made explicitly clear from the e-mail sent out by the design director), the designer had to change his/her status from the role of decision maker to design participant. This metamorphosis occurs during the rites of liminality. Additionally, it was expected that all participants contribute regardless of his/her own and others' perception on the quality of ideas during the design sessions. This enforced a change of status of all stakeholders by entering the meeting with the expectation to have an open-minded discussion. This e-mail symbolized the elimination/separation of past ideals, such as caste, class, roles, status, or hierarchical ranks, to allow new ideas to be generated. Due to the email setting the stage for a new way of working together, the stakeholders entered the meeting with the expectations of engaging with equal status partners and shared ideas, which their previously established codes of behavior or responsibilities would prohibit.

By carrying out the design idea development session, the collaborative aspect of ideating is an occasion for the designer to engage in a temporary subculture whereby design is through societal participation of all stakeholders. This implies a period during which design ownership, although existent, should be shared as the participation of all stakeholders is critical to meeting the reduced deadline with great result. However, to

arrive at this absence of ownership has proven to be difficult, as each stakeholder's perception of an ideal solution was vastly different from the rest and everyone present had his or her own self-interest. As evident from the observation sessions, trust was absent and mockery of the other team was frequently made, creating unnecessary intimidations and forming boundaries. It was not until the third session that the apparent negativity began to cease where all stakeholders came to the realization that working together was inevitable in order to complete the project on time and be successful.

The mood of the subsequent sessions was far more positive in that communication was fluid and that the mockery made was regarding people and events outside of the immediate group of primary stakeholders. Although the relationship between the stakeholders cannot be described as friendly, it evolved from strangers belonging to different disciplines to a kind of equal partnership which manifested itself over time. Undeniably, the designers and the stakeholders moved free from the "culturally defined encumbrances of his role, status, reputation, class," as Turner (1969, p. 45) claims, and became immersed into a homogenized act to solve common problems. Such a participation creates an intimacy that makes decision-making efficient as each decision is made with respect to possible benefits driven by each stakeholder's ability to provide technical knowledge and alternative perspectives towards making the design solutions as holistic as possible–this was reflected in the survey responses where 63% and 29% of the stakeholders responded that the involvement of stakeholders can help foster design solutions that are as holistic as possible by providing technical knowledge and alternative perspectives. Also, noteworthy was the duration of these design sessions which averaged

two hours (as opposed to 20 seconds to 3 minutes). The duration of these meetings was important as it allowed for rapid exchange of ideas and necessary negotiation to occur within the temporary subculture. In this sense, the design sessions were occasions for all the stakeholders to allow themselves to be incorporated into a sacred subculture of new social interaction. This social interaction allows communication to be facilitated more effectively in a large-corporate environment where interdisciplinary design process is administered as opposed to traditional design process.

Moreover, the ethnographic observations indicate a trend of reduction in arguments relating to territorial issues or status and speaking with casual language. According to the design director, the efficiency of communication has improved immensely and led to saving time that was never thought possible; thus, it demonstrated that involving stakeholders in an interdisciplinary design process is useful. Furthermore, the overall transfer of ideas was considered by the team as inspirational, "enabling creativity to be realized in manners that are obtainable."

The immediate exchange of information allows for idea exploration in a timely fashion. In the past, designers would develop a series of comprehensive solutions (which required a great deal of time), then send the information in the form of a spreadsheet to engineers with request to estimate development time. The designers would prioritize these solutions based on the amount of resource available, then reiterate the ideas, and repeat this process on several occurrences. As a result, a tremendous amount of time was "wasted" in communicating back and forth with minimal interaction between stakeholders, thus reducing efficiency.

Seeing the recent improvement, the design director has decided to take actions to prevent communication problems in the future. The product development team is experimenting on a new interdisciplinary work environment for the Cloud Project moving forward–a first of its kind at Banks. All members of the primary stakeholders (except for the design director) will be relocated into a common work area where seating arrangements are positioned relatively close to each other without the division of cubical walls. This is apparently an effort to harness an open relationship without boundaries in which conversations and discussions can take place across disciplines readily, without organizing formal meetings. White boards and bulletin boards will be easily accessible to the team for idea exchange. The objective is to further improve the efficiency of communication and to ensure that individuals are happy with one another and are engaged in fluid communication without feeling insecure. Unfortunately, the researcher was not present as this floor plan was being materialized but the product development team was feeling extremely excited as they believed it would help communication.

To conclude, the recurring collaborative aspect that is inherently necessary in a large-corporate environment requires the activities of design to be a social process. Acknowledging the need for design to be a social process has contributed to answering helped answer the first research question, which is whether an interdisciplinary design process (from the designer's perspective) facilitates communication for large-scale projects. As discussed in the Literature Review and investigated in the ethnography, unlike the traditional design process, which is typically practiced in small-scale projects whereby interaction between the designer and stakeholders is limited (Lawson, 1994), an

interdisciplinary design process permits greater opportunity for interactivity. This interactivity between the stakeholders is a social process that is crucial for the design of large-scale products as it allows communication to occur at multiple levels (Eckert & Maier, 2005). Since large-corporate environments have tendency for greater skill specialization, territoriality between stakeholders that would ordinarily prevent collaboration is likely to be more common. As a result, the level of communication pertaining to efficiency must be ensured and encouraged between stakeholders in order for a large-corporate environment to function properly in unity. From a designer's perspective the mindset of territoriality should change to give opportunity of social collaboration to take place.

As such, this paper has shown that there is a requirement on behalf of the designer to have a change in mindset and to realize that design ownership, although present, must be shared within this type of process. By comparing the design process models (traditional and interdisciplinary) to Turner's anthropological model of rites of passage, the second research question has been answered. This study found that the designer, who is in an environment where interdisciplinary collaboration is administered in the design process, experiences a gradual but temporary transformation in status and role during the liminal period. The liminal period temporarily unites the design team to the communities of the respective stakeholders into a single entity by breaking the conventional social structure and allowing each individual to share equal design ownership. In other words, although the designer does not experience a permanent change in status (as one would expect from rites of passage), this is a process whereby a symbolically mediated

transition occurs as a subculture, or a temporary working context, has been created. Keeping an open mind during this collaborative working context, in which ideas were developed and shared, realized the existence of synchronicity among the stakeholders whereby the individuals were in the mode of *spontaneous communitas*.

