2013

From engagement to alignment : exploring enterprise architecture through the lens of design science

Matthew Lloyd Levy
Louisiana State University and Agricultural and Mechanical College

FROM ENGAGEMENT TO ALIGNMENT: EXPLORING ENTERPRISE ARCHITECTURE THROUGH THE LENS OF DESIGN SCIENCE

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

Business Administration with a concentration in
Information Systems and Decision Sciences

by
Matthew Levy
B.B.A. Texas Tech University, December 1999
M.B.A. San Diego State University, May 2007
May 2013

ACKNOWLEDGEMENTS

As the completion of a dissertation nears, one cannot help but reflect on the challenges that have been overcome and the people who were there to help. I offer these acknowledgements in no particular order and with the disclaimer that there are legions of people I still want to thank. To my friends and fellow doctoral students during my time at Louisiana State University, Santiago, David, Jim, Bego, Kibily, Eric, Jeff to name a few. Thank you so much for your wise words during the comps process, classes, and teaching. Your reflective words were invaluable in me getting to this point. I sincerely would not have made it without your help. To Jennie, for offering such kind words and support, and of course, a place to crash when I came into town in exchange for banana pancakes. To my dissertation committee, Dr. Rudy Hirschheim, Dr. Andy Schwarz, Dr. Sonja Wiley-Patton, Dr. Suzanne Pawlowski, and Dr. Tracey Rizzuto. I feel so incredibly lucky to have such well-respected scholars guiding me through the dissertation process. To the entire ISDS faculty at LSU, you are truly some of the greatest academics in the world. To my girlfriend Erin, it would take an additional volume in my dissertation to express how thankful I am for your support. I am forever humbled by your presence in my life. To my best friend and brother Eddie, your support and wisdom through all the highs and lows is why I am here. To my mom and dad, who instilled in me many things, especially the practice of perseverance….and to Winston, who taught me that the only Zen you will find at the mountaintop is the Zen you bring (Pirsig, 1975).

> Being deep loved by someone gives you strength, while loving someone deeply gives you courage – Lao Tzu

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Information Systems Design Science (ISDS) as a research community is limited by a small number of research frameworks with considerable influence. The small triad of influential ISDS research, consisting of Walls, et al (1992), March and Smith (1995), and Hevner et al (2004) have primarily limited ISDS research to the positivist paradigm and the IT artifact. In contrast, Herbert Simon's intentions for design science never had such restrictions and intended a broader perspective. This dissertation explores Simon's intentions for design science, the Simonian stream of thought that includes The Sciences of the Artificial, as well as much of his most notable research, and offers an 'informed view' of design science in the tradition of Rortyian neopragmatism. Using this new lens of design science, a Bhaskarian critical realist treatment of human artifacts is also developed. Collectively, a Rortyian neopragmatist treatment for design science, and a Bhaskarian critical realist treatment of human artifacts are used as a lens to augment the Walls et al (1992) framework for Information Systems Design Theories (ISDT). An example of how to apply this lens is accomplished in Paper 2 of the dissertation. The ISDS lens is applied to the topic of Enterprise Architecture (EA). EA as vehicle for IS Alignment is well defined in terms of frameworks, artifacts, and methodology. However little is understood with respect to the discipline and practice of EA. Seeking to advance our understanding of effective vehicles for IS alignment, this research examines EA as an alignment practice and how it attempts to realize alignment. Specifically, we address the following question: How does EA manifest itself in organizations? This research employs an interpretivist epistemology in a manner quite distinct from ISDS research and thus provides contributions to academia in terms of methodology and insight on EA, and for practitioners who wish to mature an EA practice in their organization. Some of the main concepts discovered in the empirical study in Paper 2 are used to develop a practitioner-oriented framework for EA practice in Paper 3.

INTRODUCTION

Design Science in Information Systems (ISDS) represents a considerably large discipline within the IS field. Much of design science research is considerably centered on a triumvirate of heavily influential frameworks that have dominated the conversation. The three influential frameworks of Walls et al (1992), March and Smith (1995), and Hevner et al (2004) are unequivocally centered on the positivist paradigm (Levy and Hirschheim, 2012). In contrast, the research contained in this dissertation contends that design science, which is based on the canonical works of Simon (1996), intended much more. This research seeks to inform the current dialectic in ISDS with additional perspectives that it back in the direction of Herbert Simon's original intent; one that included many open ended trajectories into the human design using a variety of research paradigms, approaches, methods, and techniques. In addition, this dissertation seeks to apply this informed view of ISDS to an important IS research topic, Enterprise Architecture (EA), and derive knowledge that can be used across the academic and practitioner domains. The dissertation is divided into three papers. The first paper is a non-empirical piece that develops a lens to explore EA and combines the philosophical perspectives of Rortyian neopragmatism (Rorty, 1979), Bhaskarian Critical Realism (Bhaskar, 1975), and Simonian Design Science (Simon, 1996) to derive a new lens for ISDS research. The second paper applies this new lens to EA in the form of an interpretivist case study. Lastly, the third paper derives a practitioner-oriented guide for the discipline and practice of EA. The introductory sections below discuss the motivation for the research and provide an overview of the stream of research that represents the whole of the dissertation.

Motivation for the Research

EA represents an emerging, but important topic for the IS field. EA originated in the practitioner domain under the Zachman Framework around 1987 with his famous publication,

A Framework for Information Systems Architecture (Zachman, 1987). Later Zachman renamed his IS framework to be an 'enterprise' framework. Since that time, numerous government agencies and private corporations have adopted EA as a tool for technology-related business decisions, and as a vehicle for strategic alignment. As a by-product of the Clinger-Cohen Act of 1996, which essentially required the organizational structure of government agencies to resemble that of corporations and established the position of CIO within each government agency, the US Office of Management and Budget (OMB) issued a mandate requiring information technology architectures (ITAs) to be consistent within and between federal agencies and bureaus. In keeping with this mandate, the US Federal CIO Council published the Federal Enterprise Architecture Framework (FEAF) as a baseline to create this consistency. Since then, government agencies have been using FEAF as a baseline to publish their own versions of EA. Within government agencies, the value of having an EA to guide the Capital Planning and Investment Process (CPIC) has clearly been noticed. In a 2006 GAO report, the US government reported spending over $836 million on EA. In the same manner that government agencies are trying to create consistency in IT architectures, so too are large private sector corporations. For example, a report from the McDonalds Corporation in 2003 reported a loss of $170 million in a failed attempt to build an integrated business management system for their restaurant business, while Ford Motor Company's failed attempt to build an integrated purchasing system cost the company nearly $400 million. Both government agencies and private sector corporations alike are faced with the task of modeling complexity across giant swaths of the business. According to Carr (2005) "software debacles are routine and the more ambitious the project, the higher the odds of disappointment". The private sector has seen a more organic style of growth in EA. Rather than certain decision authorities mandating the use of frameworks in a top-down style, groups comprised of industry professionals such as the Open Group have been principally

responsible for maturing EA frameworks for private sector use. From what was originally Technical Architecture Framework for Information Management (TAFIM) used by the US Department of Defense, The Open Group Architecture Framework (TOGAF) has been matured over the past decade to become one of the more widely used EA frameworks. In general, EA as a vehicle to have business architecture and IS architecture together in a comprehensive set of artifacts is being increasingly envisaged by corporations as a more optimal way to strategically align IT. In a survey from InfoSys on large businesses, 375 organizations reported using EA as a mechanism for proactive involvement in IT transformation. In another survey from Dr. Dobbs Journal (2010), 30% of organization reported having an EA program in place, while 17% reported efforts to expand EA initiatives. Thus, an increasing percentage of businesses are allocating resources towards EA, not because federal law requires them to do so, but on their own volition because of its perceived benefits (whatever they are perceived to be). Due to the extensive use of reference frameworks, EA can be considered a rather structured discipline. However, the way in which EA organizations, and EA in general actually manifests itself in organizations is another matter. This dissertation research is particularly interested in exploring the discipline and practice of EA in organizations, and in particular, this research is interested in fostering a greater understanding of EA and promoting knowledge dissemination with respect to its discipline and practice. This dissertation research asks the following overarching research question: *How does EA manifest itself in organizations?*

Several gaps exist in the extant IS literature that serve to motivate this research. The first such gap is found in the IS literature on strategic alignment. The term ‘strategic alignment’ is from the work of Henderson and Venkatraman (1993). The Strategic Alignment Model (SAM) describes a model predicated upon ‘linkage’ between organizational infrastructure and processes, IS infrastructure and processes, and business and

IT strategy. The model presented in Henderson and Venkatraman (1993) has been chiefly advanced by quantitative research seeking to measure whether the IT and the business are ‘aligned’. The research in this dissertation contrasts with the extant literature on strategic alignment in that we seek to understand the process towards maturity rather than measuring whether or not a practice is mature. Research in participatory systems design also serves to motivate this research. Research in participatory systems design chiefly assumes that users are willing participants. In contrast, this research seeks to understand how EA organizations engage the business so they are willing participants in the EA development process. Lastly, the extant literature on Enterprise Resource Planning (ERP) serves to motivate this research. ERP research inextricably views alignment through systems implementation. In contrast, this research looks at the practice of developing EA as a precursor and vehicle to enacting technological solutions.

In addition to the above motivations are several research streams found in social psychology and IS. This research serves as motivation for analysis and model development. Of particular interest is the Group Engagement Model found in Tyler and Blader (2003), and the model for IT Engagement found in Fonstad and Robertson (2006). The former points to three factors that contribute to behavioral engagement in a group: Procedural Justice, Identity Judgments, and Psychological Engagement. Procedural Justice has four components: (1) Formal Quality of Decision Making Process, (2) Informal Quality of Decision Making Process, (3) Formal Quality of Treatment, and (4) Informal Quality of Treatment that factor into higher perceptions of procedural justice. In addition, Pride and Respect are the two attributes cited as contributing to Identity Judgments. The research contained in this dissertation found interesting commonalities between the Tyler and Blader (2003) model for group engagement and the concept of ‘linking mechanisms’ found in Fonstad and

Robertson's model for IT Engagement (Fonstad and Robertson, 2006; Ross et al., 2006). These findings are illustrated in detail in Paper 2.

Why Design Science?

The research in this dissertation uses design science as a lens to guide the research design, data collection, and analysis. There are many other ways to study the design of an EA practice within an organization. For example, a quantitative study could be employed that develops scales for group engagement using the model from Tyler and Blader (2003) to discern how EA organizations design their EA practice and involve external stakeholders from the business. As another example, a pure grounded theory study could be employed to simply see what emerges from speaking with practitioners. As even another example, the Hevner et al. (2004) framework could be used to generate a prescriptive model for EA. There are certainly contributions to be had using these research techniques and their underlying philosophical assumptions, as well as many other techniques in which to understand the discipline and practice of EA.

For the purposes of this research design science is used as a lens in which to investigate EA. Design (not design science) exists as the values, intentions, practices, events, communication, plans, experiences, etc. that culminate into a product or service. A scientific enquiry into a design seeks to identify salience in each of the aforementioned. Concomitantly, the discipline and practice of EA, which is seen by many as the employment of EA frameworks, has many underlying values, intentions, practices, etc. that go into building an EA practice that is useful to an organization. Thus, design science appears a natural fit to study the discipline and practice of EA.

This research chooses to 'inform' the triumvirate of ISDS frameworks so it is not bound by certain assumptions when conducting design science in IS. The aforementioned triumvirate is considerably centered on the positivist paradigm, which considerably limits the

variety of approaches, methods, and techniques that can be used in traditional ISDS enquiry (Levy and Hirschheim, 2012). This research echoes the call in Levy and Hirschheim (2012) that design science can include a multitude of trajectories. Design science can include elements from the natural and behavioral sciences, and be explanatory and descriptive, as well as normative and prescriptive.

Motivation for the Development of a New Lens in Information Systems Design Science (ISDS)

ISDS is currently dominated by a dialectic centered on a small triumvirate of ISDS research frameworks. The current dialectic in ISDS is considerably centered on defining what is, or is not, design science, and in particular, the dialectic centers on differentiating between natural science in the hard sciences, 'natural' science in the behavioral sciences, design science, and the difference between descriptive and prescriptive science. According to March and Smith (1995) and Hevner et al (2004) design science serves to create things that serve human purposes and to be technology-oriented". To 'create' is to infer a prescriptive scientific engagement that is distinct from explanatory or descriptive science found in the natural and behavioral sciences. This dissertation research contends that the original intentions of design science, such as that explicated by Herbert Simon (Simon, 1996) never intended any such demarcation. In addition, its quite possible that Simon (1996) may have deliberately left enquiry into the artificial open to a variety of trajectories that are free to incorporate a any number of paradigms, methods, approaches, or techniques. This dissertation research stands in contrast to the dialectic in ISDS that is couched in this small triumvirate.

The term 'design science' can be originally traced to the work of R. Buckminster Fuller (Fuller and McHale, 1963). However, the canons of design science can largely be equated with the work of Herbert Simon's *The Sciences of the Artificial* (Simon, 1969, 1981,

1996). Simon's work set forth a doctrine that expounded the many avenues research and pedagogy could realize when performing scientific enquiry into human design. The discipline of scientific enquiry into the artificial is referred to as design science, while the phenomenon under investigation is referred to as human artifice. The research in this dissertation offers 'treatments' for the ISDS notion of design science and human artifice. These treatments serve to inform the current dialectic in ISDS, which is considerably based on the positivist paradigm, and particularly concerned with differentiating design science from other types of scientific practice. Simon (1996) sets forth a doctrine that a science of design can be just as much about the investigation of cognitive artifacts as it can be about the investigation of IT artifacts. Psychology is just as much a design activity as engineering (Levy and Hirschheim, 2012). As a baseline into enquiry into the artificial, Simon (1996) sets forth four 'indicia' (See Table 2). In these indicia, it is important to notice that only the first is declarative: 'artificial things *are …'* while the other three are not: "artificial things *may* …", "artificial things can …", and "artificial things are often …". Thus, design science leaves many open-ended trajectories for enquiry into the artificial leaving the researcher the freedom to use the appropriate instruments relevant to investigation of the phenomena at hand.

Design Science is also more than just a discipline within IS. It is a multi-disciplinary research field that has several well-known journals, such as Design Issues, Design Studies, and the Journal of Design Research. Historically, these journals have published articles relating to material artifacts, however, it is also now widely recognized that design problems are ill defined, ill structured, or 'wicked' (Cross, 1982). Thus, design can exist at all levels across the cognitive, social, and material spectrum. Design journals have begun to include enquiry on a multitude of human artifacts to include wicked problems and innovative methods in performing scientific enquiry on human artifacts.

Similar pluralistic views are increasingly found in the ISDS literature. Of particular interest to this research is the work of MacKay et al. (2012) which synthesizes design research from outside the ISDS field and develops several 'design perspectives' that can be used in IS. This dissertation research takes the work of McKay et al (2012) one step further by applying the design perspectives to a qualitative research design and analysis. The design perspectives from MacKay et al. (2012) are in Table 1. The 'design profiles' can be found in the second paper of this dissertation.

Table 1: Design Conceptualizations (MacKay, et al., 2012)

Design as…	Brief Description
Problem Solving	Transforming and improving the material environment, solution-oriented, finding solutions to field problems and implementing those solutions
Product	Objects, entities, artifacts which arise and are imbued with meaning within those contexts, designer inextricably linked to the designed product
Process, Action	Processes and actions which lead to the realization and implementation of an artifact in a particular context, design involves action taking and change
Intention	Deliberate thought processes which enable the designer and user to see connections between problem and possible solutions, the intent driving the design activity and the impacts this has on the realized artifact
Planning (Modeling, representation, etc.)	Working hypothesis (or plan, model, etc.) which captures and formalizes the designer's intentions
Communication	Conceptual characteristics (form and content) of artifacts which resonate with users, the ways meaning is reconstructed by users
User Experience	The range of experiences (both manifest and latent) created for and received by the user of an artifact, the meanings and experiences a user constructs with an artifact over time
Value	The value (often symbolic and/or social) placed on the artifact and the experiences of that artifact by a user, and how this changes over time
Professional Practice	The broad responsibilities and activities of designers who inevitably change the world through their actions, an attitude towards a 'problem', consideration of the knowledge and skills required by designers
Service	Day-to-day problem solving, ability to understand and help others resolve or ameliorate problems, mindful of contextual forces and constraints

Research Process

The research contained in this dissertation proceeds as follows. The first paper combines the three perspectives of Rortyian neopragmatism, Bhaskarian Critical Realism, and Simonian Design Science to explicate a new worldview for ISDS. Pragmatism is used as a treatment in which to view design science, while Critical Realism is used as a way to view human artifacts. These three perspectives are brought forth and applied to the Walls et al (1992) framework on Information Systems Design Theories (ISDT). The Walls et al. framework is used as a departure point so that a framework can be explicated using the original intentions of Simon (1996). This framework is then applied to two separate instances of EA within a single corporation in Paper 2. Paper 2 consists of an interpretivist qualitative embedded case study on EA. As previously mentioned, the 'design science perspectives' found in MacKay et al. (2012) are used to develop 'design science profiles'. The design science profiles are developed as criteria to categorize the emergent themes found in the case study data. The design science perspectives were used throughout the research to guide research design and analysis. A within-case analysis on each case is performed. Upon completion of both of the within-case analysis, a cross-case analysis is performed and a model is derived. The cross-case analysis yields a model for IS Engagement that has implications for further research and for practitioner use. The findings from Paper 2, specifically, the interpersonal skills, organizational design, and core artifacts are assembled into a framework that is meant to guide practitioners that are seeking to establish an EA practice within their organization.

Collectively, this research begins with the theoretical and ends with the practical, as it relates to academia and practice. Paper 1 seeks to advance the state of the art with respect to design science worldviews in ISDS. Paper 2 applies this lens to EA so that it may yield new perspectives on the discipline and practice of EA and discuss the softer aspects of EA that are

absent from EA frameworks, and largely absent from the small body of research that exists on EA. This is further advanced in Paper 3 to offer guidance for establishing an EA practice. Design science affords this research the lens in which to conduct scientific enquiry. It is of sincere hope the lens developed in this research can be used by the ISDS research community to examine a multitude of phenomena beyond EA. In addition, it is of sincere hope that the findings revealed in the papers below are of use to further research on EA in both the academic and practitioner domains.

PAPER 1: EXPANDING THE DOMINANT WORLDVIEW OF INFORMATION SYSTEMS DESIGN SCIENCE[1]

Introduction

As a research community in the field of Information Systems (IS), Design Science in IS (ISDS) has made significant contributions to our understanding of the design of IT artifacts. However, the IT artifact is one of many different forms of human artifact that can be researched as part of the IS field. This research essay seeks to expand ISDS theory so different forms of artifacts can be explored. In doing so, the question must be asked: *Why is ISDS bound to a technocentric view?* Whilst, there may be many different acceptable viewpoints for which to answer this question, this research essay adopts the view that ISDS has been dominantly technocentric because it has been bound to a very small number of Design Science research frameworks. Similar in spirit to the Kuhnian view of normal science, for a conversation to take place under the auspices of ISDS, one or more of these research frameworks must exist as reference architecture. Also similar in spirit to the Kuhnian view, for a shift in paradigm to take place, a change in basic assumptions must take place to extend the basis of the conversation. In ISDS, this normal science conversation has taken place along the lines of three major research frameworks: Walls et al (1992), March and Smith (1995), and Hevner et al (2004), herein referred to as the *ISDS triumvirate*. This research finds these frameworks to be quite similar to one another. Each of these frameworks adopts positivism as its dominant paradigm and a focus on technological artifacts as objects of enquiry. Whilst, these frameworks have provided considerable contribution to the design science dialectic in IS, they have also been quite limiting, as these frameworks are largely considered canonical in their interpretation of the Simonian worldview.