Another major advantage of having an interdisciplinary collaboration involvement is the ability to increase the efficiency of communication among stakeholders by keeping objectives aligned with expectations and by allowing stakeholders an opportunity to provide valuable knowledge to facilitate the planning of a design process. This especially applies to a large corporate environment in which communication is typically segregated between disciplines. As demonstrated by Banks, the improvement in communication is self-evident when long and time-consuming tasks, such as creating a product development roadmap, can be accomplished in a short period of time. An interdisciplinary approach to design process planning can ensure that any vital information pertaining to resources, drawbacks from previous experiences, or any details that may be beneficial are brought to the awareness of all stakeholders. Thus, the transparency of communication and the possibility for successful outcomes are much higher. The increased interactivity allows the designer and stakeholders to develop and share discourse and narrative. As a result, key components are clearly identified to ensure that there is solid understanding of responsibilities among stakeholders which is an important component for any successful change in a design process and for preventing errors and gaining efficiency and effectiveness.

Limitations

In general, there are four main limitations in this research study: the short ethnography, single-case anecdotal results, the inability to observe potential disputes, and the balance between collaborative work and individual responsibilities. These limitations were taken into account prior to the completion of the research.

Firstly, the main limitation of this ethnography is the inability to observe the design team and the stakeholders for a longer period of time. It would have been beneficial to observe the dynamics of the team prior to their adaptation of an interdisciplinary design process. It would also be insightful to contrast the dynamics of the team with respect to their interactivity with other stakeholders from a traditional versus an interdisciplinary process. However, despite this limitation, approximately 60 hours were spent with the participants and yielded positive results. These results are valuable as they allowed the researcher to identify the existence of a temporary working context when the observations were compared to rites of passage. Moreover, it provided some important research finding that would assist subsequent research.

Secondly, the research result would have also benefited from conducting studies with a larger survey sample and undertaking ethnography in multiple large corporate environments. By doing so, results could have been compared and analyzed collectively to find commonalities and avoid data that could potentially be the result of cognitive bias. Furthermore, results that appear to be unusual can be isolated for further investigation and it is possible that new insights can be drawn. The greater number of studies can also help produce a stronger generalization when speaking about the potential benefits of

interdisciplinarity for design. Nevertheless, the anecdotal results from this study shed light on future research opportunities and led to important findings on which to build on the study of interdisciplinarity.

Thirdly, it would be extremely important in subsequent research to investigate whether there is the need to set up alternative reward system for interdisciplinary design process. From the ethnography, it has been observed that there may be potential drawback that is created by those participating stakeholders who take advantage of teamwork by not contributing, being aware that others will complete the task despite their absence of input. For this reason, a reward structure for teamwork to address this problem needs to be examined closely. Moreover, it would be interesting to learn about the types of reward systems that one would favor in order to prevent the likelihood of not contributing. Doing so will provide a better understanding of the potential drawbacks of an interdisciplinary design process.

In addition to these limitations and future research prospects, it would particularly be interesting to investigate whether the amount of time and resource taken away for collaborative work in an interdisciplinary setting could lead to disputes. Since participation of the team is needed for collaborative work, it would be beneficial to learn how collaborative work can be balanced with individual responsibilities. A reasonable question to ask is if the amount of time and resources is limited, then how would individuals commit to an interdisciplinary collaboration? Despite this limitation, the results presented in the research study serve great value especially for large corporations

who are considering the advantages and disadvantages of adapting an interdisciplinary design process to their development process.

Implications

The current findings have implications for both the designer and their employing organizations. The implication of comparing the interdisciplinary design process to rites of passage is the development of a very powerful method of creating a symbolic context in which the design team and other disciplines can work together where new patterns of behavior are acceptable. From the designer's perspective, it is favorable to encourage participation from all functions within a large corporate environment, and a change in mindset is certainly going to occur in an interdisciplinary collaboration. As a result, the collaboration could allow a greater opportunity for the designer to gain inspiration from the team and shed light on new ideas that would otherwise be impossible.

Additionally, it is possible that the designer and other stakeholders who take part in the temporary working context would be able to experience incremental gains of personal and professional growth upon the completion of these transitions when the stakeholders return to the pre-transformation state. These growths could be associated to one's ability to better perform group related activities which are vital in a professional environment such as negotiation and argumentation. Another example of growth could also be one's perception on the value of group created ideas and the willingness to be more receptive to others' opinions and suggestions. Therefore, when the group return to their previous positions, this type of process will continue to influence their activities.

From an organizational perspective, interdisciplinary collaboration appears to be welcomed by stakeholders as it provides opportunities for their opinions to be taken into consideration. This was reflected in the survey when a significant proportion of respondents (68%) show likelihood to provide suggestions when equal contribution is expected among the stakeholders. This implies that all stakeholders, despite their disciplinary background should be given equal opportunity to provide design related suggestions. Furthermore, where equal contribution is expected, 81% of respondents felt that the likelihood for their suggestions to be taken into consideration by other stakeholders is greater. Considering the vast variety of disciplinary backgrounds that typically support the functions of a large corporate environment, it is safe to assume that the holistic quality of design suggestions would be significant. Additionally, it is highly possible that creating a symbolic context in which the design team and other disciplines can work together, and where new patterns of behavior are acceptable, can allow personal relationships to be built and potentially result in a less rigid and territorial work environment. Consequently, during this symbolic temporary working context, it is suggested that prescribed formal behavior not be instituted for future practices as part of the mediation for the formation of effective working groups. This is because it may impose communication barriers for stakeholders to act freely. On the other hand, a person in the position of authority could create a list of suggestive informal behaviors that is intended to make clear where equal contribution would be more ideal. A work environment where individuals are happy has the potential to prompt individuals to be more creative and playful, increasing the likelihood of productivity (Fredrickson, 1998).

The potential impact of an interdisciplinary design process on communication should draw the attention of large corporate environments where design is employed as part of their development process. An interdisciplinary design process as observed at Banks is comparable to outward-bound recreational activities, such as casual, group-based corporate events like barbeques and scavenger hunts, which are designed to bond individuals outside of their normal social structure. These corporate events create great opportunities for stakeholders to interact and build relationships in a non-work environment. Also, educational institutes, government agencies, and especially professional environments where different disciplines work together would benefit from such a process. An interdisciplinary process has the ability to promote the interests and participation of employees and likely improve communication.