[1] Portions of this paper were previously presented as Levy, M., & Hirschheim, R. (2012). Removing the Positivist Straight Jacket From Information Systems Design Science Research. *Proceedings of the European Conference on Information Systems.*

Design science was principally realized by Herbert Simon in *The Sciences of the Artificial* (Simon, 1996), thus the canons of design science originate from his work. This research essay contends that Simon (1996) intended a much wider aperture for the study of human artifacts. The term design science was first coined by R. Buckminster Fuller (Fuller and McHale, 1963) and was advanced by Herbert Simon (1969, 1981, 1996) in *The Sciences of the Artificial*. The Simonian view of design science has achieved near canonical status within the ISDS community (Kuechler and Vaishnavi, 2008). Although the concept of design science has evolved considerably since Simon's 1969 publication, it still carries its original intent as a worldview for research across a variety of human designed artifacts that are studied in the natural and behavioral sciences. This research essay adopts the Simonian perspective that design science studies the products of human intervention and can be any artifact that has been synthesized by humans for human-purposive goals (Simon, 1996).

Contrary to the aforementioned ISDS triumvirate, it is possible to expand design science to include more than positivist research on IT artifacts. In contrast, Design Science can be an open-ended theoretical lens for scientific enquiry. For good reason, Simon (1996) sidestepped any delineation of ontology, epistemology, or any such specification for approaches, methods, or techniques. Increasingly, ISDS and other design science communities are realizing the impetus to expand to 'softer' forms of human artifacts. This paper analyses the philosophical traditions of design science vis-à-vis the Simonian perspective and explicates a lens for design science in the tradition of Rortyian neopragmatism (pragmatism). In addition to the use of pragmatism, Critical realism (Bhaskar, 1975) is used as a treatment for human artifacts – the objects of enquiry in design science. With these treatments, some work can be performed on the ISDS triumvirate. The latter part of this research essay applies this new lens to the framework provided in Walls et

al (1992) on Information Systems Design Theories (ISDT) and provides an example of how this new framework can be used in IS.

As often stated, the IS field can be viewed as a ‘fragmented adhocracy’ where researchers work in small communities on a wide variety of topics that are often disjointed (Banville and Landry, 1989; Hirschheim and Klein, 1994). ISDS is one such research community. ISDS has its own standards for conducting and evaluating research in the form of the ISDS triumvirate. The triumvirate collectively mandates prescriptive, artifact-centric research for knowledge contributions to even be part of the design science conversation. This research essay contends this view of ISDS is becoming increasingly untenable. Along with an emerging populace (McKay and Marshall, 2005; Carlsson, 2006; Carlsson, 2007; McKay et al 2012), this research essay takes the position that the triumvirate adopts a positivist, technocentric view that severely limits the range of human artifacts, or *IS artifacts* (MacKay et al., 2012) that can be researched in ISDS. This research essay also takes the position that pluralistic research streams hold an epistemological advantage to ones that are monistic. Thus, ISDS, or any other discipline, must foster a tradition of innovation with respect to scientific enquiry to study human artifacts and move away from the compartmentalization of a single ontological or epistemological position and/or single genre of artifacts.

Considerable discourse exists on the ontological and epistemological position of design science. For example, Vaishnavi and Kuechler (2011) viewed design science as a paradigm similar to positivism and interpretivism; Meng (2009) viewed Simon (1996) as having many open-ended constructivist trajectories, while Hevner et al (2004) viewed design science as contrasting the behavioral sciences. Several previous arguments have also been made to expand general design science research beyond positivism and the IT artifact. In ISDS, the argument centers on design science epistemology (MacKay and Marshall, 2005; MacKay and Marshall, 2007; Niehaves and Becker, 2006; Niehaves, 2007; Carlsson, 2006;

Carlsson 2007; Iivari, 2007) and viewing design science from additional perspectives such as pragmatism (Purao, 2002; Järvinen, 2007; Hovorka, 2009) and critical realism (Carlsson, 2006; Carlsson, 2007). In the general design literature, arguments have been made to expand design science to include reflection-in-practice and instrumentalist perspectives (Schön, 1983; van Aken, 2001; Almquist and Lupton, 2010) in the tradition of pragmatism. Whilst the aforementioned perspectives offer conjectures on what design science may be, the lenses are developed without much explanation as to their application. This research essay differs from the aforementioned research by providing an example of how it can be applied.

Simon made no such statement as to a philosophical position for design science. Thus, as stewards of a creative tradition in design science, due care should be exercised in making such assessments. This essay differs from the many attempts to find a 'paradigmatic home' for design science. The worldview of pragmatism is offered as language to harness the full intent of Simon's worldview, and Critical Realism is offered as treatment for enquiry into human artifacts. This essay also stands in opposition to many of the ontological and epistemological arguments made in much of the ISDS literature, and in favor of an instrumentalist treatment for design science (Rorty, 1979). *"Theories (and presumably concepts) should be viewed as 'instruments' not answers to enigmas"* (James, 1907). A neopragmatist treatment for design science sidesteps the ontological and epistemological debate and affords a worldview in relation to its purpose, versus a truth building activity in the investigation of human artifacts. Simon (1996) offered a much broader overarching lens for which to view human artifacts. "An artifact can be thought of as a meeting point – an 'interface between an inner environment, the substance and organization of the artifact itself, and an outer environment, the surroundings in which it operates." Simon never made any specification as to what is, or what is not, human artifact, what constitutes knowledge on design, or any lexicon for which to engage in scientific discourse. Simon's open-ended

explication of design science is also quite different from much of his research, which is considerably logical positivist (Simon, 1979; Simon, 1982; Eisenstadt and Simon, 1998). For those who believe scientific theories should be couched in paradigmatic frameworks in the tradition of Burrell and Morgan (1979), the lack of a paradigm for design science research is an issue. However, if viewed from the pragmatist perspective, design science could be seen as inclusive to a number of paradigms, approaches, methods, and techniques with the sole purpose of improving the explanation and practical application of phenomena rather than an advancement towards 'truth' (whatever 'truth' is).

This research essay prefers the pragmatist perspective for design science. This essay also differs from other ISDS research (Purao, 2002; Järvinen, 2007; Hovorka, 2009) in how pragmatism is used. Whilst other ISDS research has linked design science and pragmatism from a reflection-in-practice perspective, this research applies pragmatism as a treatment to the ontological and epistemological debate. As a philosophy of science, pragmatism employs an instrumentalist perspective where concepts and theories are looked at only as useful instruments that improve our ability to explain and use phenomena. For the purpose of design science, the pragmatist perspective avoids the nominalist / realist ontological debate as well as the anti-positivist / positivist epistemological debate. Pragmatism and instrumentalism move the evaluation of research away from whether or not phenomena mirrors nature and gravitates towards truth to an analysis of whether what has been evaluated fits with what has been observed (Kuhn, 1962). Whilst classifying research according to paradigms (Burrell and Morgan, 1979) might seem convenient, this convenience comes at the cost of narrowing the aperture through ontological and epistemological constriction.

Lastly, this essay is not making the claim that current ISDS research is not design science in the manner Simon intended. Quite the contrary, as positivist enquiry was very much a part of the Simonian tradition. In contrast, this essay claims ISDS research has

viewed the aforementioned triumvirate as canonical in its interpretation of Simon and never questioned what else can qualify as design science.

This paper does the following: (1) The Simonian perspective to research is outlined and contrasted to Simon's explications of a lens for design science. (2) The Simonian view of design science is outlined with special emphasis paid to his analysis of softer forms of human artifacts, specifically, the science of economics, and of the human mind. (3) A Design Science research lens is presented in the tradition of pragmatism. (4) A treatment of human artifacts using the critical realist paradigm is explicated. (5) The pragmatist critical realist view of design science and human artifacts, respectively, is applied to augment the Walls et al (1992) framework. (6) An example is provided on how this new ISDT framework can be used, and (7) a discussion on what this means for ISDS research is provided.

Delineating Simonian Research and Design Science

Simon's history of research should not be confused with what he explicates as a new perspective for science. Whilst the Simonian approach to research is clearly logical positivist (Cruise, 1997; Diamantopoulos, 1997; Subramaniam, 1963), Simon (1996), he left many open-ended trajectories for design science to be pluralistic. This includes the use of different philosophical paradigms such as positivism, interpretivism, or constructivism (Meng, 2009), multiple approaches such as language analysis, phenomenology, or action research, and multiple methods such as structural equation modeling, lab experiments, ethnography, or case studies. A pragmatist treatment of design science allows it to move beyond positivism and towards enquiry into human artifacts that explore the full range of IS.

Pragmatism

Traditional pragmatist philosophy was the creation of C.S Pierce, William James, and John Dewey. Over the course of the twentieth century, it enjoyed renewed interest from

W.V.O Quine and Wilfred Sellars as a philosophical tool to analyze the dominance of logical positivism. More recently, the work of Hilary Putnam and Richard Rorty have given rise to what is commonly termed 'neopragmatism' or 'linguistic pragmatism'. Putnam (1994) puts forth a four-point doctrine on the ideas for which classical pragmatists tended to gravitate: (1) Antiscepticism: the idea that doubt requires just as much justification as does belief. (2) Fallibilism: the idea that humans can be wrong about their beliefs and understanding of the world and that there are no metaphysical guarantees that limit us from revising any particular belief. (3) Anti-dualism: rejection of the idea that mental phenomena can be non-physical, and (4) Reflection-in-practice: the idea that practice, properly construed, is primary in philosophy. Rorty (1979) assumes a naturalist position that moves pragmatism to avoid the three 'essentialisms' of 'truth', 'reality', and 'experience' and modifies the traditional pragmatist position on three basic tenets: (1) The idea that Dewey and Pierce should be applauded for repudiating many of the methods and goals in traditional philosophy. (2) That they should be repudiated in their attempts to reconstruct what should not be reconstructed (e.g. the three essentialisms), and (3) that we must accept the idea that language is the only available tool to "furnish philosophy's materiel". Similarly, Goles and Hirschheim (2000) define pragmatism as a philosophical position that emphasizes "what works while abstaining from the use of metaphysical concepts such as truth and reality". For the purposes of this discourse, modern pragmatism can be summarized by the following five pillars: (1) Anti-essentialism: a rejection of the three essentialisms of truth, reality, and experience, and subsequently, the traditional ontological and epistemological debate. (2) Anti-scepticism: the idea doubt requires just as much justification as belief in the development of knowledge. (3) Fallibilism: the idea that knowledge is fallible and that language is our only tool for knowledgeable discourse. (4) Anti-dualism: the idea that mental phenomena cannot be non-physical, and (5) instrumentalism: the idea that theory is grounded in practice and that

scientific theory is simply a useful instrument in understanding the world. This research essay applies the Rortyian form of neopragmatism as a treatment to Simonian design science and explicates the view that a treatment of design science as principally anti-essentialist and instrumentalist, whilst sustaining the other three pillars, will facilitate a worldview that is more inclusive to a number of paradigms, approaches, methods, and techniques.

Simonian Thought

Herbert Simon, a classically trained PhD in economics who also studied under philosopher Rudolf Carnap, contributed to a multitude of fields ranging from economics, computer science, management, operations research, and philosophy of science. Embedded in the Simonian perspective is the computational theory of the mind (Putnam 1961). In this theory, the human mind is thought of as an information processing system, where thinking is synonymous with the activity of computing. This stream of thought is pervasive throughout Simon's research on artificial intelligence (Newell and Simon, 1976; Simon, 1995). Also throughout much of Simon's research is the use of predicate logic and mathematics. Simon frequently used this notation as language to explain causal relationships found through empirical analysis, such as computer games, and reported this research in an objective manner. Given the nature of this research, this research finds similarity between the Simonian perspective and the five pillars of positivism (Goles and Hirschheim, 2000): (1) Unity of the scientific method. (2) Search for Humean causal relationships. (3) Belief in empiricism and universal generalizations from empirical observations. (4) Science and its process is value free, and (5) the foundation of science is based on logic and mathematics. Furthermore, Simon's "logical analysis of language" (Carnap, 1968) and his pervasive use of "abstract reasoning concerning quantity or number, modulo modern math and logic" position the Simonian approach to research firmly within the bounds of logical positivism.

Simon used logical positivism on a range of topics ranging from artificial intelligence (Simon and Newell, 1972) to models of human thought (Simon, 1979). In one of Simon's most widely cited publications, *Human Problem Solving* (Simon and Newell, 1972), human thinking, and the spectrum of human thought were described as simple cognitive processes able to be modeled by machines in the form of symbol systems. These symbol systems take physical patterns (symbols), combine them into structures (expressions), and manipulate them using processes to produce new expressions (Newell and Simon, 1976). Symbol systems constitute one of the principal philosophies on artificial intelligence. A symbol system can be represented as a computer, where the symbols are the zeroes and ones of computer memory (the structures), and the processes are the operations that alter the state of memory. In a similar vein, intelligent human thought can also be modeled as a symbol system. Symbols are encoded in our brains where our thoughts are structured expressions and the act of thinking represents the processes that alter the state of human thought. Symbol systems form the basis of philosophy on artificial intelligence, as well as a basis for enquiry into the artificial. This description of symbol systems is important because it illustrates the widespread applicability of Simon's theories in his enquiry into the artificial, particularly its seamless transition from the physical to behavioral sciences. An enquiry into the artificial in all its philosophical, scientific, technological forms *is* design science so long as the artifacts under investigation have human-purposive goals (Rosenbluth, et al, 1943; Simon, 1996).

This brings us to a division between the Simonian perspective and Simon's intentions for design science. Simon's research contributions to fields such as computer science, economics, psychology, management, operations research, and philosophy of science are almost exclusively logical positivist (Dasgupta, 2003; Simon, 1977). Logic and mathematics as well as the application of utility theory and statistical decision theory are essential to the Simonian perspective (Simon, 1959; Simon, 1979; Simon, 1983). However, Simon (1996)

only provides a cursory mentioning of how to use these theories when devising curriculum for professional engineering schools (Simon, 1996 p.118) and makes no mention of positivist techniques to analyze human artifacts. Rather, the practice of scientific enquiry into human artifacts is left open. For example, in Simon's chapter on economic rationality an ontological prescription is sidestepped in the following quote, "In this chapter I have tried not to evaluate these forms of individual and social organizations, but to simply describe them as commonly used solutions to the central problem of accommodating to our bounded rationality" (Simon, 1996 p. 49). Simon is clearly interested in the "tools of procedural rationality" (Simon, 1996 p. 49), but as something to investigate, not as prescription into what constitutes artifacts for design research in creating the "veridical picture of economic actors and institutions". Similar open-ended intentions are found in Simon's chapters on the human mind. In these sections, Simon is particularly concerned with enquiry into the "thinking person" as human artifact: "there are only a few 'intrinsic' characteristics of the inner environment of thinking beings that limit the adaptation of thought to the shape of the problem environment. All else in thinking and problem-solving behavior is artificial – is learned and is subject to improvement through the invention of improved designs and their storage in memory". Throughout these sections, Simon provides examples of cognitive processes investigated in his prior research, for example: search strategies (Simon, 1956), the parameters of memory and chunking (Chase and Simon, 1973), the mind's eye (Chase and Simon, 1973), and semantics of processing natural language (Newell and Simon, 1956). All of the above examples are clearly logical positivist, however, these examples are only mentioned as active areas of research, particularly in psychology and cognitive science, rather than what constitutes design knowledge. In Simon's words on experiments conducted on the semantics of language processing, he states "this approach *might* (italics added) be used to explain the resolution of syntactic ambiguities by use of semantic cues". This statement is echoed when

he states the limitations of his experiments in relation to design science, “The experiments are mostly significant in what they show about the broad commonalities in organizations of the human information processing system as it engages in different tasks”. Clearly, Simon intended his prior research to be examples rather than an ontological or epistemological foundation. Further evidence of his ‘prototype’ for a design science is found in the following quote:

“A scientific account of human cognition describes it in terms of several sets of invariants. First, there are the parameters of the inner environment. Then, there are the general control and search guiding mechanisms that are used repeatedly in all task domains. Finally, there are the learning and discovery mechanisms that permit the system to adapt with gradually increasing effectiveness to the particular environment in which it finds itself. The adaptiveness of the human organism, the facility with which it acquires new representations and strategies and becomes adept in dealing with highly specialized environments, makes it an elusive and fascinating target of our scientific inquiries – and the very prototype of the artificial” (Simon, 1996, p. 110).

This delineation between Simonian research and design science is important for IS research. If phenomenological enquiry into human artifacts is constrained to an investigation of knowledge vis-à-vis the use of logical positivism, the multitude of phenomena to be investigated is ostensibly constrained under these auspices.

The Simonian View of Design Science

An artifact exists as a ‘thin interface’ between an inner and outer environment. The inner environment is the substance and organization of an artifact, while the outer environment is the surroundings in which the artifact operates (Simon, 1996, p.4). Cognition and behavior is just as much an artifact as a software application or computer system, so long

as the artifact was synthesized for human-purposive goals. The goal of design science is to investigate artifacts exclusive of nature, however nature and human artifacts are inseparable as nature is embedded within them: *"A plowed field is no more a product of nature than an asphalted street, and no less"* (Simon, 1996, p.3). Whilst design science incorporates everything that is already studied in the natural and social sciences, it is also distinct in its view of phenomena. Simon provides a general distinction of design science using the following four indicia (Simon, 1996 p.5):

Table 2: Simon's Four Indicia (Simon, 1996)

Four Indicia for a Science of the Artificial	
1.	Artificial things are synthesized (though not always or usually with full forethought) by human beings
2.	Artificial things may imitate appearances in natural things, while lacking, in one or more respects, the reality of the latter,
3.	Artificial things can be characterized in terms of functions, goals, and adaptation, and
4.	Artificial things are often discussed, particularly when they are being designed, in terms of imperatives as well as descriptives.

Two of Simon's theories, substantive and procedural rationality (Newell and Simon, 1976) and symbol systems (Simon, 1973) can act as vehicles for interpretation. However, they do not have to, as evidenced from the aforementioned indicia. For example, either form of rationality could be applied to human behavior. In the case of substantive and procedural rationality, an observed behavior is a substantive artifact while the process of adapting the behavior to an outer environment is procedural. In turn, the inner character consists of the actions and thoughts that constitute the procedural action. Substantive and procedural rationality are closely aligned with Simon's explication of economics as a science of the artificial. However his main concern is not with tangible artifacts, but rather an understanding of the rational choice of the economic actors themselves: *"We are especially lacking in empirical information about how economic actors, with their bounded rationality, form expectations about the future and how they use expectations in planning their own*

behavior". A similar example can be used for symbol systems where our present thoughts are artifacts and the inner environment consists of symbols, and patterns of symbols, 'encoded' in our brains. These symbols are adapted through the process of thinking to alter the state of human thought – the outer environment. As Simon states, "the external environments of thought, in both the real world and long-term memory undergo continual change. In memory, the change is adaptive. It updates the knowledge about the real world and adds new knowledge…A scientific theory of human thinking must take account of this process of change in the contents of memory." Thus, an artifact can be biological, physical, or cognitive depending on what the design scientist seeks to investigate so long as the artifact in question is logically manifest for human-purposive goals.

Again, Simon (1996) never placed any ontological restrictions on the artifact, its inner character, or outer environment, nor did he place any epistemological restrictions on what constitutes design knowledge. Similarly, Simon's prior research also never placed any limitations on what could be conceived as a symbol, symbol system, processes, expressions, or what constitutes substantive and procedural rationality. The essence of Simon's many theories on artificial intelligence is that they would be logical in representation to both human and artificial systems. Hence, the only boundary is scientific discourse – what the scientist can conceive, observe, and disseminate to the scientific community.

The sections below discuss two important streams of thought from Simon (1996) in his development of a lens for design science. Important in understanding these two streams of thought is that within these topics Simon provides examples that range from tangible human artifacts to cognitive artifacts that again leave design science with open-ended trajectories and affords a philosophy such as pragmatism as a treatment to sidestep the ontological and epistemological debate.