Future Research

Observation session from ethnography should be longer if possible. Despite the tremendous amount of information obtained from the experience, research in the future will benefit greatly if the duration of the participation-observation can be extended. A total of eight days was used for this research, which allowed the researcher (who has a design background) to be immersed into the activities of the observation environment. Another reason for extending the participation-observation period is to be able to take notes for the entire product development process and compare the final outcome to the initial observations. This will inevitably permit new insights to be found regarding interdisciplinary collaboration that might have been missed in between each stage of the design process; for example, the transition between conceptual design/prototyping to

embodiment design/testing. Unfortunately, this means that the participation-observation would have to be at least as long as the product development cycle. By the same token, the extension of the time of the participation session would have allowed the researcher to observe more carefully those stakeholders who may play a major role in facilitating communication and decision-making. These were not captured in the research that was done.

Lastly, another advantage of extending the participant observation time would be to increase the ability to compare the past design process to its current implementation. Although much of the information regarding the past design processes was captured by reviewing archival documents with the assistance of the design director (who has worked at Banks for nearly twenty years), there may be particulars which are crucial to the research that can help draw new insights.

Observing the activities of other stakeholders. Evidently, the insights gained from observing activities of a design team have proven to be valuable for the research. Close examination of daily events allowed observations to be captured that would otherwise be impossible. These observations evoked and allowed for the comparisons to be made to rites of passage. Aspects of the physical environment, including the floor plan and the physical location of each department, formulated the contextual relationship between the design team and its stakeholders. Such presence gave the researcher the opportunity to identify precisely when the designer goes through rites of passage, and most importantly, ask questions during the phases of these rites. These questions are related to the mindsets that the designers were experiencing during the liminal phase as

the designers entered the mode of spontaneous communitas in the interdisciplinary collaboration. By the fifth design session, the individual stakeholders had "become totally absorbed into a synchronized, fluid event," whereby role and status were perceptibly not present at moments. In a post-design session discussion, a participating designer acknowledged that design ownership at moments was non-existent, creating an experience that was enjoyable and an outcome that was efficient. These initial results are positive indications of the success in the change of the design process from the design team's perspective.

Consequently, participant observation in the work environment of other major stakeholders (engineer, product manager, product director, quality assurance, and more) could have supported the research that was done in this study. Given that a significant number of stakeholders now feel that communication will improve due, in part, to the change in open-mindedness of the designers, it would be interesting to compare the activities of these stakeholders to rites of passage as well. Perhaps, these stakeholders were experiencing ownership to the design decisions (like the designers) at one point in time, and a change in mindset occurring in the liminal phase had put them into modes of spontaneous communitas as well. Gaining a greater understanding from the perspective of other stakeholders can help immensely in the planning of design process to foster both communication and creative design solutions.

Creating a work environment to foster effective design communication. The results presented should inspire stakeholders in a large corporate environment to encourage interdisciplinary collaboration among the design team with other stakeholders.

By doing so, they have the potential to improve the efficiency of distributing important information in a timely manner and allowing for an immediate turnaround, as evident from the observations at Banks Corporation. The findings of the research are highly beneficial to the increasing demand on design companies to be competitive in the global market. Effective communication can directly translate to preventing information loss that is crucial to the success of meeting tight deadlines. However, to make this possible, the environment must be set up to encourage communication whereby disciplinary boundaries are not present and mutual ownership to decision-making is permitted and encouraged. Realizing this important factor, Banks is now planning to designate a new area in their building to experiment on an interdisciplinary work environment. The new environment is intended for the primary stakeholders of a particular project to work closer to one another in hopes of developing a subculture whereby communication has no boundaries. In the future, it would be beneficial to study the effects of this type of work environment to investigate both the advantages and disadvantages. Moreover, since the physical distance between the stakeholders are within meters distance, without walls or doors as separation, it would be extremely interesting to examine their collaborative activities and compare them to the rites of passage. Some interesting questions to ask may be:

- Where do the rites of separation occur if the stakeholders are not physically separated?
- Since the physical separation is more difficult to distinguish, how would this effect each individual stakeholder as they go through the liminal phase?

- Furthermore, how would this reduction in distance affect the rites of incorporation from taking place?

Another important aspect to examine would be the mindset of each stakeholder in order to determine whether positive or negative changes exist and how these changes influence decision-making and communication.

Observing the effect of temporary transitions on stakeholders upon return to their department. The research has focused on observing the designer and other stakeholders during the temporary transitions. It would be interesting to investigate the effect that the temporary transition has on both the designer and stakeholders upon their return to their respective department in greater detail and whether the transition back to one's respective department is mediated by ritual. The speculation is that the designer and other stakeholders are to go through the rites of passage upon one's reincorporation into their respective department and that each stakeholder can share his or her experience with the rest of the team using their respective lexicon. However, it would be valuable to explore whether one's return into their respective department would face challenges in resuming their pre-transformational roles. Perhaps, there could be an increase or decrease in personal and professional growth that is dependent on the perceived value that one has on the temporary engagement with the working group.

The need to set up an alternative reward system for interdisciplinary design process. Although the designer and other stakeholders are able to unite to work collaboratively, an interdisciplinary design process has a few shortcomings. Those stakeholders who are enculturated in the interdisciplinary setting are able to join and

conform to the norms of the team, thus given the opportunity to share responsibilities, accomplishments, and the benefit of membership as rewards. On the contrary, the drawback is created by those who take advantage of teamwork by not contributing, being aware that others will complete the task despite their absence of input. As a result, a reward structure for teamwork to address this problem should be explored in greater detail in future research.

Although observations from the "kick-off" process meetings and the design development sessions revealed that some stakeholders were less active participants, it appears that those participants who were quiet remained to be so even in a casual affair, such as sharing of chocolate, chatting, and debriefing. Therefore, it is reasonable to assume that the difference in the level of participation as observed was due to the varying personalities of the individuals. Those who appeared to be relatively introverted spoke minimally but participated in other ways, such as keeping track of minutes from the meeting and providing input through e-mail. Nevertheless, the possibility that one would take advantage of others in a collaborative work setting cannot be overlooked, especially in a large corporate environment. By the same token, developing an alternative reward system would help measure and encourage contribution, both of which are important criteria for success.

Conclusion

In this research, the activities that a designer undertakes within a traditional design process are compared to the activities of those in an interdisciplinary design process using the anthropological model of rites of passage developed by Turner (1969).

Through the combination of a literature review, ethnography, analyses of a company's internal documents, and a survey, this paper demonstrates how a designer progresses through the rites of separation, transition, and incorporation in a corporate environment while interacting with other stakeholders.

In a conventional design process whereby interdisciplinary interaction is typically limited to short information exchange, the designer assumes the responsibility of decision-making, thus filtering crucial information provided by other important stakeholders prior to applying it to the design. However, effective and fluid interdisciplinary collaboration is imperative in large-scale work environments in which individual stakeholders should have the opportunity to openly discuss their ideas with designers. Stakeholders include engineers, managers, quality assurance specialists, and more. The ideas from these stakeholders are beneficial to the final design solutions as these contributors are most likely able to generate ideas that are collectively more holistic. It is reasonable to draw this conclusion since each individual stakeholder has disciplinary training that can provide important insight based on his/her domain knowledge, personal, and professional experience.

In an interdisciplinary collaboration, designers must have an open mind and be willing to engage in a negotiation and argumentation process with other stakeholders. Designers are to realize that design ownership, although existent, should be shared and that this mutual aspect should be encouraged in the design process to promote interaction without boundaries among stakeholders. This encouragement can come from somebody in a position of authority, such as a design director, as in the case of Banks. In an

environment in which interdisciplinary collaboration is integral to the design process, designers experience a gradual transformation in status and role during the liminal period. The difficulty in practicing interdisciplinary approach is great, as Klein explains (1996); it requires individuals to breach boundaries to advance through "no man's land" between disciplines and challenge the status quo (Weingart, 2000, p. 28). This "no man's land" is much like the liminal period as it is an opportunity to unite the design team to the communities of the respective stakeholders into a single entity by breaking the conventional social structure and by giving each individual the opportunity to share equal design ownership. In other words, although the designer does not experience a permanent change in status, as one would expect from rites of passage, this is a process whereby a symbolically mediated transition occurs as a subculture, or a temporary working context, has been created. This paper unveils a very powerful method of creating a symbolic context in which the design team and other disciplines can work together and form new patterns of behavior that are not only acceptable, but also desirable, and that lead to better company results.

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Appendix A

Banks' Employee Survey: Please note that this is not the original format.

Facilitating Communication in the Interdisciplinary Design Process by Applying the Rites of Passage.

This study is for academic purposes only.

In this study, the researcher will be looking at how communication takes place in an interdisciplinary design environment. You will be asked about your personal opinion regarding design process and general design questions. The researcher will collate the results from this study. This questionnaire will take approximately 10-15 minutes to complete.

You are guaranteed total confidentiality with regard to anything you have written or said in relation to this research within the normal boundaries of law. You will not be asked to reveal your name or anything that could harm or distress you in any way. You will be asked your profession and answering this question is optional. You will not be video taped, audio recorded or photographed. You may decline to answer any of the questions in this interview. No data will be directly associated with you and all data will be sorted at the home of the researcher. The only people with access to this data are the researcher's supervisors who may request to see it but in no way will they attempt to identify you through this data.

You may withdraw from the study at anytime. Should you decide to withdraw, all the information you have provided will be destroyed. The results obtained from this study will not be available and will be kept for the duration of the research project (two years).

The research project has been reviewed and received ethics clearance by the Carleton University Research Ethics Board. Please feel free to contact the REB chair if you have any concerns or questions. If you have questions regarding this study or about withdrawal please contact the researcher or research supervisor.

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Which of the following best describes your role or job title?
(Please select one)

- Engineer
- Designer
- Product Manager
- Design Director
- Quality Assurance Specialist
- Localization
- Documentation
- Technical Support
- Information Technology
- Other:

What is the length of time that you been employed with your current employer?
(Please select one)

- Less than 1 year 2%
- 1 – 3 years 27%
- 3 – 5 years 0%
- 5 – 10 years 29%
- Over 10 years 41%

Section 1: Efficiency of Communication
Section 1 of this survey corresponds to the efficiency of communication that takes place within your organization. This refers to the accuracy in exchange of information and the ability for information to be kept up-to-date amongst stakeholders.

1. From your professional experience, who are the stakeholders that should be involved in the design process to ensure that the efficiency* of communication can successfully take place? (*Efficiency is defined as the accuracy in exchange of information and the ability for information to be kept up-to-date).
(Please select all that applies)

- Engineer 21%
- Designer 21%
- Product Manager 18%
- Design Director 14%
- Quality Assurance Specialist 16%
- Localization 3%
- Documentation 4%
- Technical Support 1%
- Information Technology 1%
- Other: 2%

2. How critical is it for all of the stakeholders (that you selected in question 1) to be involved in ensuring efficient long-term communication for projects that may take longer than one year in duration?
(1 represents not critical and 7 represents very critical)

0	1	2	3	4	5	6	7
5 %	0 %	0 %	0 %	7 %	32 %	41 %	15 %

3. How critical is it for all of the stakeholders (that you selected in question 1) to be involved in ensuring efficient short-term communication for projects that may take less than one year in duration?
(1 represents not critical and 7 represents very critical)

0	1	2	3	4	5	6	7
5 %	0 %	0 %	2 %	5 %	20 %	44 %	24 %

4. Do you feel that the efficiency of communication has improved amongst stakeholders (that you selected in question 1) over the course of your employment with your current employer?
(1 represents no improvements and 7 represents vast improvements)

0	1	2	3	4	5	6	7
0 %	0 %	24 %	12 %	20 %	12 %	22 %	10 %

If applicable, please provide an explanation for how efficiency of communication has or has not improved:

_____

_____

5. Do you feel that the efficiency of communication would improve if all stakeholders (that you selected in question 1) participate early on in the design process?
(1 represents not effective and 7 represents very effective)

0	1	2	3	4	5	6	7
5 %	0 %	0 %	5 %	10 %	22 %	29 %	29 %

If applicable, please provide an explanation for how efficiency of communication would not or would be improved:

_____

_____

_____

6. Have you ever been biased during the design process in the facilitation of communication between stakeholders?
(Please select one)

- Yes 76%
- No 24%

If applicable, please provide an explanation for your answer:

_____

_____

_____

Section 2: Design Solution

Section 2 of this survey corresponds to the holistic quality of design solutions that take place within your organization. Holistic quality refers to the degree of comprehensiveness of the design solutions and its ability of being interconnected with one another.