Economics: Human Artifacts and the Science of Scarcity

Simon considered economics the purest form of human design. Economic rationality is a social activity where the artifacts manifest themselves as behaviors in the allocation of scarce ‘things’ such as land, money, time, fuel, and attention (Simon, 1996 p. 25). Economic artifacts are manifest through human behavior vis-à-vis individual actors, organizations, markets, and interactivity between them. Human artifacts can be the scarce things themselves, or the behaviors exhibited in their allocation. Simon presents an application of design science to economics where the outer environment is the aggregation of behaviors by individuals, firms, and markets, the inner environment is the capability for rational adaptive behaviors, and human artifacts consists of the goal-driven behaviors in the allocation of scarce things. However, anything considered ‘scarce’ by humans – “land, money, time, fuel, attention, and many other things” – are human artifacts (Simon, 1996 p.26). Thus, a material construction exists on the same plane of scarcity as a construction of the mind.

Central to an understanding of how inner and outer environments interact is the concept of substantive and procedural rationality. Substantive rationality represents the product of adaptation, while procedural rationality represents the process. Simon’s concept of adaptive complexity (Simon, 1996:7) provides an example: A complex system is any system composed of a series of interconnected parts where the whole exhibits properties exclusive of the properties of the individual parts. A complex system is adaptive when it is capable of changing from experience. The stock market is one of the purest examples of a complex adaptive system. Substantive rationality is illustrated by its adjustments to changing conditions (e.g. other markets), while procedural rationality is the knowledge and computational processes used to discover appropriate adaptive behavior. Simon believed that complexity ‘unmasked’ affords us a view of simplicity: “Human beings, viewed as behaving systems, are quite simple. The apparent complexity of our behavior over time is largely a

reflection of the complexity of the environment in which we find ourselves" (Simon, 1996 p.53). Although this particular quote may seem reductionist, many other aspects of design science are considerably comprehensive or holistic as evidenced by his study of complex adaptive goal-oriented systems "as wholes" (Simon, 1996 p.173).

Adaptive complex systems are created by assumingly simpler symbols, combined into expressions, and manipulated using processes to create new complex adaptive systems (Simon, 1996 p. 215). Knowledge of symbols, their intended structure, and the processes by which they are adapted to an outer environment is known from *a posteriori* knowledge. Thus, knowledge for adaptation is created for, and by, means of knowledge (Mingers, 2000; Bhaskar, 1978, Simon, 1996). This concept is also found in the critical realist view of the social sciences. From the standpoint of scientific investigation, substantive rationality is intransitive and realist, while procedural rationality is transitive and knowledge dependent. This research also applies critical realism as a treatment to human artifacts. In turn, while economic analysis provides a macroscopic view of human behavior, human cognition and behavioral analysis can present a more microscopic view of human artifacts.

The Human Mind: Cognition as a Science of the Artificial

In Simon's thinking about 'thinking', a cognitive architecture "must somehow be organized in the human brain to work together in a coordinated fashion" (Simon, 1990). From a biological perspective, cognitive capacity is realized through the process of conversion from short to long-term memory. According to theories found in the evolving field of neuroplasticity, this occurs when binding proteins enact segments of a cell's DNA, which leads to the production of special proteins that change the structure and activity of nerve cells for days, weeks, or longer (Schwartz, 2003). Whether or not we find the above hypotheses plausible, an agreement can be reached that the process of remembering and

learning causes minor changes in our biological makeup. This is effectively Simon's viewpoint as it relates to physical symbol systems.

For the intelligibility of scientific enquiry into human artifacts, Simon considers memory less a part of our biology, and more a part of the outer environment to which memory adapts (Simon, 1996 p. 53; Eisenstadt and Simon, 1997). The 'thinking person' is a product of human artifacts where the design of cognitive processes and requisite behaviors can be equally investigated. The "cocoon of information" (Simon, 1996 p. 110) is also part of the human environment that we spin and store in long-term memory and literary forms. "The external environments of thought, both in the real world and long-term memory, undergo continual change" (Simon, 1996 p.100). Similar to his theories on economics, Simon refers to the thinking person as an adaptive system, which again, given that memory undergoes continual change, gives rise to the concepts of substantive and procedural rationality.

Behavior can be thought of as the substantive rationality of the thinking person, while procedural rationality is the adaptation of previously acquired behaviors to an outer environment. Human-purposive goals are the impetus for procedural rationale, and subsequently, substantive adaptation. In the thinking person, procedural rationality is manifest through the process of cognition. Knowledge becomes embedded in our memory stores and scientific enquiry of the thinking person reveals many properties of cognitive procedure and behavioral substance. Simon believed scientific enquiry into the thinking person would reveal very little about the 'physiological machinery' that enables a person to think. Thus, psychology is a design science as all is learned and subject to improvement through the invention of improved designs (Simon, 1996 p. 54). From Simon's perspective, the human mind designs and adapts to an outer environment through two major components:

real objects *sensed* through “eyes, ears, and touch, and *acted* [italics added] upon by leg, hand, and tongue” (Simon, 1996, p.86).

Thinking about design research from this perspective affords design research many open-ended trajectories about the thinking person. Design enquiry must identify artifacts of human thought and describe the goals for which it was intended, the outer environment it is adapting to, and inner character and processes by which cognitive adaptation is taking place. Design science can thus be looked at as an instrument for understanding, explaining, and creating human artifacts. This instrumental perspective can be viewed in the tradition of pragmatism.

The Pragmatist Lens for Design Science Research

As a treatment for design science, pragmatism offers ISDS a widened aperture for which to incorporate Simon’s worldview. The five pillars of pragmatism outlined in this section can be aligned with Simon’s intentions for design science. Before doing this, it must be stated that Rortyian neopragmatism was much more than an explication of a philosophy of science, but a fundamental theory in the nature of knowledge. The first pillar that distinguishes pragmatism, anti-essentialism, is the principle guideline that allows design science to sidestep the ontological and epistemological debate. It also permits the lens of design science to possess a more exploratory and/or theoretical component as the inclusion of all three of the aforementioned ‘essentialisms’ no longer constitute an ontological basis for knowledge itself. The second pillar, antiscepticism, is not so much a matter for a theory on human artifacts, but rather a matter for philosophy of science in general in how, for example, knowledge of a theory of human artifacts, or doubt thereof, should exhibit equivalent levels of scrutiny. The third pillar, fallibilism, represents the gap between what we ‘emit’ and ‘receive’ (Simon, 1996 p.3). The fourth pillar, anti-dualism, is directly in line with the Simonian stream of thought as it relates to cognition and the transferability of theory between

natural and artificial intelligence. Lastly, the fifth pillar, instrumentalism, is the only logical way to explain Simon's view on design science without it becoming confounded with his own previous research.

From this pragmatist treatment of design science, a new lens for the study of human artifacts is conceived. This new lens has the following characteristics: (1) It is normative and concerned with the science of *oughts* vs. *is* (Simon, 1996 p.5) as human artifacts are adapted to goals. (2) It is inseparable from nature as nature is "embedded in human artifice" (Simon, 1996:4). (3) It is a view of the world that depicts human artifacts vis-à-vis an inner and outer environment, and (4) it is pragmatist in the sense that science should employ whatever philosophical and/or methodological approach works best for the particular research stream (Goles and Hirschheim, 2000). Within the lens for design science is the scientific process of discovery about the inner environment and the process by which the inner adapts to its outer environment. This process of discovery *can* apply Simon's theories on substantive and procedural rationality, and/or his theories on symbol systems.

Using this lens, design science is unchained from a particular ontology or epistemology, particularly positivism. It is also aligned with a pragmatic view, as paradigmatic positions are to be looked at as instruments for a purposive use, rather than an ontological or epistemological position that attempts to march science towards the three essentialisms of truth, reality, and experience. Whilst Herbert Simon, one of the most prolific researchers in modern times, was unequivocally logical positivist, design science as a worldview can and should be applied using a variety of research paradigms, approaches, methods, and techniques.

The above lens for design science research can be summarized as follows: (1) A design science consists of an (a) outer environment: the environment to which we adapt to for human-purposive goals, (b) an inner environment: the character and composition of what has

been adapted for human-purposive goals, and (c) human artifacts: the thin interface between the inner and outer environments. (2) Human artifacts can consist of any human design artifact such as land, money, time, altruism, cognitive processes, behaviors, etc. (3) Human artifacts can be conceptualized in terms of (a) substantive rationality: how well an intelligent system has adapted to its outer environment in light of its goals, and (b) procedural rationality: the reason and logic by which it was discovered how an intelligent system has adapted, and/or (c) symbol systems: physical patterns (symbols) combined into structures (expressions) and manipulated using processes to produce new expressions (Newell and Simon, 1976). (4) Design science differs from much of the natural and behavioral sciences by an emphasis on normative vs. descriptive science, but is not exclusively one or the other.

The above description describes a lens that is quite different from the triumvirate of research frameworks in ISDS. This lens implies that design science does not exist on the same plane as positivism or interpretivism, but through a pragmatist worldview of the artificial world where different models for research could be used to explain the manifestation of human artifacts in pursuit of human-purposive goals. Design science is not locked in to any particular type of artifacts, nor is it bound to any particular paradigm, method, or technique in scientific investigation. In essence, this pragmatist treatment for design science affords multiple research traditions to be employed under the auspices of Simon's design science worldview.

In the following sections, the pragmatist treatment of Simon's design science worldview is used to view human artifacts through the lens of critical realism. Either perspective, pragmatism or critical realism, could be used as a treatment for Simon's worldview, however, critical realism is a philosophy that is particularly concerned about the treatment of objects and how we come to observe them. Critical realism will be used in this essay to augment the Walls et al (1992) framework for ISDTs. Critical realism, and its bases

of transcendental realism as ontology, relativism as epistemology, and critical naturalism as a treatment for critical realism's use in the social sciences, affords ISDS a view that allows us to view different forms of human artifice under a single lens, something that cannot be done with positivism alone.

Critical Realism as a Paradigm for Design Science

Whilst there exists a short history that has sought to link critical realism (Bhaskar, 1975) and IS (Mingers 2000, 2004a, 2004b), very little research has attempted to apply critical realism to a particular IS research stream. In this section, the five pillars of pragmatism are used to demonstrate the use of critical realism as one particular philosophical paradigm can be applied to the Simonian worldview of design science.

Critical realism asserts that for the intelligibility of science, a realist position (i.e. the study of 'things' external to the mind) must be adopted while respecting the corrigibility of perception (Mingers, 2000). Two proposals are made in this section: (1) Design science can easily assume a realist ontological position and investigate artifacts as if they have objective or absolute existence in the tradition of critical realism. (2) As knowledge is produced through social discourse, design knowledge is no exception and thus we have an ontological and epistemological position in critical realism that also aligns with the pragmatist worldview of design science. Thus pragmatism as a treatment for the worldview of design science and critical realism as an ontological and epistemological position for the treatment of human artifacts affords ISDS a variety of research traditions and operates as a vehicle to incorporate pluralism in ISDS and general design science research.

Critical Realism

This section draws heavily from the work of Mingers (2000, 2004) and Bhaskar. For a full review, the reader is encouraged to consult Bhaskar (1975, 1987, 1989, 1989), Collier

(1994), Mingers (2000, 2004a, 2004b), and Dobson (2001, 2002). Critical realism (Bhaskar, 1975) evolved as a response to the difficulty in maintaining a realist position in the natural sciences (Mingers, 2004). It accepts a realist ontological position, whilst accepting a relativist epistemological position. In critical realism, the constitution of knowledge, including the practice of science itself, is considered to be historically and socially conditioned. Bhaskar's view of reality is both intransitive (existing independently of human cognition) and stratified. Bhaskar's first form of stratification creates three ontological domains: *Domain of the Real, Domain of the Actual,* and *Domain of the Empirical*. The relationships between these three domains are illustrated in Figure 1, and the resident characteristics of each of the domains are listed in Table 3.

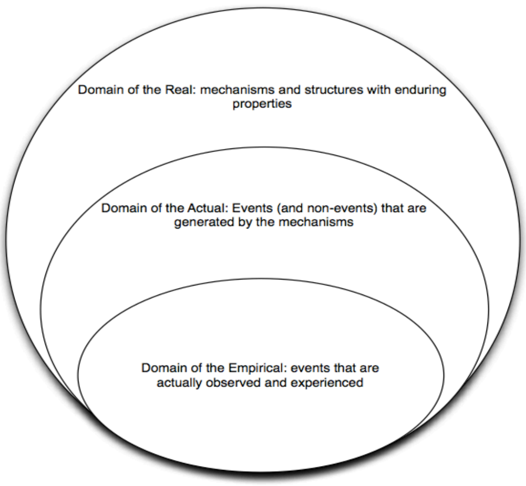

Figure 1: Bhaskar's Stratification of Reality – adapted from Mingers (2004)

The above stratification is based on the 'objects' that reside within each of the domains. Mechanisms exist as objective entities equivalently in nature and as constructions of the mind, events act as the triggers that encourage a human's ability to form a perception of a mechanism, while experiences represent the empirical knowledge that affords our ability to create knowledge of these structures.

Table 3: Domain Characteristics (Bhaskar, 1975)

Domain Characteristics for Critical Realism			
	Domain of the Real	Domain of the Actual	Domain of the Empirical
Mechanisms	X		
Events	X	X	
Experiences	X	X	X

A second form of stratification is amongst the mechanisms themselves, where causal powers, or generative mechanisms can be generated by mechanisms at a lower level. For example in the natural sciences, a chemical reaction between two substances can also be viewed as the number of atoms that have been displaced or made unstable. In the behavioral sciences, a higher order psychological construct can be the product of several lower level constructs.

The first form of stratification establishes relevance for a discussion on a philosophy of design science. If human artifacts are viewed as objects of scientific investigation, they must also have an intransitive inner character capable of being *actualized* to produce observable outcomes. This establishes a basis for realist ontology. However, scientific knowledge itself is a construction of the mind as we only know what we observe, and disseminate through scientific discourse. Hence, our knowledge of human artifacts is relativist as language is all we have to disseminate scientific knowledge. In moving from the empirical domain to the real, critical realism proposes a method of retroduction where a critical realist would take some unexplained phenomena and proposes hypotheses, which *if they existed*, would generate a cause that is to be explained.

In the section below, the finer points of transcendental realism are investigated. Transcendental realism is the ontological position that affords the critical realist a basis to move from one domain to the next and reconciles the realist and relativist ontologies.

Transcendental Realism – Reconciling Between the Empiricist, Idealist, and Realist Traditions

Three ontological traditions historically dominate philosophy of science: classical empiricism, transcendental idealism, and transcendental realism. The former is the product of David Hume, while Immanuel Kant developed the latter two. In advancing transcendental realism, Bhaskar explicates two ontological criteria of adequacy for a philosophy of science: a dependence on a *transitive* process, e.g. one that is dependent on antecedent knowledge and the activity of man, and a dependency on *intransitive* objects, which depend upon neither. Bhaskar's exact criteria are stated in Table 4 (Bhaskar, 1978, p. 24):

Table 4: Bhaskar (1975) Criteria of Adequacy for Transcendental Realism

Adequacy Criteria for Bhaskar's Advancement of Transcendental Realism	
(1)'	a criterion of the non-spontaneous production of knowledge, viz. the production of knowledge from and by means of knowledge (in the transitive dimension), and
(2)'	a criterion of structural and essential realism, viz. the independent existence and activity of causal structures and things (in the intransitive dimension).

The first ontological tradition, classical empiricism, is the view that science can only explain events that can be observed. Bhaskar rejects the notion of classical empiricism on the basis that within the empiricist ontology all events must be analyzed as sensations. Thus, classical empiricism can barely hold (1)' and cannot sustain (2)'.

The second ontological tradition, transcendental idealism, holds that objects of scientific knowledge are models, ideals of natural order, but these objects are not independent of men or human activity in general (Bhaskar 1978; Mingers 2000; Mingers, 2004). Thus, transcendental idealism cannot sustain the two criteria of adequacy. While transcendental idealism may satisfy the criterion of the transitive dimension (1)', it cannot hold the idea that objects of knowledge exist independently of human activity in the intransitive dimension (2)'.

The third ontological tradition, transcendental realism, is the Kantian tradition advanced by Bhaskar. Both transcendental idealism and transcendental realism reject the empiricist account of science, but they disagree as to whether order discovered in nature would exist independently of men (a realist position), or whether this order is actually imposed by men in their cognitive activity (an idealist position). Bhaskar's treatment of transcendental realism argues that it is necessary for the "intelligibility of science" that the order discovered in nature should be considered to exist independently of human activity. The transcendental realist believes that if there were no science there would still be a nature and thus, nature is what is investigated by science. This treatment is also simply a philosophical position to engage in scientific discourse that is ultimately a social activity and should not be confused with religion or metaphysics.

The transcendental realist position affords design science an ontological treatment to study human artifacts. In Simon's words, "At each step towards realism, the problem gradually changes from choosing the right course of action (substantive rationality) to finding a way of calculating, very approximately, where a good course of action lies (procedural rationality)" (Simon, 1996 p.26). From a critical realist perspective, a treatment of the inner character as the generative mechanisms that produce observable social events represents the thin interface, or artifact, between the generative mechanisms and the outer environment that serves as the human-purposive reason for agency. Transcendental realism serves as the principle ontological position of critical realism, while it is relativistic in its epistemological position in the sense that scientific knowledge is produced through the process of dialectics. Furthermore, critical realism uses critical naturalism as a lens so that 'objects' in the social sciences can be investigated in the same regard as objects in the natural sciences. However, when the lens is applied to the social sciences a position is taken with the idea that social

structures, as opposed to natural ones, are in a much greater state of flux such as what we see in Gidden's (1984) argument about the duality between structure and agency.

The Ontological Perspective: Transcendental Realism and Design Science

As discussed, design science offers the scientific community an alternative worldview to conduct scientific enquiry into human artifacts. Artifacts can be any identifiable physical or social structure considered the product of human intervention for human-purposive goals. Simon (1996) provides many examples of artifacts ranging from the physical to the behavioral sciences. In the physical sciences, Simon provides examples that stem from sciences that include Astronomy, Biology, Chemistry, and Physics. In the behavioral sciences, these examples include Economics, Psychology, Sociology, and Anthropology. The design scientist is charged with identifying human designed artifacts and providing an understanding of its current incarnation *in situ*. Specifically, a design scientist provides knowledge about the artifact as an interface between its inner and outer environment. The existence of an artificial 'thing' is first identified, and an interpretation about its inner character and external environment becomes an account of the design scientist.

The critical realist views artifacts as *intransitive* 'things' for the purposes of investigation, but *transitive* in the acquisition and production of knowledge, from, and by means of knowledge in scientific discourse. An understanding of the intransitive is initiated by the empirical events generated by the real in the domain of the actual, which serve to excite the senses. Thus, any 'thing' from clocks to psychological constructs is a 'real' artifact when adopting a critical realist position for design science and can be explained using critical realism's two forms of stratification in relation to the artifact as a 'thin interface' between the inner and outer environment.

This research contends that transcendental realism is the vehicle that affords the design scientist the ability to explain a variety of natural and social phenomena in the

Simonian tradition. In the following section the structure and verbiage from Simon (1996) is applied to explore whether it satisfies critical realism's ontological criteria of adequacy.

To satisfy the criteria of (2)', Simon's four indicia (Table 2) distinguish design science from natural science. Each of the four indicia references "artificial things". Furthermore, similar to institutional theory (Berger and Luckmann, 1967) where objects of knowledge become reified, Simon believed that artifacts move towards realism as they become enacted (Simon, 1996, p. 26)

Transcendental realism follows this same theme, where the world consists of 'things', not events (Bhaskar, 1978 p. 51). These things possess "tendencies, liabilities, and powers", and it is in reference to these tendencies, liabilities, and powers that the phenomena of the world are explained. Generative mechanisms, are nothing other than ways of "acting a thing" (Bhaskar, 1975 p. 51) to provide the realist basis for causal laws. Simon's four indicia explicitly concern a science of things that are the products of human intervention as "at each step towards realism, the problem gradually changes from choosing the right course of action (substantive rationality) to finding a way of calculating, very approximately, where a good course of action lies (procedural rationality)" (Simon, 1996, p. 26). Clearly, Simon viewed both physical and social structures as intransitive and realist. An ontology of structured and essential realism in design science affords our exploration a sufficient condition for (2)' in the intransitive dimension.

To satisfy criterion (1)', an analysis of design science as *transitive* requires greater analysis. The *transitive* dimension regards the production of knowledge from and by means of knowledge. Knowledge is viewed as objects, which can then be self-referenced to generate new knowledge (Mingers, 2000). The Simonian view of design science also allows us to confront the fact that knowledge is socially and historically conditioned. Simon states that 'strings of artifacts' make up significant parts of the environment that we receive through

our eyes and ears in the form of written and spoken language that we then pour out into the environment (Simon, 1996 p.2). Thus, a design science is only advanced through the design scientist's interpretation of artifacts, where these artifacts themselves may be a product of cognitive activity. This view is mirrored throughout Simon (1996) as he relates a science of design to advances in biology and computer science, as well as psychology and economic rationality. The latter two being relativistic in terms of what is investigated in social scientific discourse. For example, a behavior that perceived to be economically 'rational' exists as part of the allocation of scarce 'things', which exists for some human-purposive goal, and is considered a human artifact. This behavior has an inner character based on a psychological construct, and an interface (the behavioral artifact itself) that is adapted to goals pertaining to one's interaction with their outer environment – humans as behaving systems. The substance and organization of the behavior (the inner environment) is socially and historically conditioned, and an evolution of *a priori* behaviors. These behavioral artifacts, their inner character, and how it is molded to an outer environment occur in everyday life and in the process of scientific discourse. If knowledge about *a priori* behaviors in scientific discourse (e.g. whether they were successful or unsuccessful in pursuit of goals) leads to the production of new behaviors (or new knowledge about behaviors) then we find ourselves in satisfaction of (1)'. Furthermore, as transcendental realism is the only major ontological tradition that can sustain critical realism's two criteria of adequacy, transcendental realism becomes a suitable ontological perspective for design science.

The Epistemological Perspective: Knowledge in the Sciences of the Artificial

"A plowed field is no more a product of nature than an asphalted street, and no less" (Simon, 1996). The nature of this quote was not to argue for the analysis of artifacts solely in nature, but to emphasize that much of what we encounter in our daily lives, from ploughed fields to human interactions, are the products of human intervention. An artifact can be

physically or socially constructed, and regardless of how it was constructed, these artifacts act as 'interfaces' between an inner and outer environment. As has been discussed, an irony exists in ISDS where design science adheres strictly to a study of the IT artifact (McKay and Marshall 2005, McKay and Marshall 2007), yet it is clear from Simon's original thesis he had no such restriction in mind. To paraphrase Simon's words: a science of design must include an explanation of the 'interface', its characteristics, the environment from which it was molded, and an understanding of the human-purposive adaptation to a goal that led to the artifact's current incarnation. Nothing about Simon's intention for a design science, or a holistic view of his thesis places any restriction on what artifacts are worthy of scientific discourse.

The Simonian view of design science also recognizes fallibility in the production of design knowledge. In Simon's words, "significant parts of the environment consists mostly of strings of artifacts called symbols that we receive through our eyes and ears in the form of written and spoken language that we pour out into the environment…the determinants of their content are all consequences of our collective artifice" (Simon, 1996, p.2). This is true in the everyday accumulation of knowledge on artifacts, as well as in scientific discourse. As a species separated from the natural world (Berger and Luckmann, 1967), the artificial is present in everything we "emit and receive" (Simon, 1996 p.3). The difference between what we "receive" and "pour out into the environment" is a matter of interpretation and illustrates a relativistic view of knowledge. In summary, the existence of an artifact does not constitute knowledge of it. This is equivalent to Bhaskar's "epistemic fallacy". Thus, while design science assumes realist ontology of structures and natural laws embedded within the artifice, this research proposes epistemology of design that is both relativistic and anthropocentric.

The critical realist also assumes there is more to knowledge than the category of experience and that statements about being cannot be transposed into statements about

knowledge. To do the converse is to commit an epistemic fallacy. The epistemic fallacy is a manifestation of beliefs derived from classical empiricism (Bhaskar, 1978, Mingers, 2000, Mingers, 2004). Thus, to be considered design knowledge, this research contends that boundaries must be set beyond the realist ontological perspective. These boundaries come straight from Simon's four indicia (Table 2). Simon's first indicia sets the lower boundary for an epistemology of design, and *may* include indicia (2), (3), or (4). However, as evidenced by Simon's use of the words "may", "can", and "are often" in indicia (2), (3), and (4), respectively, they do not have to. Lastly, to be considered design knowledge, a scientific investigation must include a description of the artifact, and its role as an interface between an inner and outer environment.

Synthesizing Design Science and Critical Realism – The Design Scientist's Perspective of Critical Realism

Critical Realism's principal form of stratification provides a basis for the critical realist to view design science. The critical realist first identifies a phenomenon that is perceived to be a product of human intervention. The critical realist then observes the inner character of the artifact and the external environment that has served to mold the artifact's current incarnation – this occurs in the domain of the empirical. The domain of the actual provides the critical realist access to observable elements in the domain of the real, where characteristics about the inner and outer environment exist when assuming transcendental realist ontology. The domain of the real consists of human artifice believed to exist *a priori*. These artifacts can consist of products, methodologies for problem solving, processes, actions, intentions, models, social representations, communicative behavior, values, professional practices, services, or any other salient object, or object of knowledge (McKay, et al, 2012). Based on the above discussion, Figure 2 below augments the Mingers (2004) conceptualization of critical realism to include design science.

The above discussion proposes critical realism as a paradigm to conduct scientific enquiry on human artifacts. In developing a use for critical realism in design science, the above presents an alignment between the Simon's perspective of design science and the ontological and epistemological positions in critical realism. Unlike other research, which has sought to apply critical realism to design science (Carlsson, 2006; Carlsson, 2007) this synthesis is developed without confounding it with the IS discipline. The traditions central to IS and ISDS research should be looked at separate to this lens. In the following section, the pragmatist treatment of design science is coupled with the critical realist position on human artifacts is used in looking at the triad of seminal research in ISDS.

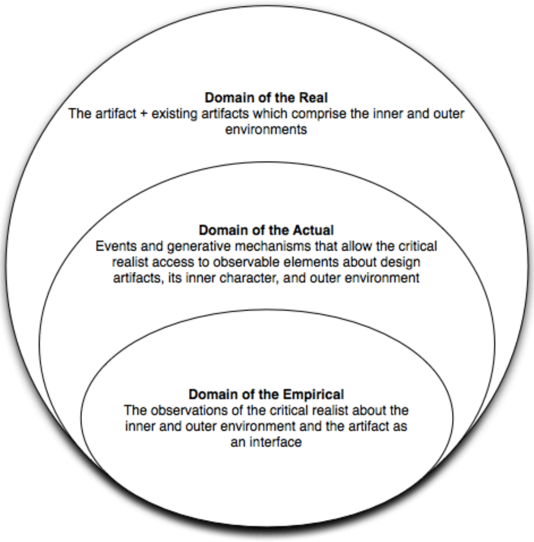

Figure 2: The Critical Realist Perspective of Design Science

Applying a New Worldview of Design Science to ISDS

The previous sections outlined pragmatism as a treatment to widen the aperture of design science. It was widened in such a manner that affords the use of a variety of paradigms and research traditions to encompass the full intent of Simon (1996). Upon expanding the design science lens, an example in the form of critical realism was provided as a treatment to human artifacts. These three perspectives, design science, pragmatism, and critical realism, affords ISDS and design science research, in general, an informed worldview

for a more diversified portfolio of human artifacts for design science enquiry. This worldview can be applied to the aforementioned triumvirate of ISDS research frameworks. In the following sections, this is used to inform Walls et al (1992) and their framework for Information Systems Design Theories (ISDT).

The Dominant Worldview in ISDS Research

ISDS is perceived by some to operate in a "positivistic box" (MacKay and Marshall, 2005; MacKay and Marshall, 2007). Furthermore, there exists a considerable dialectic in ISDS pertaining to paradigms, as well as alternative ontologies and epistemologies (Carlsson, 2006; Järvinen, 2007; Niehaves & Becker, 2006; Purao, 2002). This research essay is concomitant with the positivist view of design science, however, further analysis is warranted to illustrate the association between ISDS and positivism. Given that such a small number of ISDS research frameworks are so widely used (e.g. the triumvirate), an analysis can be centered on these three frameworks. This section provides a brief analysis of these seminal frameworks vis-à-vis the conventional definition of positivism.

Burrell and Morgan (1979) describe positivism as the search for objective knowledge amongst a society of regulation where we search for causal norms. Unlike pragmatism or critical realism, positivism is inextricably linked to a particular form of research methodologies. Knowledge in positivism is reported using discrete logic, mathematical notation, or statistics where a belief in the integrity of 'hard numbers' is the basis of knowledge. This notation is perceived to be exclusive of researcher social values, specifically the social values of the person reporting them. Positivist research is nearly always quantitative, and quantitative research inherently assumes a hypothetico-deductive method where theories in the form of hypotheses are essentially in search of data. These data are constantly in search of causal relationships that are not necessarily observable (e.g. Hume's notion of scepticism) but are derived from hypotheses declared *a priori* and

empirical analysis. Thus, in most positivist research, a theory begins in search of data (a deductive process) and moves to a theory derived from data.

Hevner, et al (2004) is currently the most widely cited ISDS research framework (over 2500 citations in Google Scholar as of November 2011). If we align Hevner et al (2004) to the five pillars of positivism in Goles and Hirschheim (2000), it is clearly in satisfaction of Pillar (1) based on the following figure:

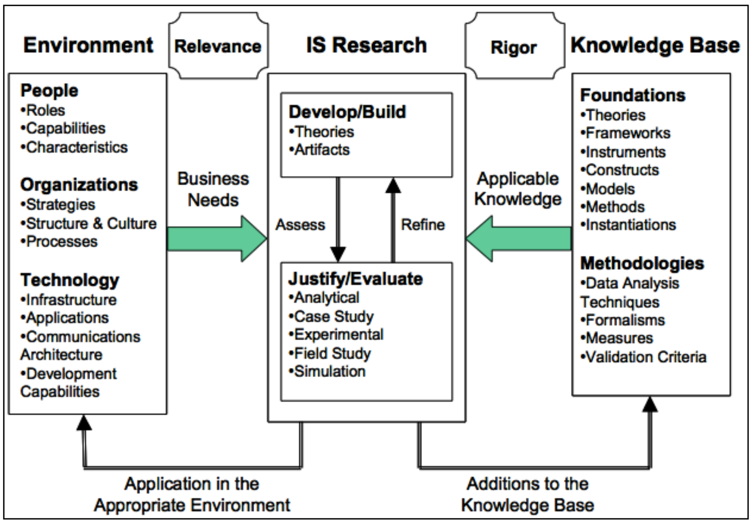

Figure 3: Hevner et al (2004) Research Framework for Information Systems

The assessment of IS research in terms of the development/building of theories and artifacts as a precursor to justifying and evaluating them is holistically essential to the hypothetico-deductive method. Furthermore, the very notion of kernel theories as derivatives from behavioral science implies a search for causal relationships, thus satisfying Pillar (2). Pillar (3) is easily obtained from the following quote, “For such artifacts, knowledge of behavioral theories and empirical work are necessary to construct and evaluate such artifacts” (Hevner et al, 2004 p.88), in addition to the numerous references to empirical observation as an essential part of design science. Pillar (4) is satisfied by the notion of the IT artifact as the object of creation and study: “the design-science paradigm seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts (Hevner et al,

2004 p.88)". Lastly, Pillar (5) is satisfied by the following quote, "A mathematical basis for design allows many types of quantitative evaluations of an IT artifact, including optimization proofs, analytical simulation, and quantitative comparisons with alternative design" as well as the many references to "logic and mathematics" as a way to evaluate artifacts. This research makes the inference that adopting a framework such as Hevner et al (2004) inherits its paradigms. Thus, to use the Hevner et al (2004) ISDS research framework is to conduct research that is positivist in nature. Consequently, much of ISDS research assumes a positivist perspective.

In a similar vein, March and Smith (1995) can also be considered a positivist research framework for ISDS as per Goles and Hirschheim (2000). March and Smith (1995) declare ISDS to require "extensive use of the hypothetico-deductive method" in scientific study (March and Smith, 1995 p. 253) and differentiates design science from natural science in that "natural science tries to understand reality, design science attempts to create things that serve human purposes" (March and Smith, 1995 p. 253). March and Smith (1995) declare four primary outputs of design science research, *constructs, models, methods, and instantiations*. The searches for Humean causal relationships are the laws behind any theory about a relationship between constructs; this satisfies Pillar (2). In addition, March and Smith (1995) correlate design science with Simon's contributions to computer science (Newell and Simon, 1972). Satisfaction of Pillar (3) is obtained by a strict call for empirical research in design science and the call for empirical analysis in the instantiation of artifacts. The artifact centric nature satisfies Pillar (4) as we are creating and evaluating IT artifacts instead of the variety of human artifacts that surround IS in many different capacities, and lastly, the statement that research outputs are to be "well-formed logical structures" (March and Smith, 1995, p.256) finds us in satisfaction of Pillar (5).

Lastly, in the triumvirate of ISDS research is Walls et al (1992). This framework's alignment with positivism made explicit as it builds directly on Dubin's method of theory building in the traditional sciences (Dubin, 1978). Whilst Dubin never prescribes the scientific method as the only method for conducting science, he does emphasize that a theoretical model or system forms the basis of inquiry for the purposes of any empirical testing (Dubin, 1969 p.6). To satisfy Pillar (1), March and Smith (1995) state that theoretical models are "intensely practical" for the purposes of ordering relationships with the "environing universe". To satisfy Pillar (2), March and Smith (1995) espouse the empirical testing of theories. To satisfy Pillars (3) and (4), 'values' are associated with units of a theory, or variables, rather than those of the one conducting scientific enquiry. Lastly, to satisfy Pillar (5), an ISDS theory must entail the logical presentation of "units of a theory".

In summary, the triad of seminal research in ISDS is considerably positivist as it is considerably centered on a positivist triumvirate of ISDS research frameworks. If the position is taken that anyone who adopts these frameworks as a basis for research also assumes its philosophical position, ISDS research, as a whole, is also considerably positivist. Hence, this research is concomitantly aligned with the viewpoints found in MacKay and Marshall (2005), MacKay and Marshall (2007), and MacKay et al (2012).

The Effects of Positivism on Information Systems Design Science Research

The above analysis finds ISDS as a discipline facing considerable impediments to studying of a multitude of human artifacts if it is to continue along the conversational path of normal science. For example, while March and Smith (1995) is built on research frameworks in IS such as Ives et al (1980), Gorry and Scott-Morton (1971), and Mason and Mitroff (1973), it is considerably focused on IT research rather than the entire range of human phenomena surrounding the IT artifact. In March and Smith (1995), descriptive research is something that is done after design science and the creation of an artifact has been

undertaken, *"First, design science creates artifacts, giving rise to phenomena that can be the targets of natural science research"*. Furthermore, Hevner et al (2004) builds directly on both of the other two frameworks, which may be why it is the most widely cited.

From a historical account, the positivistic position of design science is quite understandable. When many of these frameworks were created, there was an intense debate in IS research on rigor vs. relevance (Benbasat and Zmud, 1999) and the IT artifact (Orlikowski and Iacono, 2001) that was deeply related to the core identity of the discipline. So, what does this translate to as it relates to ISDS research? Walls et al (1992), March and Smith (1995), and Hevner et al (2004) combined have over 3000 citations. The use of these frameworks, which this research asserts are largely positivist and technocentric, has left us with a very small range of human artifacts which can be investigated. According to March and Smith (1995) and Hevner et al (2004) these artifacts are in the form of *constructs, models, methods, or instantiations*. For example, an ISDS artifact in the form of an XML schema definition such as that found in Aalst and Kumar (2003) is a prime example of what types of artifacts the triumvirate of ISDS research frameworks intended. In a similar vein, Markus et al (2002) presents a design theory using Walls et al (1992) on the process of generating and capturing emergent knowledge through the design of a software tool. This is again considerably focused on a design theory that is centered on the IT artifact.

This is where the triumvirate of ISDS frameworks has left ISDS research. It is not that this approach is wrong, or is in some way not considered design science. Quite the contrary as the Simonian logical positivist perspective to research ultimately gave rise to the Simon (1996). However, there is also much to be said about what is implied by the overarching nature of Simon's writing. This research takes the position that the Simonian stream of thought and how it gave rise to a new lens for science, but not a specific paradigm,

approach, method, or technique implies that design science can be equally explanatory as it is prescriptive (Baskerville, 2010) and equally inductivist as it is deductivist.

As intimated, this research essay is not alone in this endeavor to widen the aperture of design science. Within IS research and across other disciplines, design science is undergoing a scientific revolution (Kuhn, 1962). Increasingly, ISDS research is sidestepping these frameworks and returning to the roots of the Simonian worldview (Gasson, 2006). Thus, the time has come to for new research models in ISDS that are inclusive to the many genres of human artifacts. As MacKay et al (2012) have stated, this constitutes a movement from the IT artifact to the "IS artifact".

Emerging Alternatives in ISDS

What is described above represents an emerging movement in ISDS. Design science in IS research, especially in the German tradition represents a discipline of considerable size. Design science papers are widely cited throughout IS research, and there is currently a conference dedicated solely to the discipline. However, even with its considerable importance, ISDS is constrained by a small triumvirate of research frameworks. This research contends the positivist grip on ISDS is losing hold. Either research is sidestepping these frameworks completely (Gasson, 2006), or new worldviews are being developed (MacKay and Marshall, 2005; MacKay and Marshall, 2007; MacKay et al, 2012; Carlsson, 2006; Järvinen, 2007; Purao, 2002, Hovorka, 2009; Germonprez et al 2011). For example, MacKay and Marshall (2005) postulate that if IS becomes inclusive to a number of research traditions and approaches then a variety of artifact types as well as research traditions should be available for use. The point they make is that IS researches human activity systems that are usually technologically enabled and that design science should embrace such a worldview. However, while MacKay and Marshall (2005) call for enquiry into more socio-technical human artifacts, they still state the aims of design science research are to focus on

the designing, building and/or developing of an artifact. This research differs from this viewpoint and further states that an explanatory component (Baskerville, 2010) to scientific enquiry in human artifacts is just as significant as any prescriptive counterpart, and that both constitute design knowledge. Furthermore, given the space limitations researchers face in academic journals, it is simply too much to ask of every publication include a prescriptive component just so it can be considered ISDS. The result is a 'watering down' of important explanatory aspects in favor of building an artifact in an attempt to make ISDS appear more 'applied'. Thus, the triumvirate of seminal research frameworks *cannot* continue to be the canons of ISDS. Design science is not a purely prescriptive, techno-centric stream, but a pragmatic worldview that must now be inclusive to a variety of research traditions and approaches.