7. From your professional experience, which design project stakeholders should be involved in the design process to ensure that the design solutions are as holistic* as possible? (*Holistic is defined as being comprehensive and interconnected).
(Please select all that applies)

- Engineer 21%
- Designer 21%
- Product Manager 18%
- Design Director 14%
- Quality Assurance Specialist 13%
- Localization 4%
- Documentation 1%
- Technical Support 3%
- Information Technology 2%
- Other: 1%

8. How critical is it for the design project that all of the stakeholders (that you selected in question 7) be involved in order to foster design solutions that are as holistic as possible?
(1 represents not critical and 7 represents very critical)

0	1	2	3	4	5	6	7
0 %	0 %	2 %	2 %	7 %	32 %	37 %	20 %

9. Do you feel that communication has improved amongst stakeholders (that you selected in question 7) over the course of your employment (with your current employer) in order to foster design solutions that are as holistic as possible?
(1 represents no improvements and 7 represents vast improvements)

0	1	2	3	4	5	6	7
10 %	2 %	20 %	12 %	12 %	15 %	22 %	7 %

If applicable, please provide an explanation for how communication has not or has improved:

_____

_____

10. Do you feel that communication has improved by having all stakeholders (that you selected in question 7) participate early on in the design process to foster design solutions that are as holistic as possible?
(1 represents no improvement and 7 represents vast improvements)

0	1	2	3	4	5	6	7
0 %	2 %	7 %	7 %	22 %	17 %	34 %	10 %

If applicable, please provide a reason for your answer:

_____

_____

11. Have you ever been biased during the design process in the facilitation of communication between stakeholders (that you have selected in question 7) to foster design solutions that are as holistic as possible?

(Please select one)

- Yes 61%
- No 39%

If applicable, please provide an explanation for your answer:

_____

_____

_____

12. If generating design solutions are typically the responsibility of the design team, how do you think the involvement of other stakeholders (that you have selected in question 7) can help foster design solutions that are as holistic as possible? Stakeholders can help by:
(Please select one)

- ...providing technical knowledge 63%
- ...providing instantaneous feedback in light of tight deadlines 5%
- ...providing alternative solutions 29%
- none of the above 2%

If applicable, please provide an explanation for your answer:

_____

_____

_____

13. Do you think that designers have tendencies to prevent other stakeholders (that you selected in question 7) from becoming involved in the idea development stage of the design process?
(Please select one)

- Yes 95%
- No 5%

a. If Yes, what makes you feel this way?

_____

b. If No, what makes you think this way??

_____

c. Do you think this can impact the design process? How?

_____

d. Do you think this can impact the quality of the final design? How?

_____

Section 3: Miscellaneous

14. How important is it for meetings relating to the design process to take place in common meeting rooms in order to enable *equal contribution amongst stakeholders? (*Equal refers to input of unbiased information without consideration of status, roles or hierarchical ranks)

(1 represents not important and 7 represents very important)

0	1	2	3	4	5	6	7
5 %	5 %	5 %	8 %	5 %	13 %	39 %	18 %

15. How important is it for somebody in a position of authority to encourage open discussion for equal contribution amongst stakeholders?
(1 represents not important and 7 represents very important)

0	1	2	3	4	5	6	7
5 %	3 %	3 %	8 %	10 %	5 %	45 %	23 %

16. How important is it for a member of the design team to encourage open discussion for equal contribution amongst stakeholders?
(1 represents not important and 7 represents very important)

0	1	2	3	4	5	6	7
0 %	3 %	0 %	8 %	8 %	13 %	30 %	40 %

17. How important is it for all stakeholders to encourage open discussion for equal contribution amongst stakeholders?
(1 represents not important and 7 represents very important)

0	1	2	3	4	5	6	7
5 %	3 %	3 %	5 %	8 %	15 %	41 %	21 %

18. During a meeting where equal contribution is expected, how would you rate your likelihood of providing suggestions?
(1 represents not likely and 7 represents very likely)

0	1	2	3	4	5	6	7
8 %	3 %	8 %	3 %	13 %	15 %	28 %	25 %

19. During a meeting where equal contribution is expected, how likely is it for your suggestion to be taken into consideration by other stakeholders?
(1 represents not likely and 7 represents very likely)

0	1	2	3	4	5	6	7
0 %	5 %	0 %	8 %	8 %	18 %	20 %	43 %

20. During a meeting where equal contribution is expected, do you think your status is enhanced or that you are recognized by other stakeholders for your contribution?

- Yes 53%
- No 48%

If applicable, please provide an explanation for your answer:

_____

_____

Debriefing
Thank you for participating in this academic survey. This is a reminder that all of the information you provided is confidential.

Comments related to the questions? Any opinion you would like to express?
Please feel free to add comments below.

_____

_____

_____

Section	Type	Space	Time	Actors	Objects
Introduction Kick-Off #1	Observation of a meeting.	Eng-A Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" meeting room. A common meeting room is a general resource room which can be reserved by any employee. It is located on the opposite side of the building.	Duration of 2 hours. One official break. Actors stepped in and out of the meeting room.	Designer (2) Dan and Dave - Engineer (5) one lead Eric, Evan, Ernest, Eduardo, Eli - Design Manager (1) Matt the Manager - Design Director (1) Denise the Director - Quality Assurance (1) Andrew *Pseudo names	Two whiteboards Dry erase markers, multiple colors, low odor Projector, connection cables Empty chairs and extra chairs One large conference table - Designer had notepad and laptop. Engineer had laptop. Design Director came with documents from previous projects. Everyone else came with notepads, pen/pencil

Section	Type	Space	Time	Actors	Objects
Kick-Off #2	Observation of a meeting.	Laurentian Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" meeting room mostly used for presentations and conference calls. A common meeting room is a general resource room which can be reserved by any employee.	Duration of 2.5 hours. No official break. Actors stepped in and out of the meeting room. People who stepped out came back with drinks. Mostly cold pop from the machine.	Designer (2) Dan and Dave - Engineer (5) one lead Eric, Evan, Ernest, Eduardo, Eli - Design Manager (1) Matt the Manager - Design Director (1) Denise the Director - Quality Assurance (1) Andrew *Pseudo names	Pencil Paper projector one whiteboard dry erase markers, odorless and orignal (strong odor) Reference documents laptops (2) - Everyone brought notes with them for discussion. It's mostly "Agile development" processes that they prepared for the meeting. Two people had print out of notes found online regarding "agile development".