MacKay and Marshall (2007) made further calls for moving beyond the techno-centric nature of design science and to recognize the socio-technical core of our discipline and make that inclusive to the study of human artifacts. Carlsson (2006) explicates the use of critical realism (Bhaskar, 1975) as the ontological and epistemological strands for design science, while Järvinen (2007), Purao (2002), and Hovorka (2009) call for pragmatism from a reflection-in-practice perspective. However, amongst the aforementioned literature that constitutes this emerging movement, there is still a major theme that is particularly damaging to the design science community: the notions that design science will always offer more practitioner-friendly, or applied, research. This is another reason ISDS finds itself in a prescriptive straight jacket as well as a positivistic one (Levy and Hirschheim, 2012). Design science is not a panacea for the ills in the rigor vs. relevance debate. In contrast, practitioner-friendly research requires much more than the application of any paradigm, method, or technique. It requires research situated in a topical context to IS practitioners and presented in both a consumable form and forum. Design science could very well steer IS research away

from the practitioner if the academic community blindly researches topics that are of no tractable interest to the practitioner community. Another area of interest where the emerging ISDS movement falls short is that many of them are simply suggestive as to the different types of artifacts that could be explored and/or how else the research can be used. This research takes the position that ISDS should have usable reference points with examples, else the ISDS research community will continue to revert to what is available.

Evolving ISDS can be thought of as design science activity. The triumvirate of seminal research in ISDS represents the thin interface between an inner character, which is the constitution of philosophies and paradigmatic views that make up the common belief system within the triumvirate. In this case, the inner character is firmly positivist and a belief that artifacts must be tangible and technical in nature to be considered artifacts relevant to the ISDS community. This inner character also consists of the belief that all ISDS research must be normative and prescriptive in nature. In turn, the inner character and thin interface is an effort to adapt to an outer environment. The outer environment is the larger IS research community for which it seeks acceptance, and for ISDS to find acceptance amongst mainstream IS research it feels it must provide the appearance it is producing something practitioner-friendly. However, in this research essay and in much of the research previously cited (Carlsson, 2006; Carlsson, 2007; Gasson, 2006; Germonprez, et al, 2011; Hovorka, 2009; Järvinen, 2007; McKay and Marshall, 2005; McKay and Marshall, 2005; MacKay, et al, 2012; Niehaves, 2007; Purao, 2002), there is little discourse on how and/or why to adapt. Thus, the questions arise: What should ISDS be adapting to? Why should ISDS do this and how? This research builds on the above-cited research to apply the widened aperture of design science to the ISDS triumvirate. To further this emerging movement, this research essay informs the Walls et al (1992) ISDT framework to provide something usable for the ISDS research community. This new model for ISDS includes both an explanatory and

prescriptive component. It is explanatory as it explains this particular piece of human artifice (the ISDT framework) using the Simonian worldview under the auspices of critical realism and designs a preference to the Simonian worldview over the Walls et al (1992) interpretation of design science. An evolution of these frameworks is necessary and critical to the future of ISDS. Some of the most widely cited research in ISDS has been generated from this framework (Markus et al, 2002; Gregor, 2007). However, given the emerging movement in ISDS this framework offers fertile ground for maturity to incorporate the full prospectus of the Simonian worldview.

Walls et al (1992) and The Informed View of ISDS Research

A stream of research, reified in the form of a series of journal publications constitutes human artifice. The written word could be considered the thin interface where the theoretical intentions of the research stream constitute an inner character that adapts to an outer environment – the community of scholars which the publications and people behind them seek adaptation for the purposes of acceptance. The framework for design science presented in Walls et al (1992) is one such artifact that has spawned a stream of widely referenced design science research, both in the form of additional theory development (Markus et al., 2002; Gregor and Jones, 2007; Gregor 2007; Gregor, 2009) and in more applied research. Walls et al (1992) denotes what they believe constitutes design theory in IS research. In so doing, they make a call for a 'class' of design theories that are prescriptive, and create a distinction between the explanatory and predictive theories found in the natural or physical sciences and prescriptive theories, which they believe are essential to a design science in IS. Walls et al (1992) are superb in their efforts to carve out a particular portion of *The Sciences of the Artificial* (Simon, 1981) that was usable for the IS community of scholars. However, this research contends the explication of an ISDT framework by Walls et al (1992) was

techno-centric in its efforts and omitted the full range of human artifice to be examined in ISDS research and the full range of human artifice presented in Simon (1981, 1996).

This section applies the aforementioned theoretical development as a vehicle to mature the Walls et al (1992) framework. Specifically, this research uses pragmatism as the lens to incorporate a multitude of human artifice for scientific enquiry in ISDS, and critical realist as the lens to include different types of human artifice that range from the technical to the cognitive.

Simon's Design Science and The Walls et al (1992) Explication for ISDS

This research has contended that much of the theory development in Walls et al (1992) improperly frames Simon's argument about the distinctions in the sciences and therefore sets an improper basis for a framing of design science for IS. Although Walls et al (1992) does not make extensive reference to Simon, they do make canonical reference to *The Sciences of the Artificial* in claiming that, "little has been done to follow up on Simon's recommendations" (Walls et al., 1992 p.37). Furthermore, in their explication of what constitutes design theories Walls et al (1992) adopts a hard line positivist position in adopting Dubin (1978) and Nagel (1961) as their theoretical bases, which have little to do with Simon's explications for design science. In contrast, Simon (1981, 1996) provides a very different distinction than what Walls et al (1992) and even March and Smith (1995) and Hevner et al (2004) discuss. Simon provides a distinction between natural and artificial <u>phenomena</u>, not between the natural and artificial <u>science</u>. While this distinction may appear subtle, it has important implications for design science research as the latter serves to restrict the content and form of scientific discourse. Dissemination of human artifacts can be just as explanatory as it is predictive and prescriptive and thus due care should be taken to be inclusive to a multitude of paradigms so as not to constrict the ISDS worldview. This due

care must increasingly be taken in today's IS research landscape as the discipline uses a significant amount of references disciplines and alternative genres.

While the class of theories Walls et al (1992) develops is based on a deductive-nomological model of science, this framework can be augmented to the pragmatist-critical realist perspective with some work. This research finds this task worthy of undertaking given the weak linkages found Walls et al (1992) as it pertains to the difference between what Nagel (1961) and Dubin (1978) explicate as the core elements of theory, and what Walls et al (1992) explicates as the core elements of a design theory. Table 5 depicts this weak linkage, which potentially cripples the basis for the Walls et al (1992) class of design theories.

Table 5: Linking the Theoretical Bases of Walls et al (1992)

Nagel (1961)	Dubin (1978)	Walls et al (1992)
1. An abstract calculus, which is the logical skeleton for the explanatory system, and that implicitly, defines the basic notions of the system.	1. Units whose interactions are the subjects of interest	1. Design theories must deal with goals as contingencies
2. A set of rules that, in effect, assign an empirical content to the abstract calculus by relating it to the concrete materials of observation and experiment	2. Laws of interactions amongst units	2. A design theory can never involve pure explanation of prediction.
3. An interpretation or model for the abstract calculus, which supplies some flesh for the skeletal structure in terms of more or less familiar conceptual or visualize-able materials.	3. Boundaries within which the theory is expected to hold.	3. Design theories are prescriptive
	4. System states within which the units interact differently	4. Design theories are composite theories which encompass kernel theories from natural science, social science, and mathematics

(Table Continued)

Nagel (1961)	Dubin (1978)	Walls et al (1992)
	5. Propositions or truth statements about the theory (laws are a subset of propositions)	5. While explanatory theories tell 'what is', predictive theories tell 'what will be', and normative theories tell 'what should be', design theories tell 'how to/because'
	6. Empirical indications related to the terms in the propositions.	6. Design theories show how explanatory, predictive, or normative theories can be put to practical use.
	7. Testable hypotheses incorporating empirical indicators	7. Design theories are theories of procedural rationality.

Table 5 explicates the weak linkage with respect to how the Walls et al (1992) parameters for ISDTs were derived. If "science may be viewed as the process of designing theories" (Walls et al, 1992 p. 38) then a design science must be inclusive to a variety of methods for which to derive them. Again, Simon's four indicia (Table 2) come into play, as there is very little agreement between these indicia and the Walls et al (1992) distinctive features of an ISDT (Table 5, column 3).

Given the explications about what is believed to be Simon's original intimations for a design science, namely his principal distinction between natural and artificial phenomena rather than natural and artificial sciences, we arrive at several boundaries for a science of the artificial in ISDS. Using Simon's four indicia, we arrive at the following boundaries (in contrast to what Walls et al (1992) refer to as goals) for a design theory in ISDS (Table 6):

Table 6: Boundaries for an Information Systems Design Science

Boundary Conditions for an Information Systems Design Science	
1.	A design theory can be explanatory, predictive, or prescriptive
2.	A design theory can explain, predict, and/or create new forms of human artifacts
3.	A design theory can characterizes human artifacts in terms of functions, goals, and adaptation
4.	A design theory can discuss artificial things, particularly when they are being designed, in terms of imperatives as well as descriptives
5.	A design theory shall describe human artifice using the Simonian world view of design science (Table 2), which characterizes human artifacts in terms of an inner character, outer environment, and 'thin interface' between the two

In accordance with Table 6 and in the tradition of the Simon's explication for design science, any 'distinctive' features of a design theory must be related to an enquiry into a certain class of phenomena, namely human artifice, rather than a distinction between the different types of sciences. This inevitably leads us to deconstruct the seminal arguments made in the triumvirate of seminal ISDS research and to revert to the original Simonian stream of thought for design science. Again, Simon sets apart four indicia that, rather than setting apart the natural from the artificial sciences, they seek to set apart enquiry into natural and artificial phenomena. These four indicia are listed in Table 2 and in order to make them distinctive features of a design theory we offer the proposed modifications in Table 6. These imperatives should be distinctive features of design theories in ISDS as well as any other discipline that employs the Simonian canons of design science.

In reverting to Simon's worldview, ISDS is afforded a more flexible perspective that is inclusive to a variety of research traditions. In deconstructing the dominant logical positivist view in ISDS, it is able to create distance from the notion that one type of science may precede another (e.g. behavioral vs. design). Walls et al (1992) have taken this position in their framework in how they denote kernel theories, which are theories that derive from the natural or behavioral sciences. This tenuous position locks ISDS into a logical positivist position where a certain form of research must always precede design research. In contrast,

this research takes the Simonian position that a design science must be empirical in whatever form of human artifice design research seeks to explain and possess observables related to the inner and outer environment of the artifact under enquiry.

Walls et al (1992) present their formal definition of a design theory based on the presumption that theories in the natural and/or behavioral sciences must precede ISDTs. For clarity, the Walls et al (1992) formal definition of a design theory is re-stated below:

Table 7: Components of an ISDT: Adapted from Walls et al (1992)

Components of an Information Systems Design Theory	
Design Product	Meta Requirements: Describes a class of goals or requirements to which the theory applies.
	Meta-Design: Describes a class of artifacts hypothesized to meet the meta-requirements
	Kernel Theories: Theories from the natural or behavioral sciences governing design
	Testable Design Product Hypotheses: Used to test whether the meta-design satisfies the meta requirements.
Design Process	Design Method: A description of procedures for artifact construction.
	Kernel Theories: Theories from the natural or social sciences governing design process itself.
	Testable design process hypotheses: Used to verify whether the design method results in an artifact that is consistent with the meta-design

In addition to what constitutes a design theory, Walls et al (1992) formed antecedents and consequents for each of the above definitions using the following diagram:

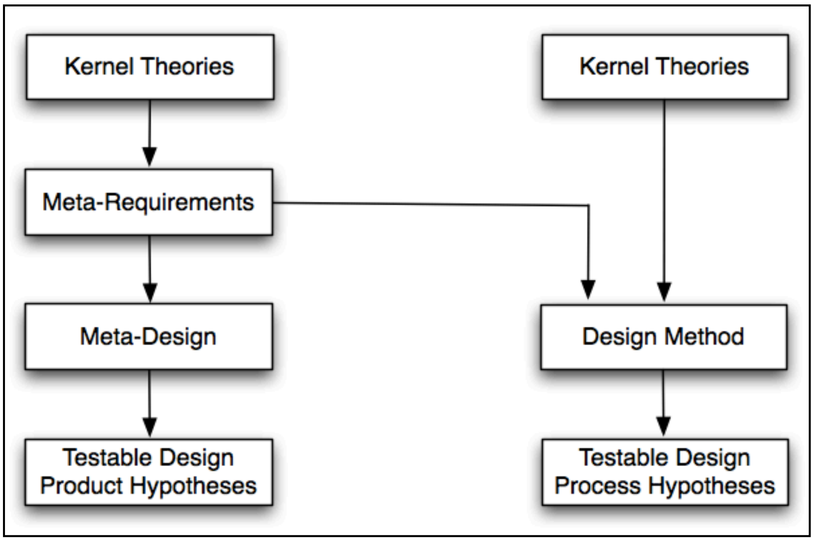

Figure 4: Components of an Information Systems Design Theory (Walls et al., 1992)

Two important distinctions are problematic regarding Figure 4 with respect to the encapsulation of a class of design theories as well as a design science. Walls et al (1992) explicate that a design theory must describe a product and a process of design. While this research does not contest that this aligns well with Simon's stream of thought, it does contest the position that that both must be a requirement for an ISDT. In contrast, a design theory can be about a product, process, or many different forms of human artifice. Furthermore, a product and a process are equivalent forms of human artifice that may include other inner and outer products or processes. A process that is well defined represents a product in, and of itself, and may include other sub-processes, behaviors, value systems etc., that are representative of the artifice under enquiry. Thus, there must be more flexibility in ISDT frameworks so ISDS can move beyond the IT artifact and towards an explication of IS artifacts (MacKay and Marshall, 2005; MacKay and Marshall, 2007; MacKay et al, 2012) that encompass the full range of products, processes, value systems, models, social representations, etc. that surround the analysis, development, fielding, and usage of IS.

The second contention this research essay has with Figure 4 is with the linear relationships between the different components of an ISDT. Whilst a kernel theory may be

about certain psychological or cognitive entities that are desirable in order to form a domain of observables, kernel theories do not always precede a class of requirements. It could very well be that an explanatory stream of design research relies solely on kernel theories in its explanation, or that a more prescriptive stream of research relies on requirements for a kernel theory about a product of human artifice. Moreover, Walls et al (1992) infers that meta-requirements must always precede meta-design in a waterfall-like framework.

The second half of this paper explicates the Software Development Lifecycle (SDLC) as a design theory; however, it appears Walls et al (1992) has also used the waterfall methodology as a process for ISDS. This inevitably turns design theory in IS into a workflow and a surrogate for engineering activity in ISDS. ISDS must rid itself of the notion it must always create an artifact, as there is much more to enquiry into human artifice than pure prescription. If this view is removed, it can be seen that that requirements, in both the product and process of development represent two distinct types of artifacts that could involve many different accompanying artifacts as an interface, inner, or outer environment. For example, the Walls et al (1992) notion of testability of both the product and process is itself an artifact. If we are not solely concerned with engineering research in ISDS, this notion of testability is only a concern if we are working with prescriptive design research. However, as MacKay et al (2012) intimate, there are many more testable artifacts than products or processes.

The work of MacKay et al (2012) represents a significant departure point for ISDS and for the different genres of human artifacts for scientific enquiry. This research has identified several the gaps in the aforementioned triumvirate of seminal ISDS research and proposes nine different genres of human artifacts that should be explored as we seek to move from the IT to 'IS artifact'. These nine perspectives are listed below (Table 8).

Table 8: Differing Perspectives of Design from non-IS Disciplines (MacKay et al 2012)

Design as…	Brief Description
Problem Solving	Transforming and improving the material environment, solution-oriented, finding solutions to field problems and implementing those solutions
Product	Objects, entities, artifacts which arise and are imbued with meaning within those contexts, designer inextricably linked to the designed product
Process, Action	Processes and actions which lead to the realization and implementation of an artifact in a particular context, design involves action taking and change
Intention	Deliberate thought processes which enable the designer and user to see connections between problem and possible solutions, the intent driving the design activity and the impacts this has on the realized artifact
Planning (Modeling, representation, etc.)	Working hypothesis (or plan, model, etc.) which captures and formalizes the designer's intentions
Communication	Conceptual characteristics (form and content) of artifacts which resonate with users, the ways meaning is reconstructed by users
User Experience	The range of experiences (both manifest and latent) created for and received by the user of an artifact, the meanings and experiences a user constructs with an artifact over time
Value	The value (often symbolic and/or social) placed on the artifact and the experiences of that artifact by a user, and how this changes over time
Professional Practice	The broad responsibilities and activities of designers who inevitably change the world through their actions, an attitude towards a 'problem', consideration of the knowledge and skills required by designers
Service	Day-to-day problem solving, ability to understand and help others resolve or ameliorate problems, mindful of contextual forces and constraints

These nine genres represent departure points in the study of human artifacts. This research regards them as departure points as IS researchers must be creative in allowing new forms of human artifacts to be investigated that are important for IS. Thus, the fruitful work of MacKay et al (2012) represents a starting point, not a finish, and armed with a pragmatist worldview of design science, we can look to critical realism and its ontological and epistemological position to apply the work of MacKay et al (2012) to Walls et al (1992). As

this research has mentioned, critical realism assumes the transcendental realist ontology, whilst for the intelligibility of science, a relativist epistemological position as discourse is only vehicle we have for dissemination of scientific knowledge. Furthermore, for scientific discourse in the social sciences, critical realism assumes the position of critical naturalism in stating that scientific enquiry should view cognitive aspects as 'real' but in a greater state of flux as our own cognitive processes evolve these constructs.

Whether it is a product, process, value, practice, etc., it is through our sense data that we form interpretations of human artifice. Each of the above nine genres can be thought of as existing independent of our perception of them, however, it is our perception of them through which we can provide explanations and possibly prescriptions. Even though we evolve cognitive forms of human artifice, they can be thought of as mind independent structures where the design scientist can explicate knowledge about current and new forms of these artifacts through a relativistic scientific discourse. Hence, critical realism affords the design scientist a lens to look at human artifice in its many tangible and psychological forms under similar auspices. The nine genres from MacKay et al (2012) are simply different forms of human artifice available for view under the transcendental realist ontology.

As consequence of this evolved worldview, the Walls et al (1992) framework for IS design theories can be subsumed. Rather than a waterfall style workflow as an instructional set to develop design theories, ISDS research would be better served with a model that simply explains what an ISDT might possess as ISDS research seeks to expand to new, and previously unexplained forms of human artifice under the design science lens. The evolved model and an explanation of how it subsumes the Walls et al (1992) items and relationships are provided below:

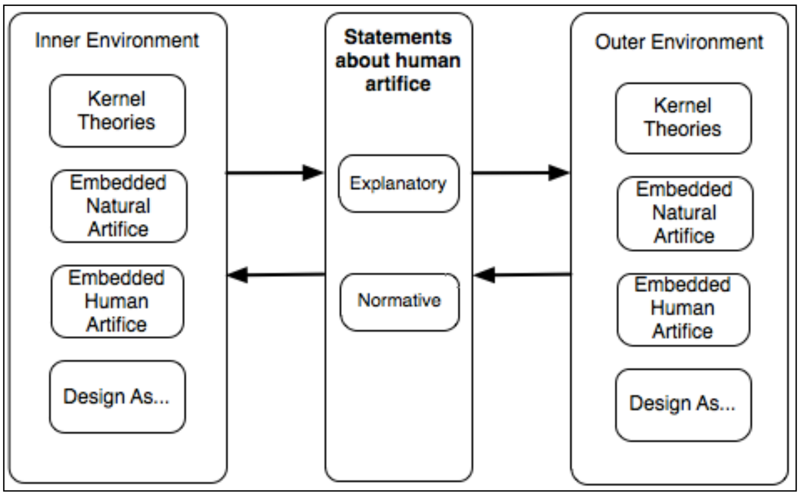

Figure 5: Components of the Information Systems Design Theory Framework

Figure 5 affords ISDS a framework, rather than a workflow, to develop design theories for ISDS. Gone from this framework is the waterfall style model to develop theories where kernel theories must precede what Walls et al (1992) refer to as meta-requirements and meta-design. As this research has explained, this is a rather untenable position for theory development. Furthermore, the meta-requirements, meta-design, design method, and 'hypotheses' components about product and process have been subsumed as part of the embedded natural and human artifice that make up the inner and outer environments. In applying Simon's worldview on design science, requirements, design, and design method are simply embedded artifice that goes into a theory about the artifice under investigation. One or more kernel theories may, or may not, contribute to an understanding about how an artifact has manifested itself from an explanatory perspective, and/or using that explanation as a pre-cursor to develop new forms of the artifact. Furthermore, what Walls et al (1992) refer to as "Testable Design Product Hypothesis" and "Testable Design Process Hypothesis" is subsumed from both a critical realist standpoint as well as from the standpoint of what MacKay et al (2012) have explicated. 'Product' and 'Process' are two of the many different genres of human artifacts MacKay et al (2012) express can be studied under ISDS in generating knowledge about the IS artifact. However, as mentioned above MacKay et al

(2012) simply represents a departure point for the study of many different genres of artifacts that are involved in the development, deployment, and use of IS. These artifacts, whether it is the theories or embedded artifice in the inner or outer environment satisfy Bhaskar's criteria for transcendental realist ontology, as they can be thought of as intransitive in their independence (2)' and transitive in our knowledge of them (1)'. This research further posits that a transcendental realist ontology, a relativist epistemology, and a critical naturalist view of constructs in the social sciences extends beyond the nine genres and to any artifact of human design worthy of scientific enquiry.