Section	Type	Space	Time	Actors	Objects
Kick-Off #3	Observation of a meeting.	Dovercourt Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" meeting room mostly used for presentations and conference calls. A common meeting room is a general resource room which can be reserved by any employee.	Duration of 2 + 1 hours. One official break. Lots of stepping in and out of the meeting rooms. People who stepped out came back with drinks. Mostly cold pop from the machine.	Designer (1) Dan - Engineer (6) one lead Eric, Evan, Ernest, Eduardo, Eli, Erin (new engineering member) - Design Manager (1) Matt the Manager - Design Director (1) Denise the Director - Quality Assurance (1) Andrew	Marker Pencil Paper Whiteboard projector laptop - Everyone brought notes with them to the meeting. A draft of the development process was produced prior to this meeting. It was shared over email. This email has proven to be useful as a supplement to the regular meetings. It keeps everyone up to date.

Section	Activities	Events	Goals	Feelings
Introduction Kick-Off #1	Conversation began in casual language. When technical jargon comes along, "funny" and descriptive langages were used. It's almost like a way to explain the technical jargons. At first, it was hard to understand what the speaker was saying and many didn't seem interested. - Very casual street talk, sketching, Dave ripping of paper to symbolize the old design process documentations. "Elimination" of the past. Everyone felt shocked when that happened but it was funny...lol - On the flip side, those actions seems abit extreme. Ripping paper and putting it on the table. - The designer photographed the whiteboard after the meeting was done for documentation. (iphone) It will be shared through their internal database or typed using a computer... TBD.	Chain: Department (talk) > Hallway > Meeting room > Hallway > Department (45 secs. walk to meeting room from design department) - "Kick-off" is an introduction to the development team. The development team consist anyone who is immedate to the project. The goal is to let the plan sit down to discuss and plan for the upcoming activites for the next months. Mainly, it is to figure out how the development time can be cut by more than half of the existing time. - "Dramatic, WTF?, How's that possible" - engineering - Eric and Evan. Everyone started to laugh. - Some of the key questions that came up were: resources, conflicts, open-process, when to enlist more stakeholders, project road map for Cloud vs other projects?	Objective was to introduce the project to the development team and also introduce who the team members were. Any questions pertaining to roles, target and "whatever" can be brought up without having to worry. "Everything is behind closed doors". - Denise and Matt emphasized. - Denise wants to hear about everyone's feedback and let everyone have equal ownership to the Cloud Project. "It's a fresh start". How does everyone feel about the quicker turnaround? Looking for suggestions?	Generally feeling was pretty negative. Everyone seemed pretty negative and pessimistic about the fact that development time is to be cut by more than half. The engineers seems to be pissed and were confrontational towards the designers. Dan was making fun of the engineers about something internal, perhaps, they had conflicts before? Lots of mockery between Dan, Eric and Evan. Dave seems to be fairly quiet, observing perhaps. - "What you do? What we do? You should do this. Let us do that. WTF." - Eric and Evan. "We can't do this if we were to following the same type of development process." - Alot of eye contact between individuals within their own team. It seems like they had certain expectations from the meeting or maybe they are just worried.
Section	Activities	Events	Goals	Feelings
Kick-Off #2	Discussion began by going around the table to talk about the agile development process that everyone brought to the meeting. It appears that the processes are inspiring but it's not very "realistic" for Banks and Cloud Project. - Debate the Pros and Cons of each process. Price vs. Resource available. Start up difficulty? - Sketches we used to demonstrate the design process. (very low fidelity) - Narrow down to the two most desirable processes for Cloud's long and short term goals. All of this information will be uploaded to the intranet/database. - Dave and Eli took turn writing on the whiteboard. They were also taking ntoes. - Manager and Director hardly spoke.	Chain: Email > short meeting > Department (talk) > Hallway > Meeting room > Hallway > Department - Determine the versatility and compatability of the product. Begin talk about producing the specs... criteria, timing, and overall resources is required. - Future forecast: if they pick the wrong specs and the stupid process then the product has the potential to fail "miserably". Nobody would use it. - Determine whether there are new technologies that stakeholders have to learn to develop the product. This is a question for the specs meetings which will happen later in the week. - Engineer had prepare a demo on computer to show what the technologies are capable of. Designer also had a list as	The goal is to decide which development process is good and use it. Everyone present has a stake in it and it appears that everyone is involved. Most notable are Dan, Eric, Evan (sometimes), Eduardo. Eli seems to be the note taker.	Engineers are starting to open up more while the designer appears to be less aggressive. Minor mockery here and there. A lot more jokes in this meeting about the executives than before. - Doesn't seem like kids on a play ground arguing anymore. At least not as much. - Everybody seems open to adapt to a new development process but not sure who to integrate the old process with any of the new/proposed processes.
Section	Activities	Events	Goals	Feelings
Kick-Off #3	Discussion and debate between stakeholders. They are working together and not against eachother. No mockery was present. No jargons. Conversation was extremely casual as it was incredibly different than the first meeting. Maybe they realize that this is the last meeting for this exercise? - Draw - on white board. Talk - casual conversation between teams every now and then. Mostly about the past projects. Joke- about executives and other projects	Ideas were presented. They had to discuss whether anything needs to be redone or if was okie. - The plan appears to be good but it's hard to say whether it will workout as the availability of resource will change everything in the upcoming months. There's resource conflict between Cloud project to the existing projects that others are working on - Plan is good.	Look over proposals and ideas > Draw insights from it > Discuss good vs. no good. - The goal is to go over each one as presented and put them on the white board. The manager and director evaluated with the stakeholders. - Manager and director were nervous. Must meet projected profit and revenue by the end of year. it'll only work if the team feels strongly about the direction they are taking. Any issues are to be brought up now and or soon with everyone present.	Everyone seems to be on the same page. The meeting was long so it was divided in two. People were walkking in/out of the meeting. No debriefing. - Worries from previous meetings are still present but less obvious. Everyone is starting to believe that things will work out or maybe they have to? - It will be interesting to see what the next series of meetings will be like. Carry the momentum?