While the above explains how the components themselves are subsumed under this evolved framework, it is also important to explain the removal of the reliance of the relationships between these components. First is the removal of the notion that a kernel theory has precedence over other artifacts. While kernel theories, which are assumed to be from IS or other reference disciplines may provide a certain degree of explanation, however, they may not always be present. This is especially true if the goal of a design science enquiry is to produce a kernel theory. Furthermore, meta-requirements meta-design, design methods, and hypotheses about product and process all exist as equivalent forms of human artifacts and do not have any particular precedence over each other. Although they certainly could if we were, to say, provide an explanation of certain form of human artifice in the form of how design theories manifest themselves as intransitive structures in the ISDS research community!

In contrast, the relationships in the form of bi-directional arrows are between the 'thin interface' of human artifact and the inner character and outer environment. This research purposely makes these relationships reciprocal in the form of bi-directional arrows as it assumes a critical naturalist position where it is posited that social structures are both the

product of human agency and are modified by it. Hence, this makes this framework for an ISDT a more practical instrument for ISDS and a greater understanding of the IS artifact.

This section has provided an informed framework for the development of an ISDT. In the tradition of pragmatism, this research has provided a treatment of Simon's worldview so that design science in IS can be inclusive to a number of paradigms and research traditions. This evolved worldview informs the positivist perspective that dominates ISDS, and facilitates a treatment of human artifacts from a critical realist perspective. Using the nine genres of IS artifacts in MacKay et al (2012) as a departure point, many of the constructs in Walls et al (1992) were subsumed to produce a modified ISDT framework. The above framework also differs greatly from Walls et al (1992) in that it removes the waterfall style workflow from the ISDT framework. While a workflow can be beneficial to theory development, it is distinct from a framework as an approach to an idea or thought. This research provides a considerably widened framework for Simon's worldview on design science that affords the design science researcher a class of issues to think about when investigating human artifice. In the sections below, the implications of such a framework are discussed with respect to ISDS. In the normative tradition of design science, this research provides an example as to how this framework could be used to explain human artifacts and generate an ISDT.

An Example Using the ISDT Framework

One particular example of how the aforementioned framework could be used to provide both explanatory and prescriptive aspects of human artifacts is with an applied topic such as Enterprise Architecture (EA). EA is a classic design problem as it has many different types of IT artifacts that link an organizations business architecture with IS architecture as well as how the development, deployment, and use of the EA will be governed (Ross et al., 2006). EA is also interesting when looking at how it manifests itself in public organizations

versus private ones. In the case of the US federal government, all government agencies are required to have an EA for purposes of accountability (GAO, 2010). Many times the EA for federal agencies manifests itself as a derivative of the Federal Enterprise Architecture Framework (FEAF) (CIO Council, 1999). Thus, there may be quite the contrast between how federal and private organizations realize EA. Recent reports have shown that quite a bit of private organizations are using an EA approach as a vehicle to realize IS/IT alignment with the overarching needs of the organization (InfoSys EA Survey, 2008).

The research design below provides an example of a qualitative study, with the principal research question of: *How does EA manifest itself in organizations?* Specifically, we are interested in investigating the types of human artifacts most salient in realizing a mature EA. The research is both inductive and deductive in nature. Profiles related to design science are used to guide data collection and analysis, while generalization to theory is derived directly from data. One example of design science profiles could be the nine design perspectives from MacKay et al (2012). Data could be coded using open coding and categorized based on the design perspectives. The table below sumarizes this research design (Table 9):

Table 9: Example Research Design using ISDT Framework

Research Example:	Manifestation of EA in Organizations
Research Question	How does EA manifest itself in organizations?
Research Type	Qualitative, Inductivist, Deductivist
Data Collection	Case Study, Open ended interviews, archive review
Data Analysis	Open Coding
Theoretical Background	MacKay et al (2012), Simon (1996)

Once data has been collected and categorized vis-à-vis the nine design perspectives from MacKay et al (2012), an ISDT in the tradition of Figure 5 could be developed. This

research design removes the positivist straight jacket from ISDS (Levy and Hirschheim, 2012) and actually uses design science research to guide all aspects of the research process.

The aforementioned qualitative analysis holds the potential to reveal new insight using the design science lens. For example, while conducting data analysis it was found that *Design as Value* was found to be significantly different across cases. In other words, the symbolic or social value in developing EA as proof an organization's IT was aligned with business objectives was found to be significantly higher in private industry than in government. Using these data, an ISDT could be developed that theorizes the most salient values in an EA effort, for example, work ethic, personality type, etc. These value types represent kernel theories that may be part of a particular process or service that is provided by the people with these personality types that make a significant contribution to realizing a mature EA. Another example may be that the services EA personnel provide may result in more optimal EA development efforts (*Design as Service*). A service constitutes a behavioral form of human artifice that has an inner character that can be based on kernel theories from IS or other reference disciplines, natural artifacts in the form of more primitive psychological constructs, and other forms of human purposive artifacts that leads to the manifestation of the EA artifact in this context. In turn, this *Design as Service* artifact is a construct that adapts to an outer environment, which in this case may be a mandatory process that is part of the organizational context. Knowledge about the inner environment of the artifact, an explanation of the artifact itself, and an understanding of the outer environment for which human agents are seeking to adapt to artifacts constitute knowledge to practitioners. This knowledge may be about a particular type of service, or personality types better suited for EA. The above example also avoids the notion of an IT artifact as being the principle output of design science, and in turn, provides a purely cognitive example as to how design science

researchers can provide an understanding of human artifice and a theory that will enable more optimal design.

Implications for ISDS

Current design knowledge in ISDS is considerably centered on a triumvirate of research frameworks. In particular, much of ISDS research utilizes the Hevner et al (2004) research guidelines and subsequently assumes their ontological and epistemological positions. The seven Hevner et al (2004) research guidelines for design science research are summarized as follows: (1) Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation. (2) The objective of design-science research is to develop technology-based solutions to important and relevant business problems. (3) The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods. (4) The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods. (5) Design science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact. (6) The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment. (7) Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

This research contends that the above guidelines for design science research have created a constrictive and impoverished view for ISDS. Guideline 1 is the principal culprit as it restricts the other 6. Furthermore, if the central goal of ISDS is to produce an IT artifact in the form of a "construct, model, method, or instantiation" we are not engaging in producing an understanding of new phenomena but rather using the ISDS research community as a surrogate for engineering. The mandatory production of artifacts only affords ISDS the

appearance of a normative science and hamstrings the ability for research into the full range of human artifacts.

This essay has provided a framework for ISDT that is crafted in a teleological sense rather than from an ontological or epistemological basis. This 'informed view' affects the ISDS research community in several capacities. From a philosophical perspective, design science can now move beyond the current positivist myopia and towards more pluralistic research. This also serves to move ISDS away from the mandatory prescription of IT artifacts as the output of all ISDS research, and moves ISDS away from the dichotomy between natural/behavioral and design science. Collectively, this serves to open the door to enquiry into new types of artifacts for IS research.

This research essay has also argued for pragmatism as a treatment for design science research. Pragmatism moves the discourse in ISDS away from an ontological and epistemological positioning, which Simon never intended. To be clear, this research is advocating pragmatism as a treatment for how to deal with a tradition of design science, not as a philosophical underpinning for a model of research. Purao (2002), Järvinen, (2007), and Hovorka (2009) have already made these fruitful contributions to the discourse of design science. This research aligns with Rortyian neopragmatism in its treatment of ontology and epistemology as matters of sociology and cultural politics rather than foundational justification. In Rorty's words: "I linguisticize as many pre-linguistic-turn philosophers as I can, in order to read them as prophets of the utopia in which all metaphysical problems have been dissolved, and religion and science have yielded their place to poetry" (Saatkamp, 1995). Design science in the manner Simon intimated is far more concerned with its purpose as a way to view the artificial world rather than as practice-transcending legitimation. Design science is not concerned with what is, or is not design, whether human artifacts are real and immutable versus subjective constructions of the mind, or what types of expressions

constitute design knowledge. In the same capacity, that Rorty sought "to move epistemology and metaphysics into matters of sociology and cultural politics, and from claims to knowledge and appeals to self-evidence to suggestions about what we should try" (Rorty, 1979) is the same manner that design science research communities should understand Simon's view of the artificial world. If this position is taken, ISDS can distance itself from the behavioral/design science dichotomy, transcend from techno-centric enquiry to many different forms of human artifacts, and inform an explanatory (Baskerville, 2010) as well as prescriptive aspect to design science.

In ISDS, the current discourse centers on a dichotomy between the natural or behavioral sciences and design science. March and Smith (1995) term the natural and behavioral sciences as "two different species" where design science is concerned with "devising artifacts to attain goals". In a similar vein, Hevner et al (2004) state the behavioral paradigm seeks to find "what is true", while design science seeks to "create 'what is effective'". The difference between what March and Smith (1995) call 'natural science' and what Hevner et al (2004) call 'behavioral science' is negligible. Both are discussing Simon's notion of a descriptive science in terms of what *is* instead of *oughts*. However, this discourse, which is in intended to parallel Simon's, is misrepresented. Early in Simon (1996), a distinction is made between descriptive and normative science where descriptive science is concerned with what *is*, while normative science is concerned with *oughts*. Simon takes the pure empiricist's position in this argument and declares irreducibility from "*ought* to *is*" (Simon, 1996, p.5). However, the similarities end there. While March and Smith (1995) consider the purpose of design science research to devise artifacts to attain goals and Hevner et al (2004) consider the purpose of design science to create what is effective, Simon sought the treatment of artificial or goal-seeking as phenomena, <u>without commitment to their goals</u> (Simon, 1996 p. 5). Furthermore, Simon's consideration of *oughts* has more to do with

investigation of the artificial things themselves rather than the practice of a design science. As we have stated, the exclusion is made as we move from "natural to artificial phenomena" not from natural science to design science. Thus, design research can be explanatory or descriptive as well as normative and prescriptive, and is certainly not forced to include the creation and instantiation of artifacts. The arguments made in March and Smith (1995) and Hevner et al (2004) further diverge from Simon's arguments, as there is no mentioning of his distinction between engineering and science. "A science of the artificial will be closely akin to a science of engineering – but very different" (Simon, 1996 p.5) as "engineering is concerned with synthesis, while science is concerned with analysis" (Simon, 1996 p.4). ISDS has incorrectly concerned itself with engineering and synthesis, rather than scientific analysis.

ISDS as a research community must move beyond the artifact-centric notion of design science towards research that performs enquiry into the full range of human artifacts. It is rather tautological in the sense that IS already investigated much of this phenomena, but it is Simon's lens that makes design science research distinct from other types. As we have stated, while we believe ISDS research to be in line with Simon's explication for design science, ISDS has never questioned what else can qualify.

One of the last points to be made during this discussion is the lack of examples and quotes in this research essay from Simon (1996) Chapter 5. This chapter is titled, "A Science of Design" and has been a bit of a red herring for ISDS. The triumvirate of ISDS research as well as much of the reflective discourse in ISDS (Baskerville 2008; Baskerville et al, 2009; Baskerville, 2010; van Aken 2004; Gregor 2007; Gregor and Jones 2007; Gregor 2009) has used this section in a manner other than how it was intended. In this section, Simon does not outline what it means to conduct a science of design, but rather illustrates what curriculum and pedagogy on design in professional engineering schools would look like. In contrast, this

research essay has looked holistically at *The Sciences of the Artificial*, and what it means for a science of design and ISDS. The decision to avoid much of this section was also based on a shared viewpoint on the distinction between research, curriculum, and pedagogy. While the three are inseparable in relation to the ultimate goals of academia to provide and disseminate knowledge, research should be taken as the intersection of knowledge and guidelines to inform the development of curriculum and pedagogy (Shaffer and McDermott, 1992). In the same capacity that "engineering is concerned with synthesis, while science is concerned with analysis" (Simon, 1996 p.4) curriculum development and pedagogy should be concerned with the structured composition of a course of study and the method and practice of teaching, respectively, rather than explicating new knowledge of human artifacts. However, we readily admit the three intersect in many different capacities.

Conclusion

This essay has provided ISDS an 'informed view' of design science in the tradition of Rortyian neopragmatism, as well as a treatment of human artifacts using Bhaskarian critical realism. In using Simon's worldview for design science, as well as calls for research into 'softer' forms of human artifacts in IS research, an informed version of the popular Walls et al (1992) framework was provided. In addition, this research essay provides an example that demonstrates how such a framework could be applied. The example provided is valuable to both academics and practitioners. The example addresses how to research a practitioner-friendly topic in IS and valuable in providing an example that could be prescriptive to practitioners in their realization of EA.

This research essay also spends significant time and space outlining the Simonian perspective to research and contrasting that with his view for design science. In addition, significant space was allocated to the alignment between design science and Bhaskarian critical realism. Critical realism provides an interesting example as to how to treat artifacts

using realist ontology, relativist epistemology, and a critical naturalist point of view regarding artifacts in the social sciences. Thus, the central contributions of this essay are as follows: A correction from the techno-centric view of design science in ISDS is offered in favor of Simon's original intentions for a science of design. A lens for design science in the tradition of Rortyian neopragmatism was provided as a vehicle to allow different research traditions into ISDS. Bhaskarian critical realism was provided as a lens for which to view different forms of human artifice, and finally, a modification of the Walls et al (1992) framework for ISDT was provided to afford ISDS scientific enquiry into softer forms of human artifacts.

The pragmatist tradition offers a philosophical stance that avoids the positioning of design science amongst an ontological and epistemological debate, and avoids the convenient classification of research within paradigmatic frameworks such as Burrell and Morgan (1979). Furthermore, a treatment of human artifacts using a lens such as critical realism affords ISDS a reconciliation between conventional the ontological and epistemological positions that inextricably link philosophical strands to approaches and methodologies for research.

When a relatively small number of research frameworks have created a protective belt around a 'normal science' (Kuhn, 1962), there is considerable reason for concern. This is of great concern for ISDS and this research is not alone in voicing this concern. There has been considerable discourse on expanding the perspective of design science, both within ISDS, and within other design science communities. This essay differs considerably from previous research in that it does not seek an ontological and epistemological home for design science, but rather offers the pragmatist perspective as a treatment to allow the design science community the opportunity to explore human artifacts using a multitude of paradigms and research models for explanation, prediction, and even prescription of human artifacts. It is a sincerely hope this essay appropriately compounds the growing concern in ISDS and in

design research to expand what it means to conduct scientific enquiry into human artifacts, and subsequently, remove the positivist, artifact centric straight jacket from ISDS research.

PAPER 2: SHELFWARE OR STRATEGIC ALIGNMENT? INVESTIGATING THE EMERGENCE OF AN ENTERPRISE ARCHITECTURE PRACTICE

Introduction

Organizations are increasingly turning to Enterprise Architecture (EA) as a vehicle for IS alignment (Gartner, 2012; Martin and Gregor, 2002). EA is generally known as a framework to build artifacts that govern the development of technology so that IS is better aligned with strategy (IS Alignment). EA is a well-defined practice that employes the use of standard frameworks and well-defined methdologies to realize EA artifacts. These frameworks enact alignment by applying a variety of methods to align business architecture with, information, application, and technology architectures (Pereira and Sousa, 2005), aligning IT architecture with business scope (Luftman, 2000), and as the organizing logic between business and IT infrastructure (Ross, et al., 2006). However a significant chasm exists in the academic and practitioner literature between the development of EA artifacts and how these artifacts are enacted to improve alignment. The use of an EA framework should not be confounded with maturity and the notion of maturity of EA artifacts should not be confounded with the maturity of an EA practice. This research investigates two distinct instances of EA organizations in a single firm to form an embedded case study (Yin, 2009). An embedded qualitative case study was chosen to advance our understanding of EA by providing two distinct approaches to establishing an EA practice within a single firm. Treating the two instances of establishing an EA practice as separate cases captures both the contrast and context of the phenomena under study in considerably more depth (Yin, 2009; Löfqvist, 2010). This led to a greater understanding as to how an EA organization is pursuing IS alignment. This research asks the following question: *How does EA manifest itself in organizations?*

In this research essay, an 'EA organization' consists of the team responsible for developing EA artifacts and building an EA practice. The members of an EA organization are *designers* of an EA practice. Enterprise Architects (EAs) as designers design everything from cognitive conceptualizations to material artifacts. In turn, a study of EA in practice, thus conducts research in design activity, and thus engages in design science. This resaerch employs design science, but does so in a manner quite different from the extant literature in Information Systems Design Science (ISDS). In addition to differing from much of the extant literature in ISDS, this research builds upon the IS research themes of *strategic alignment, participatory systems design,* and *enterprise resource planning (ERP)* to identify emergent design perspectives and build a model for 'IS engagement'.

Strategic alignment derives principally from the work of Henderson and Venkatraman (1993). The strategic alignment model (SAM) that originated from this work described a model predicated on 'linkage' between business strategy, IT strategy, organizational infrastructure and processes, and IS infrastructure and processes. This work has been advanced in IS literature by research that has principally sought to measure the degree to which an IS organization is strategically aligned. This has been performed using measures of IS effectiveness as it relates to business performance (Chan, et al., 1997), empirically validating the Henderson and Venkatraman (1994) model (Avison et al., 2004), examining the effects of strategic alignment with respect to IT use (Kearns and Lederer, 2000), and different ways of measuring how 'aligned' an IT organization is with organizational strategy (Wagner, et al., 2006; Beimborn, et al., 2007; Wagner, et al., 2005). This research does not seek to measure alignment in any sense, but to investigate how organizations are building and enacting EA to eatablish alignment.

Similar research also exists with respect to participatory systems design. Research in this area has historically focused on collaboration with the consumers of the system during

design and development. Seminal research in participatory design was largely the work of Mumford (1983), Trist (1981) as socio-technical systems, and Checkland (1981) as soft-systems methodology. Early research in participatory design performed enquiry into the relationship between user participation and constructs such as system quality, system acceptance, intention to use, and informaton effectiveness. Early on, it was also found that much of this research was poorly grounded in theory and methodologically flawed (Ives and Olson, 1984). However interpretive field studies such as Hirschheim (1985) found participatory systems design improved communication, lessened resistance to new systems, decreased implementation time, and increased productivity. Other research has sought new ways of measuring how user involvement contributes to constructs such as system quality and acceptance as well as studying the usability of online information. Research on participatory design principally assumes users are engaged and willing participants in the design process and that the users have taken an active stance in organizational change. This largely omits the process of engaging users to participate in the design and development process. This research essay differs from much of the work on participatory systems design as it seeks to understand how organizations foster business-IS engagement (e.g. engagement between he EA organization and those in specific business units).