Section	Content/Comments/Idea
Introduction Kick-Off #1	Nobody knew what Cloud project was before the meeting. It appears that not every stakeholders have worked with each other before. An casual introduction took place. - What the fu*k (WTF) was fairly commonly expressed. The meetings are sometimes difficult as abbreviations are used frequently. Some abbreviations such as OEM and API are commonly used in the industry. - Debriefing (Director, Manaer, designer) During a debriefing, the Director, *Manager and Designers didn't think it* went well. "Stressful, frustrating, more difficult than anticipated". - Only Dan and Dave took notes on their notepad. Others had mostly questions and appears to be unsure about the scope of the Cloud project at first.

Section	Content/Comments/Idea
Kick-Off #2	During a debriefing, the designer, manager and director agreed that they are on the right track. However, there still some negative feeling about this type of meeting. "Not as brutal but still a long way to go" - Denise and Dan. The team seems to be more optimistic in this meeting than the last one. - Worried about the amount of resources available to finish this Cloud project in the near future. - Very surprising to see drama in the professional environment. Territoriatity is prevalent as each team fights for resource. Not everyone seem to agree with each other.

Section	Content/Comments/Idea
Kick-Off #3	No debriefing between Designer, Director and Manager. Overall, it can be considered successful. The objective was completed and the Director is very "satisfied". - Overall, the meeting was surprisingly productive and many were on the same page about the ideas that were presented in the meeting. Huge contrast to the first meeting. - No surprises. It feels more like a slow uphill battle for everyone to agree to the same thing but one "an agreement" is established, everyone seems to know what to do and who to talk to.

Section	Type	Space	Time	Actors	Objects
Design Idea Development Session 1	Observation of a meeting.	Eng-A Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" *meeting room. A common* meeting room is a general resource room which can be reserved by any employee. It is located on the opposite side of the building.	Duration of 1 hour. No breaks. Relatively short meeting.	Designer (2) Dan and Dave - Engineer (5) one lead Eric, Evan, Ernest, Eduardo, Eli - Design Manager (1) Matt the Manager (left mid-way) - Design Director (1) Denise the Director - Refer to original notes for visual reference.	Candy Marker Projector ntoes laptop coffee - Everyone brought a note pad or some sort of writing material.

Section	Type	Space	Time	Actors	Objects
Design Idea Development Session 2	Observation of a meeting.	Engineering - Area Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" area close to the engineering department. A common meeting room is a general resource room which can be reserved by any employee. The area was empty and quiet.	Duration of 2 hours.	Designer (2) D1 and D2 - Engineer (5) one lead *Eric, Evan, Ernest, Eduardo,* Eli - Design Manager (1) DM1 (left mid-way) - Design Director (1) DD1 - Refer to original notes for visual reference.	Whiteboard marker paper notes coffee Many computers were accessible - The laptop seems to have replaced the reference documents.

Section	Type	Space	Time	Actors	Objects
Design Idea Development Session 3	Observation of a meeting.	Eng-A Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" meeting room. A common meeting room is a general resource room which can be reserved by any employee. It is located on the opposite side of the building.	Duration of 1.5 hours. Lunch meeting.	Designer (3) D1, D2, D3 - Engineer (5) one lead *E1, E2, E3, E4, E5* - Design Manager (1) DM1 - Design Director (1) DD1 - Quality Assurance (1) QA1	Marker Projector Note pad Whiteboard Indian Food (take out) Soft Drinks (no coffee) - Drawn objects > reference samples > tech demos, website, books

Section	Activities	Events	Goals	Feelings
Design Idea Development Session 1	The funny thing is that everyone seems happy when they sad the candy. Lots of jokes came up right after. The activity was to explore technology together. What are the cost/overhead? - Discussion, sketching. Discussion got heated abit. It's like the first kick-off meeting. There was mockery between the designer and engineer. - Writing and drawing on the whiteboard.	Email first > department > hallway > meeting> hallway department - The email was from the design director: Let people contribute in the ideation phase just like the kick-off. It was also a email to congratuate on the success of the previous meetings.	The goal is to produce a specification for the Cloud Project. The most important part is the figure out the technology and to explain in great depth what the pros vs. cons are. - Designer is the facilitator... it seems. Asking more questions than usual. Engineers answer the questions about whether it is feasible.	The overall meeting was awkward. It didn't have the chemistry as the kick-off meeting. There seems to be more territorial arguments than before. Perhaps it is the nature of the discussion as it is more closely related to design activities. Planning vs. design activity? Design activity steps on the territory of the designer. - There appears to be more communicaiton issues. It seem that some words are misunderstood by others. What is proof of concept? Prototype? Ask them after if necessary. Evan and Dan are always going at it.

Section	Activities	Events	Goals	Feelings
Design Idea Development Session 2	Discussion, drawing, writing and using the computer to search for information. - This is to follow-up to the previous meeting. The signficant is that the stakeholders acknowledged the previous meeting was unproductive. - It started off relatively quicker then the previous meeting. Quicker as in going right to work. - Don't understand technology so stakeholders were frequently asking questions and "thinking aloud" with the whiteboard.	Department > hallway > meeting> hallway department - Discussion, drawing, writing and using the computer to search for information.	The goal is to make "great" progress - designer - Dan - Some people appear not as interested...appear discouraged. "Overhead is overwhelming" - engineering - ernest. - Learn what needs to be there before things get crazy around Banks. [Crazy is busy] -	It appears as though some are not really "convinced" with the way the market is moving. This includes the existing technology, the amount of resources that are available and how thhings are moving with the project. - There's one personality that is difficult to work with and is not satisfied with anything. This person is also refusing to provide reason for his dissatisfaction - Evan.

Section	Activities	Events	Goals	Feelings
Design Idea Development Session 3	Unlike previous meetings, discussions and questions were mostly for the manager and director. This is by far the most participation the two has taken part in of all the meetings this far. - A list of questions were put together by the designers, engineers and QA. - A short presentation was put together for manager and director. - At this point, the main question the manager and director need to answer is regarding scheduling and resource conflicts. - Together, the whole team needs to come up with an elevator pitch. What does it entail? What does the technology allow it to do? Value proposition?	Email first > department > hallway > meeting> hallway > department - Present short presentation > finalize product scope and elevator pitch > tech/resource/budget - Tweak specification based on resource and technology. The technology determines how much resource is needed, however, careful planning is required to make sure that everything is affordable. Also, this exercise will be undertaken in the future on a frequent basis to ensure things are within expectations. If anything should go wrong, at least everyone will know and act accordingly.	The goal of this meeting is to get a few key issues figured out: spec details. Technology and future goals. Also, come up with a elevator pitch and find the real value proposition. It's a "vision update" - Dan. - Finalize product scope. Questions regarding user research came up. Different regions? Eng and Designer agree of the region but not sure how much resource should be placed in. - Time is the limiting factor > Eric and Dan agree that working together can speed things up. "So it's essential that everything is on the table".	Very efficient. Little or not disagreement or mockery. The conversation is also friendly even - Evan. He seems to be less dissatisfied. - The process is back and forth. They make decisions, go back and reiterate due to unknowns. - Turnaround seems to be quick as well. Questions at the end of previous meeting were research by the stakeholders independently and come back to the meeting to discuss their findings. "Save time". - Once in the room, communication is quick. Email is to update in between meetings.