Lastly, this research is also distinct from much of the research on ERP systems. ERP research spawned from reports of high failure rates of ERP implementations witnessed in practice (Hong and Kim, 2002). ERP research is considerably centred on systems implementation (Robey, et al., 2002; Boudreau and Robey, 2005) and possible reasons for reasons for failure or success. Brown and Vessey (2003) identify five reasons for successful implementation: (1) top management is engaged in the project, not just involved; (2) project leaders are veterans, and team members are decision makers; (3) third parties fill gaps in expertise and transfer their knowledge; (4) change management goes hand-in-hand with

project planning; (5) A satisficing mindset prevails. In contrast, Boudreau and Robey (2005) explicate an interpretivist study through the lens of human agency. Their findings suggest that technological consequences for organizations are enacted in technology's use rather than its technical features. While the above examples have little to do with IS alignment, Presley (2006) presents a model built on Henderson and Venkatraman (1993) to analyze the cost benefits of ERP investment. In the same manner Ross et al. (2006) view EA as a 'foundation for execution' Presley views ERP systems as a source of financial and competitive benefits and requires major changes in an organization's processes, culture, and design. The findings from this research essay offer similar guidance for practitioners, however, it investigates architecture as a growing practice in IS versus implementation. ERP represents the effect of EA. This reseach, in contrast, seeks to investigate the design of EA as the potential cause of strategically aligned IT.

Enterprise Architecture

Enterprise architecture is the organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's operating model (Ross et al., 2006). The operating model is the desired state of business process integration and business process standardization for delivering goods and services to customers. This broad definition often has to do with producing blueprints for an organization that are in line with strategic objectives, and *if* the blueprints are executed upon with respect to technology, then in theory, the IS in an organization is more aligned to organizational strategy. EA is *practice* that continuously works to find the best strategies that drive development of the enterprise. Thus, the practice of EA entails many different types of architectures and architects including, but not limited to: business architecture, process architecture, information architecture, application architecture, and technology architecture. EA is historically artifact-driven. The US federal government classifies EA as an IT function

where EA entails a suite of documents that is the summary of an examination of the enterprise and describes the IT necessary to accomplish the objectives of the agency under inquiry (CIO Council, 2001). Several frameworks exist for EA including the Open Group Architecture Framework (TOGAF 9), the Zachmann Framework for EA, and the Federal Enterprise Architecture Framework (FEAF). The Clinger-Cohen Act of 1994 essentially mandated that each US government agency produce a variation of FEAF. In contrast, private organizations, having no such mandate tend to adopt a hybrid of frameworks that best suits their organizational structure and organizational needs. As the practice of EA matures, it is important to understand how organizations are crossing the chasm between EA artifacts and IS alignment and whether EA is a vehicle that can improve IS alignment.

This research employs the lens of design science to investigate two separate instances of EA within a single technology organization. In contrast to the three influential ISDS frameworks of Walls et al., (1992), March and Smith (1995), and Hevner et al. (2004), this research uses design science as a lens in a pragmatist sense (Rorty, 1979) and the treatment of human artifacts in a critical realist sense (Bhaskar, 1975). In the pragmatist tradition, design science is a tool used for the practical purpose of scientific inquiry versus an advancement towards truth. In the critical realist tradition, this research assumes a realist ontology under the auspices of design science in relation to all forms of human artifacts, from social to material objects. As knowledge is produced through social discourse, design knowledge is no exception. Thus, there can exist an ontological and epistemological position in critical realism that also aligns with the pragmatist worldview of design science (Levy, 2012; Levy and Hirschheim, 2012; Mingers, 2004). This research contrasts from much of the research that derives from the aforementioned influential ISDS frameworks as design science was used throughout the research process. The design science conceptualizations found in MacKay et al. (2012) were employed for data collection, analysis, and as a vehicle to derive

theory. Under these auspices, an interpretivist epistemology was employed (Walsham, 1995; Walsham, 2006; Klein & Myers, 1999) to collect data qualitatively and assume a reliance on the researcher's interpretations of data to methodically move from data to theory. The result is an extension of theory from IS practitioner literature that employs widely cited research from social psychology. This *is* design science in the tradition of Simon (1996) – as it is inquiry into human artifacts exclusive of the positivist paradigm, and exclusive of an ISDS workflow to build design knowledge.

The following sections detail the research process. These sections elaborate on the theoretical design to arrive at a set of *design science profiles* that guide the research, elaborate on the methodology employed to perform data collection and data analysis, depict and analyze two distinct case studies on EA, and perform a between-case analysis of the two cases. The final sections of this paper discuss the implications of the study, limitations, and conclusions, respectively.

Theoretical Design

Information Systems Design Science (ISDS) has historically been predicated on the axioms of three influential frameworks (Walls, et al, 1992; Hevner, et al., 2004; March & Smith, 1995). However, there has also been significant advancement in fostering a more pluralistic view (Goldkuhl, 2011; Goldkuhl, 2004; Baskerville, 2010; MacKay, et al., 2012; Levy and Hirschheim, 2012). Design Science goes far beyond IS. The dialectic of design science exists across the domains of Architecture, Engineering, Computer Science, and many other fields. In addition, since the mid to late 1960s, the decade that spawned the first design methods conference (1965) and the first edition of Herbert Simon's *The Sciences of the Artificial*, the dialectic of design science has progressed to several well-known multi-disciplinary design journals (e.g. Design Issues, Design Studies, Journal of Design Research). Traditionally, these design journals have published articles related to the configuration,

composition, structure, purpose, value, and meaning of material things (Bayazit, 2004). However, these journals are increasingly publishing articles that describe the socio-cognitive perspectives, or 'wicked problems' (Churchman, 1967), that emerge from design (Buchanan, 1992). This research study posits that design conceptualizations exist at all levels across the cognitive, social, and material spectrum. This worldview that takes into account all forms of the human artifact, known and unknown, widens the aperture of phenomenological enquiry, and aligns with the Simonian tradition (Simon, 1996).

Simon (1996) is widely considered the seminal literary work that embodies the canons of design science. The original intentions of Simon (1996) involved design thinking, research, and knowledge that are inclusive to all forms of the human artifice (Simon, 1980; Levy and Hirschheim, 2012). Since design journals have opened the door to more socio-cognitive perspectives, design science now includes constructivist trajectories (Meng, 2009), action research (Järvinen, 2007), and 'naturalized' epistemologies (Stich, 1993). Relevant to this research essay is the work of MacKay et al. (2012) which synthesizes literature from the major design journals for the purposes of ISDS. MacKay et al. (2012) frames ten design 'conceptualizations' that are used in the research design, data collection, and data analysis of this research stream. These conceptualizations, prefaced with 'design as…', identify perspectives for both explanatory and normative design research (Baskerville, 2010). Table 10 contains summaries of the ten design conceptualizations.

Table 10: 'Design As' Conceptualization from MacKay et al (2012)

Design as…	Brief Description
Problem Solving	Transforming and improving the material environment, solution-oriented, finding solutions to field problems and implementing those solutions
Product	Objects, entities, artifacts which arise and are imbued with meaning within those contexts, designer inextricably linked to the designed product

(Table Continued)

Design as…	Brief Description
Process, Action	Processes and actions which lead to the realization and implementation of an artifact in a particular context, design involves action taking and change
Intention	Deliberate thought processes which enable the designer and user to see connections between problem and possible solutions, the intent driving the design activity and the impacts this has on the realized artifact
Planning (Modeling, representation, etc.)	Working hypothesis (or plan, model, etc.) which captures and formalizes the designer's intentions
Communication	Conceptual characteristics (form and content) of artifacts which resonate with users, the ways meaning is reconstructed by users
User Experience	The range of experiences (both manifest and latent) created for and received by the user of an artifact, the meanings and experiences a user constructs with an artifact over time
Value	The value (often symbolic and/or social) placed on the artifact and the experiences of that artifact by a user, and how this changes over time
Professional Practice	The broad responsibilities and activities of designers who inevitably change the world through their actions, an attitude towards a 'problem', consideration of the knowledge and skills required by designers
Service	Day-to-day problem solving, ability to understand and help others resolve or ameliorate problems, mindful of contextual forces and constraints

The design conceptualizations in Table 10 were used 'as is' to generate an interview guide (Appendix 1). For comparative purposes in the data analysis, the principal attributes of each design conceptualization from MacKay et al. (2012) were identified and augmented with comparative research from the Management and IS literature to provide clear guidelines for each design science profile. Each of the design conceptualizations and accompanying attributes represents a design science profile. The explicit use of these design science profiles *a priori* to data collection defines a qualitative study that uses a combination of inductive and deductive reasoning for research design, data collection, analysis, and theory development.

The following sections detail each design conceptualization and how the attributes were derived.

Design as Problem Solving

Problem Solving can be viewed as a means for ordering the world, of meeting needs, making desired improvements, and transforming and improving the material environment (Dilnot, 1982). *Design as Problem Solving* characterizes design as a verb, as a way of defining problems and projects, and acting responsibly to seek betterment in the world (Boland et al., 2008). Krueger and Cross (2006) characterize problem solving as an emphasis placed on defining and understanding the given problem where design is characterized as a solution to the problem. MacKay et al. (2012) characterizes *Design as Problem Solving* as the solving of field problems where the problem solving activity involves designing a solution, as well as implementing that solution. This research study used a combination of dimensions from each of the aforementioned studies. These attributes are: *means for ordering the world* (Dilnot, 1982), *emphasis on the definition and understanding of the problem at hand* (Krueger and Cross, 2006), and an *emphasis on the means of transformation or improvement of the environment* (Boland et al., 2008; MacKay et al., 2012).

Design as Product

When focus is placed on the designed artifact, it reveals a product view of design (Marxt and Hacklin, 2005). ‘Product’ as an artifact and could be seen as all encompassing. Simon (1996) explicated everything from cognition to software algorithms as human artifacts (Simon, 1980; Simon, 1996). This research defines ‘Design as Product’ as an emphasis on *the construction and use of material things*.

Design as Process

Designing process entails a formalization or standardization of activities. This explicitly discriminates between the product and the activity to create it (MacKay, et al. 2012). While a process can also be considered a product once it has been given formal status, it is the events and activities themselves that embody a particular convergence towards designing process that is of interest to this research. Ryan (1997) suggests that in design "the path is the goal" where a process is the formalization of the activities that can take a vague question or ill-defined problem and find an appropriate response. Crowston (1997) frames process design with respect to coordination theory. Coordination theory states that coordination problems arise from dependencies that constrain how tasks can be performed. To overcome these problems actors must develop coordination mechanisms (Malone and Crowston, 1990) that consists of additional activities to overcome the coordination problems. Designing process refers to the design of actions (an event) to produce an outcome (Willem, 1990) and understanding those actions so they can be formalized. This research characterizes *Design as Process* using the following attributes: *actions taken to produce an outcome*, *the understanding and formalization of actions, and an understanding of how process manifests itself.*

Design as Intention

Intentions are aims that manifest themselves in behavior. Design occurs when the intention to design is present (Willem, 1990; MacKay et al., 2012). Thus, designing intention is a socio-cognitive artifact that is realized in other *Design As* conceptualizations. In the design literature, *Design as Intention* refers to what is 'intentional' (Willem, 1990; MacKay et al., 2012). In the psychology literature, intent serves as an antecedent to behavior (Fishbein & Ajzen, 1975). According to Fishbein and Ajzen (1975) intention and behavior are preceeded by personal beliefs and attitudes in the expected outcome as well as the

subjective norms embodied in the interaction with others in the organization. The evaluation of the outcome and subjective norms factor into intentions, which are manifest in behaviors. This relationship is explained in the following diagram (Ajzen, 1980):

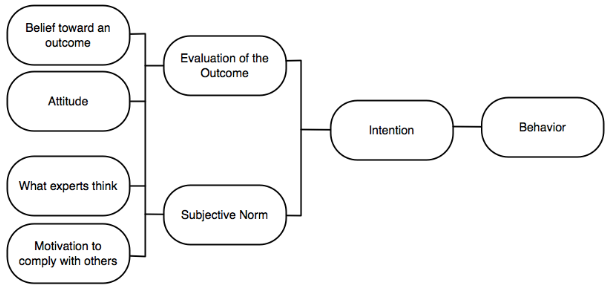

Figure 6: Theory of Reasoned Action (Fishbein and Ajzen, 1975; Ajzen, 1980)

This research adopts the four principal antecedents to behavior from Fishbein and Ajzen (1975) as attributes to characterize *Design as Intention*: *belief toward an outcome*, *attitude*, *what experts think*, and *motivation to comply with others*.

Design as Planning (Modeling, Representation)

Cognitive design conceptualizations (e.g. values and intent) can manifest themselves in models and other representations related to planning. According to Dilnot (1984b), design is a conscious attempt to build plans and models. Plans and models are themselves products of design, however, they also differ. For the purposes of this research study, the chief discriminators between design as product and design as planning is the explicit detailing of planning artifacts necessary to realize goals. This is an integral part of the design process (van Aken, 2004) as the act of designing a plan constitutes behavior. For the purposes of this study, we use the following attributes for *Design as Planning*: *how to plan for an end goal, intentions exhibited as behaviors, and models and other representations*.

Design as Communication

Design as Communication entails designing communicative artifacts aligned with the values and intentions of the eventual user. Design is the process by which the meanings

intended by the designer are communicated to an audience, and received either as intended, or as reconstructed by the audience given their context, values, and the like (Kazmierczak, 2003; MacKay et al., 2012). Designing with respect to communication redefines designs from immutable objects of aesthetic and practical consideration to semiotic interfaces to facilitate the reconstruction of meaning (Kazmierczak, 2003). An understanding of how communication is designed entails an intricate knowledge of subjective norms and the organizational environment. Thus, success in designing communicative artifacts is measured by its ability to be received by the intended parties (Lunenfeld, 2003). In turn, inquiry into designing for communication requires an understanding of the external organizational environment and the values and intentions of the recipients. This research frames *Design as Communication* using the following attributes: *An emphasis on the semiotic interface between an artifact and its recipient*, *the attention paid to the external environment in construction of the artifact*, and the *alignment between the designer's intentions and user's interpretations*.

Design as User Experience

Design as User Experience entails designing for the user and his or her multi-sensory experiences (Redstrom, 2006). Designing for user experience concerns the aesthetics imbued with meaning to be interpreted by the user. Redstrom (2006) argues that the effectiveness of design is better measured through the eyes of the end user. *Design as User Experience* entails how one designs user experiences in terms of utility, usability, communication, interpretation, understanding, and experience (Kazmierczak 2003, Redstrom 2006, Boztepe 2007). The internal workings (e.g. processes) of the design artifacts are marginalized in favor of the ultimate consumer's approval. Norman (2009) describes design as "a cohesive, integrated set of user experiences". In the ISDS literature, Hirschheim (1985) assesses user experience with respect to user participation in systems design. This research looks at

technical content in relation to social content, and high involvement versus low involvement with respect to user participation and the quality of the user experience. Improved communication lessened resistance to new systems, decreased implementation time, and increased productivity. When designers are designing from a 'user experience perspective' considerable emphasis is paid to the following attributes as they relate to the user experience: *designing utility, usability, communication, interpretation, and understanding and potentially including the user in the design process*.

Design as Value

The notion of value is quite polysemous in meaning. From a philosophical perspective, axiology is the philosophical inquiry into values, and is a collective term for ethics and aesthetics. In the anthropological literature, Graeber (2001) describes the concept of values in the sociological sense as to what is ultimately good, proper, or desirable in human life; in the economic sense as the degree to which objects are desired; and in the linguistic sense as 'meaningful difference'. In the design literature, Cross (1982) views value as culturally based where value in design consists of "practicality, ingenuity, empathy, and a concern for appropriateness"; while Bozetepe (2007) applies Graeber (2001) to define 'utility', 'social significance', 'emotional', and 'spiritual' as user value types. *Design as Value* entails a combination of economic exchange and human desire. Along these same lines, for something to be considered valuable there must be utility as well as social and personal significance. We adopt the Bozetepe (2007) value classifications of *utility, social significance, emotional, and spiritual* as attributes for *Design as Value*.

Design as Professional Practice

In the MacKay et al (2012) synthesis of design literature for ISDS, the act of design in professional organizations could be considered *Design as Professional Practice*. Design is an amorphous word that is simply the art or action of conceiving, producing, or the 'art of

manifestation'. In turn, design research could be considered phenomenological inquiry into design's manifestation. While MacKay et al (2012) synthesize the design literature to arrive at a definition for *Design as Professional Practice*, this concept is also found in Management and IS (Boland and Collopy, 2004; Boland et al 2008; Wastell, 2010). When an effort is made to standardize the processes, products, plans, and models, as well as the knowledge, skills, and attributes that express how to produce artifacts of interest, designers are engaging in a design of professional practice, i.e., when a designer designs *what designers do* (Dilnot, 1984b). This research frames *Design as Professional Practice* using the following attributes: *standardization of best practices*, *consideration of the knowledge, skills, and abilities of designers*, and the *expressed use of a standardized practice*.

Design as Service

Inherent in designing for user experience is the service an artifact provides. A user interface provides a functional service that allows a user to accomplish a given task in a reasonable amount of time. A web-service exposes a service contract that allows a user to access data and processing services. In modern organizations, a single instance of design output might be considered a product, process, professional practice, plan, model, or user experience; however, the continuous production of these artifacts is a service to the organization. *Design as Service* emphasizes how this continuous production is designed. *Design as Service* is a behavioral action where values and intentions are manifest and includes each of the aforementioned design conceptualizations. MacKay et al. (2012) states that design activity has much more to do with sustained service as the methodical day-in and day-out solving of problems. For the purposes of this study, *Design as Service* can be categorized using a single attribute: *a continuous business function a designing organization provides*. Table 11 summarizes the above attributes:

Table 11: Design Science Profiles

Design as…	Typology	Supporting References
Problem Solving	• Means for ordering the world • Emphasis on the definition and understanding of the problem at hand • Emphasis on a means of transformation or improvement of the environment	• Boland et al., 2008 • Dilnot, 1982 • Krueger and Cross, 2008 • MacKay et al., 2012
Product	• Construction of material artifacts • What products are being produced • Design and use of particular products	• Dilnot, 1982 • Marxt and Hacklin, 2005 • Simon, 1996 • Simon, 1980
Process	• Taking action to produce an outcome • Recollection and formalization of events • How process manifests itself	• Crowston, 1997 • MacKay et al., 2012 • Malone and Crowston, 1990 • Ryan, 1997 • Willem, 1990
Intention	• Belief toward an outcome • Attitude • What experts think • Motivation to comply with others	• Ajzen (1980) • Fishbein and Ajzen (1975) • MacKay et al., 2012 • Willem, 1990
Planning (Modeling, representation, etc.)	• Intentions exhibited as behaviors regarding *how* to plan for an end goal. • Models that manifest regarding planning	• Dilnot (1984a) • Dilnot (1984b) • MacKay et al (2012) • van Aken (2004)
Communication	• Semiotic interface between an artifact and its recipient • Attention given to the external environment in construction of the artifact • Alignment between the designer's intentions and user's interpretations	• Kazmierczak, 2003 • Lunenfeld, 2003 • MacKay et al (2012)
User Experience	• Designing utility, usability, communication, interpretation, and understanding and potentially including the user in the design process.	• Boztepe 2007 • Hirschheim, 1985 • Kazmierczak 2003 • Redstrom 2006
Value	• Utility • Social Significance • Emotional • Spiritual	• Bozetepe, 2007 • Cross, 1982 • Graeber, 2001

(Table Continued)

Design as…	Typology	Supporting References
Professional Practice	• Standardization of organizational best practices • Consideration of the knowledge, skills, and abilities of designers • Expressed use of a standardized practice	• Boland and Collopy, 2004 • Boland et al 2008 • Dilnot, 1984b • MacKay et al., 2012 • Wastell, 2010
Service	• Continuous business function a design organization provides	• MacKay et al., 2012

As noted in the aforementioned descriptions, the design conceptualizations are not exclusive, but rather interrelated. Artifacts that are cognitive in nature manifest themselves in the behaviors of artifacts that have an external interface. For example, *Design as Value* and *Design as Intent* can be manifest in *Design as Product*, *Process*, *Communication*, *Professional Practice*, *Planning*, *Problem Solving*, and *User Experience*. In turn, *Design as Service* can encompass the other nine design conceptualizations. The diagram below illustrates these relationships.