Section	Content/Comments/Idea
Design Idea Development Session 1	The Cloud project seems to be attracting a lot of attention from the stakeholders. Everyone seems to be really enthusiastic about the meeting. Communication. The mood was getting better at the end. - Note: Email was sent from the Director. - At times it was rude and mockery was made between stakeholders. Why we here? - Surprisingly, it seems that the candy was an ice breaker. it generated conversation and created a relaxed atmosphere. The designer didn't seem as interested in the candy though. - Not everyone is involved with writing on the whiteboard or notepad. It seems *that one person volunteers to take* notes for the entire meeting... whoever is the closest to the whiteboard puts notes there as well.

Section	Content/Comments/Idea
Design Idea Development Session 2	Field observation, problems in context, bad designs. - Touch base via email. Schedule *meeting and Eli send notes out.* - Although, everyone present appears to be happy with the progresss, Evan had refused to cooperate for some strange reason. - Progress is better than the first day. Better and quicker. "Avoid politics". Ego and ownership. Joking and conversation seems to help build relationship.

Section	Content/Comments/Idea
Design Idea Development Session 3	User research key components: Obvious observation sessions showing designers looking and thinking - Look for a number of poorly designed products and how people find ways to "fix" the problems. Are they problems?

Section	Type	Space	Time	Actors	Objects
Design Idea Development Session 4	Observation of a meeting.	Eng-A Meeting Room #2 "The big area". Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" meeting room. A common meeting room is a general resource room which can be reserved by any employee. It is located on the opposite side of the building.	Duration of 3 hours. Lunch to 3pm. Frequent breaks.	Designer (2) D1, D2 - Engineer (4) one lead E1, E2, E3, E4 - Design Manager (1) DM1 - Design Director (1) DD1 - Quality Assurance (1) QA1	Desktop computer Software (competitors) Notes pens/pencil snacks drinks projector whiteboard - Mock-ups on the whiteboard and computer projection.

Section	Type	Space	Time	Actors	Objects
Design Idea Development Session 5	Observation of a meeting.	Dovercourt Refer to original notes for visual reference of the space and seating arrangements. - This is a big "common" meeting room. A common meeting room is a general resource room which can be reserved by any employee. It is located on the opposite side of the building.	Duration of 2 hours.	Designer (2) D1 and D3 - Engineer (5) one lead E1, E2, E3, E4, E5 - Design Manager (1) DM1 (left mid-way) - Design Director (1) DD1 - Refer to original notes for visual reference.	Desktop computer Laptop Projector Note pad whiteboard - Mockups and a list of requirements on the whiteboard.

Section	Activities	Events	Goals	Feelings
Design Idea Development Session 4	Use the roadmap and presentation version 2 to explain the technology and plan for deveopment. It's fairly technical. - To speed up the development process, they were wondering if repetitive work can be leverage by a consultant. (design team and engineering team) - Come up with a list of questions for IMP and forward this to managers.	Testing competitive software. What is good or bad? Notes were taken. What can be used and is it worth the risk to implement similar technology into Cloud project? - Some questions were generated in the meeting for "IMP" to answer. It's another department that usually take care of post production hassles. "This is not typical, trying to leverage work". - Then figure out if it's worth it to utilize technology from "IMP".	To determine whether the technology can be leveraged for projet use from other internal and external software. - Much of the worry came from whether utilizing internal technology would change the scope of the project. "It would defeat the purpose of conducting user research." Both the engineers and designers agreed that they had to be very careful not to forget what they intended to do from the very beginning. - This is a very good sign of cooperative work. - Save time vs. lose control?	This meeting was fairly technical. The most technical out of all the meetings. The designers had to ask the engineers questions frequently. It's like the engineers were translating information to them. This is a good sign as im not sure how the designers would have figured ot details like this before. It would probably take a really long time if each detail had to wait for emails or meetings to figure out. Confirm this with Director. - The feeling and environment is good. People are working together without any arguments. Quite friendly. - Most productive meeting since the beginning of observations. - They used notes from past meetings as a reminder on activities. Everyone has a consensus to previous activities and decisions. - Change in attitude is very
Section	Activities	Events	Goals	Feelings
Design Idea Development Session 5	Sketching (very basic) > writing the details of the specification. - Summary to get everyone aligned. - Refer to original notes for basic visual reference of sketching. The quality is nothing fancy at all. It's something that can be produced by anyone.	Lunch > Email confirm > Hall > Meeting > Hall > Department. - Put everything they've done together to get approval for budget from higher level stakeholders. - Requirements for the specificationn defined.	To align everyone's expectations and finalize the specifications. "Last call for questions and concerns". No particular concern was raised except for worries about future months. - Collate all the information, it will be put together in a storyline of what Cloud Project aims to accomplish. - Showcase proposal - Figure out to see if things work out. Setup for the next couple of months.	Communication is smooth and argument exist but limited. Apparently, this type of communication is far better than before. "Time saving". "Definitely more efficient", according to the director. - In comparison to the first meeting, everyone is working together to solve problems. Stakeholders are asking eachother questions. Especially, the designer and engineer are talking to eachother seeking advice and expertise.

Section	Content/Comments/Idea
Design Idea Development Session 4	Designer wanted everyone to sit together to come up with a list of questions for "IMP". I think this is a sign that the designer needs technical input from the engineers.

Section	Content/Comments/Idea
Design Idea Development Session 5	"IMP" requirements were rejected. They decide to stick to the original plan. This decisions was based on a number of drawbacks regarding the lost of control if technology was borrowed by "IMP". Both the engineers and designers agreed that it's best to not adopt for the sake of long term versatility.