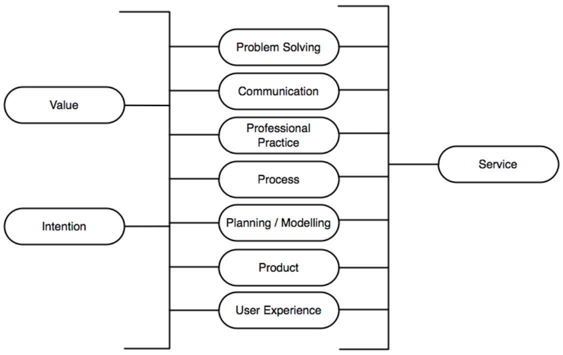

Figure 7: Relationships between Design Conceptualizations

While Figure 7 infers dependencies in some circumstances, it is not meant to infer that one design conceptualization may 'trump' another. A logical link must exist between transcribed text, its accompanying theme, and its closely inferred explanation. For the purposes of this research, explanations must relate directly to the criteria in a design science profile, and not to one profile as a potential surrogate for another.

The above design conceptualizations constitute design science profiles for the purposes of this research. These theories also constitute a framework that acted as a design science lens to guide research design, data collection, analysis, and theory development. The following section explains the research methodology and how this research employs the above framework.

Methodology

In both the academic and practitioner literature, very little is written about EA in practice. Given the scarcity of research, it was felt that knowledge of the social constructions of EA such as language, consciousness, shared meanings, documents, tools, and other artifacts should be explored using qualitative analysis (Klein and Myers, 1999). This research sought to assemble a rich profile of EA in organizational contexts; thus, a qualitative case study approach was undertaken (Yin, 2009). In addition, an interpretivist epistemology (Walsham, 1995; Walsham, 2006) is declared given the inextricable link between a researcher's placement into the social context of a qualitative data collection environment and their preconceptions that guide the process of inquiry.

The use of design science profiles (Table 11) coupled with the theoretical concepts that emerge from data intimates a combination of deductive and inductive reasoning. The research is deductive as the design science profiles were used to guide the research design and process. The research is inductive as themes and explanations emerged from field data and the researcher's logical sensemaking (Weick, 1995; Ashforth, 1998). Sensemaking refers to identification of explanations as individuals interpret information about a target and integrate it with the preexisting frame of their self-defining stories. Sensemaking was used by the research as a cognitive tool to gravitate similar themes to logical explanations (Lindlof and Taylor, 2011; Mason, 2002; Charmaz, 2006) about human designed artifacts.

The overarching lens for the research was design science (Simon, 1996). This research uses design science as a lens to reveal salient design conceptualizations in an EA practice. This was accomplished using the design science profiles in Table 11. An initial interview guide was developed based on the *Design As* conceptualizations from MacKay et al. (2012) and was augmented if there was something the interviewers felt was missing from the question set. For example, the final question of each interview was, "What could I have asked / What didn't we cover?". If a question or concept was commonly missed, it was appended to the interview guide.

The study consisted of two case studies within a single organization (psuedonym: SWEA). This organization was chosen because it offerred the researcher the unqiue opportunity to investigate EA in a private organization. Data collection consisted of 23 1-hour interviews over a 5-day span. In order to capture a broad range of perspectives on EA, interviews of all available personnel "in and around the EA effort" were requested. This included the perspectives of senior business executives such as the Chief Technology Officer (CTO), and the enterprise, information, application, and business architects in both the central EA organization and in the business units. Partway though the interviews it became clear two distinct cases were being discussed. Case One took place from 2004 to 2007, while Case Two occurs from mid-2009 to present day. For reasons that will be discussed below, the EA organization was discontinued in 2007 and was not re-instituted until mid-2009 with new personnel and a completely different philosophy. The contrasts between the two time periods offer considerable insight for academics and practitioners. This contrast would not be readily apparent if the entire organization was only discussed as a single case.

Data analysis for the study was performed in 6 stages. *Stage 0* consisted of denaturalized transcription of each of the 23 interviews (MacLean, et al., 2004; Billig, 1999; Oliver, et al., 2005). A denaturalized approach to transcription attempts a verbatim depiction

of speech while still working for a “full and faithful transcription”. Denaturalism has less to do with depicting accents or involuntary utterances and more with the substance of the interview; that is, the meanings and perceptions created and shared during a conversation. Stages 1-5 applied the seven steps found in Creswell (2003). The following table lists these steps.

Table 12: Steps to Analyze Qualitative Data (Creswell, 2003)

Steps to analyze qualitative data (Creswell, 2003)	
1.	Get a sense of the whole. Read all transcriptions carefully. Jot down ideas as they come to mind.
2.	Pick one random document and ask ‘what is this about?’ Think about the underlying meaning and write thoughts next to the actual text.
3.	When you have done (2) for several informants, make a list of all the topics.
4.	Take this list and go back through your all the data writing the codes next to the appropriate segments of text. Note any new categories and/or codes that emerge.
5.	Find the most descriptive wording for you topics and turn them into categories. Look for ways of reducing the total number of categories by grouping related topics.
6.	Make a final decision on each category and alphabetize the codes
7.	Assemble all the data material belonging to each category and perform a preliminary analysis
8.	If necessary re-code your existing data

Stage 1 maps to Creswell (2003) steps 1-3. Each of the 23 transcriptions were read carefully to understand the overarching ideas. As these ideas resonated they were recorded in a spreadsheet. Every attempt was made to stay *close to the text*. Overarching ideas contained direct quotes that exemplified the nature of the idea. Examples of the initial ideas consisted of, “Governance alone dosen’t get you an EA” and “EA cannot self-identify problems…there must be collaboration with the business”. Once each of the transcripts had an initial read, a subset of seven transcriptions were selected for initial theme analysis.

Each theme from the subset of seven interviews was recorded and added to a spreadsheet giving it a ‘cell code’. Again, every attempt was made to stay close to the text. Themes were either direct phrases from the text or close summarizations of the underlying

idea using the same words. Partly through the evaluation of this subset, similar themes began to emerge. Similar themes were assigned a cell color and a description (Hirschheim, et al., 2012) and each theme's cell was color coded. Upon completion of Creswell's Step 3, each cell was grouped by color and was gravitated to an overarching *explanation* (Vough, 2012) through logical sensemaking (Ashforth, 1998; Weick, 1995). These explanations were entered as column titles in a new spreadsheet in preparation for Creswell's Step 4.

Stage 3 maps to Step 4. Using the new spreadsheet containing the aforementioned explanations, all transcriptions were coded using an abbreviation for each column and the cell number containing the theme. For example, the theme 'capturing redundant processes, eliminating silos' was brought under the explanation 'promotion to the enterprise' as it was logically inferred that multiple duplicate silos of information, data, and applications existed at the 'business unit level' and there was a desire to re-design IT to work across business units. Subsequently, this theme was coded across the text as '[ENT-5]'. In addition, there was also a column available to indicate any themes that may have felt 'forced' to reside under any of the existing explanations. An additional spreadsheet was created to record the number of times each code appeared.

Stage 4 maps roughly to steps 5-8. Two important steps were taken during this phase. As each of the transcripts was being coded, the placement of a [1] or [2] next to coded statements were made to denote whether the statement was referring to Case One or Case Two, respectively. This was used as another source of evidence to warrant splitting the data into two cases. While every attempt was made to stay away from counts in other parts of the data analysis (Mason, 2002; Charmaz, 2006), the [1] and [2] codings were used as secondary criterion. Themes with a [1] delineating Case One totalled 140 codes, while themes with a [2] delineating Case Two had over 300. The second step entails gravitating the explanations to the design science profiles. As the final step of this stage, the columns titled with the

explanations were logically compared against the criteria in Table 11 and color-coded accordingly (Hirschheim, et al. 2012). Comparative sensemaking between the explanations and design science profiles gave design science based insight to the explanations. Subsequently, the explanations were renamed using a duplicate of the master spreadsheet to map the steps of explanation building (Yin, 2009) through the data analysis process.

Stage 5 used the grouping of themes under explanations for both cases to perform a between-case analysis. Some explanations were local to a case, some spanned both cases, and some had a presence/absence or absence/presence between cases. Similarities, differences, presence, and absence were all of interest. Amongst the interview data, there were even explanations the informants described as important, but could not consistently define. The principal example is the 'engagement model' theme grouped under the *Social Engagement* explanation. It was because it was deemed important but not concretely defined it was of considerable interest in the between-case analysis.

Additional Data Analysis Tools

In addition to the aforementioned use of cell and text coloring in spreadsheets, some additional tools were used for data analysis. The 'Sublime Text 2' text editor was used to perform massive text searches across the transcriptions and display text that was a few sentences before and after the codes. In addition, sites such as wordle.com were used to generate 'word clouds' from the data (See Appendix 3).

The Use of 'Counts' in Interpretivist Research

Considerable debate exists in interpretivist research communities regarding the use of counts. Mason (2002) and Charmaz (2006) both discourage the use of counts, while Sandelowski (2001) argues that meaning depends, in part, on number. This research choose the use of counts as criteria for dividing the case data. This research essay posits that a

significant difference exists between a count and the participant observer's interpretation from being embedded in the social context. The researcher's "constructions of other people's constructions" is central to the emergent dialectic and a reliance on counts potentially distorts these 'constructions' (Walsham, 1995; Walsham, 2006).

Description of Cases[2]

Case One and Case Two were split amongst the larger EA study that was done at SWEA. The Case One timeframe took place from 2004-2007 while Case Two is 2009-present. The informants who spoke about Case One from the perspective of the present day were reflective of their prior aims and what caused the EA organization to end precipitously. Half of the informants were part of the EA organization during Case One, while the other half were new to either the EA organization or new to SWEA. The EA organization consists of several different types of architects: business architects, information architects, application architects, and enterprise architects. In addition, these functions are performed at two levels: within the central EA organization and within the business units. The architects within the business units are loosely tied to the central organization and have reachback through architecture review boards, standards boards, architecture insights, and other forums to share ideas and domain knowledge. Business units are also termed 'segments' that roughly equate to an enterprise level business process such as sales, marketing, or mergers and acquisitions. Segment architecture is defined as "a detailed, formal description of areas within an enterprise, used at the program or portfolio level to organize and align change activity" (TOGAF9, Section 3.62). The EA organizations in Case One and Case Two are faced with the daunting task of navigating across the business segments to create a horizontal view of the enterprise. The sections below describe each of these cases.

[2] Within the case study analyses, single quotes are used to denote researcher-derived themes. Double quotes are used for actual quotes from the text.

Case 1: EA as Artifacts

1990 to 2002 saw exponential growth at SWEA. The company went from being principally based in the US to one of the largest multinational technology companies in the world. Along with this growth, SWEA became considerably more 'divisional' as the number of business units doubled to nearly 40. These business units became fully functioning organizations in their own right. Subsequently, this compromised the integrity of many of the central IT functions as these functions were dispersed to the business units. The need to look at the organization as business processes that exist both within and across the business units created the impetus for EA. It was felt by senior leadership that EA needed to provide "governance, standardization, and compliance" of IT functions. Thus, in order to make information and applications in the business units more easily accessible, for example, accounting and legal, it was felt that a "forcing function" needed to be established to get the individual business units to comply. In early 2002, a skeleton crew of technology architects was relocated to the central IT department to perform this function.

By late 2002, the vision of the EA organization was established. The principal function of the EA organization was to establish and govern standards for IS development across the organization. The EA team began to develop "reference architectures" that detailed data, service, application, and technology standards. Once the vision of the EA organization solidified, it was considerably expanded to have the necessary resources to produce technology standards and governance processes. At the height of Case One, there were 18 architects working under these auspices.

The EA organization faced an uphill battle from its inception. It existed within the central IT organization and consisted principally of technology architects. The architects envisaged themselves as the purveyors of governance and compliance. However, only those within the EA organization shared this viewpoint, and not senior business unit leadership.

The EA organization also had the monumental task of trying to govern tens of thousands of employees and thousands of systems spread across nearly 40 different business units.

The EA organization spent the period during the Case One timeframe developing standards and searching for ways to govern and enforce compliance. From the beginning, it was found to be extremely difficult to gain access to the data needed to develop standards within the context of the organization. "Nobody ever had to return our phone calls or emails" as the organization neither had the endorsement of senior leadership, nor were a part of anyone's annual "commitments" to the organization. Consequently, without access to data, the standards were written "in the ivory tower" and referred to as "shelfware".

The EAs learned valuable lessons from the Case One effort. The principal lesson was that constructing standards artifacts does not create tractable governance, hence the title of this section: *EA as Artifacts*. For the EA organization to be considered a worthwhile asset to the organization these artifacts had to be enforceable, and enforced as part of a governance function. This was where the governance-heavy EA organization ran into considerable trouble. Without the endorsement of senior leadership, a divisionally autonomous organization such as SWEA pushes considerable amounts of political power to the business units. Thus, the business units have the power to reject EA outright if they choose. In addition, the more profitable the business unit, or the more it is aligned with strategy, the more implicit and explicit power it has over the EA organization's future. Many of the business units already had their own EA function and viewed the central EA team as an impediment to honoring both personal and organizational commitments. This caused a divergence of opinions between the central EA organization and the business units. This divergence eventually led to the EA organization being 'shut out' of much of the company. This became common knowledge across the organization and shortly thereafter made it extremely difficult to procure funding. The result was near complete disbandment of the EA

organization as members were either dispatched to business level EA functions or returned to their 'IT roots'.

Case One Analysis

To arrive at a theory for Case One, an iterative approach was taken. During data analysis, theory development occurred by moving between the themes, explanations, and extant literature (Vough, 2012; Corbin and Strauss, 2008). This assisted in gravitating themes to explanations while using extant literature as a source of outside validation. As themes were clustered together to build explanations, they were logically compared against the design science profiles from Table 11 and assigned one or more *Design As* categories to identify design science perspectives relevant to the case.

As previously mentioned, the period that comprised Case One did not end under the most favorable of terms. Naturally, when speaking about an endeavor that went awry, there is a reflective tendency to discuss what was learned or what went wrong. The explanations that emerged from Case One tended to be explanations that were based on these reflections. From Case One data analysis, four explanations emerged and were given the following labels by the researcher: *Isolationism*, *Jurisprudence, Techné, and Knowledge Availability*. The following four sections provide insight into these explanations and how they were derived from the research.

Isolationism. The term 'isolationism' is a term commonly found in politics that refers to the view that a country should abstain from political or economic relations with other countries. Scores of countries over time have pursued this philosophy in part, or in whole. In present day, very few countries pursue this philosophy, as the import and export of everything from material goods to ideas has shown to improve socio-economic status. While the EA organization at SWEA is not a country, it was isolated organizationally, continued to produce

EA standards and governance in isolation, and was rebuffed when trying to impose standards and governance. This led to SWEA abandoning EA for several years.

> They couldn't get buy-in so they went about EA alone...they left the business units alone and they never got integrated – Information Architect

The themes that emerged from the text were gravitated to *Isolationism* when they referred to the EA organization proceeding without stakeholder buy-in. Themes such as 'ivory tower', 'lack of engagement', and 'unable to get buy-in' were gravitated to this explanation when they were also coded as themes that referenced the Case One timeframe.

> The whole model was thrown away. There was a lot of pushback from the individual teams. All they saw was the EA guys going there and throwing red flags – EA from Marketing Segment.

The above statements about Case One revealed initial dismissal by the business units early on. The attempt to create standards and governance without participation from the business units led to outright rejection when the EA organization attempted to impose standards and governance.

> From the beginning, how to engage with the business was never clarified. The minimum required artifacts were never clarified. Do not get me wrong, there were pockets of excellence, but looking at the enterprise as a whole we had no consensus. So the work that one pocket of excellence may not lead into other parts of the process. – Principal EA

The term *isolationism* surfaced when the informants were asked about the value of EA. One informant described a "lack of engagement" during the Case One timeframe where all the standards and models for governance were "done in isolation" and that "totally left the EA's open to the criticism of being ivory tower". Another informant spoke of the "misconception" of EA being "IT related" and the EA team being "unable to sell the journey they wanted to take". This reinforced the idea that the EA organization was being ostracized from the outset. Another informant replied in similar fashion when asked how standards and governance were received: "All they saw were policemen saying thou shalt not do it" and

that because they were unable to build “trust” it was effectively conversations between “senior business leaders and business managers” that “drove them out of business”.

The EA team was not able to procure ‘engagement’ from business unit stakeholders early in the EA endeavor. Consequently, it ran into considerable difficulty in proliferating their efforts. The architects were isolated initially by senior business unit leaders, which sent the EAs to the ‘ivory tower’ in which they continued to develop standards with little outside interaction. When these standards were thrust upon the business units, they were viewed as additional burdens and subsequently rebuffed. Once organizational leadership was given notice, it cut the EA organization’s funding.

Isolationism was clearly not the preferred course of action. In contrast, the architects saw the importance of establishing the utility of EA to the rest of the organization. The architects desired to make EA an integral aspect of both technology development and something that was significant to people and processes. The architects intended to design value into the EA organization. When it became apparent that it was going to be extremely difficult to get stakeholders in the business units on-board, the design of an EA practice became centered on the design of material IT artifacts and what products were going to best contribute to standardization and governance. Thus, *Design as Product* is identified as a design science profile from Table 11.

Jurisprudence. In addition to *isolationism* as an explanation for Case One’s course of events, the idea of a ‘rule of law’ also emerged as a contributing factor. Jurisprudence refers to a theory or philosophy of law. For example, ‘American Jurisprudence’ is a published artifact of United States law. In a similar vein, Case One was considerably centered on establishing standards and governance. *Isolationism* was the effect of attempted jurisprudence where jurisprudence was the cause. Case One had a “governance heavy” emphasis that unfortunately was not well received by the business units.

> So it was more about there was a group that was doing EA work that was about governance than anything else. We were assigned to the individual business units and our role was to see whether the projects that are being executed there are doing the right things. – Segment Architect in Accounting/HR

Case One's governance-heavy mission led to it being perceived as an organization for "compliance", "thou shalt", and "dictatorship". During the Case One timeframe, the EAs felt they were more in the business of saying "that's good or bad" and "finger pointing".

> The EA organization had somewhat of a checkered history … we had a different view of it…and to be fair, that was the prevailing view of Enterprise Architecture at the time. It was principally about governance and when I think about governance, I think about an established a set of rules and then trying to force some level of compliance… it was not a role that was particularly welcomed. – CTO

From the data analysis, several themes emerged that gravitated to this explanation. Themes such as 'governance alone does not work', 'must have respect to have governance', 'cannot simply drive ontology and governance', as well as other quotes that alluded to a governance-heavy model in a divisional organization:

> You don't need a report that tells you the 22 things you need to fix… that was during the days of the heavy governance first approach, and when all that exploded on our face most of our architects got sent out into engineering units – Chief EA

Governance and jurisprudence can be seen as equivalent terms. The idea of enacting a rule of law for which to develop IT triggered a search of the literature on IS Governance. Evident from Case One was that it was extremely difficult to enact governance in a divisional organization when there is no mandate from top-level leadership. Compounding this idea is research that exhibits a tight relationship between governance and the degree of structure in an organization (Ein-Dor & Segev, 1978). In addition, research has also found a positive relationship between the degree of centralization and governance (Ahituv, et al., 1989), and that companies with a 'defender' strategy (Miles, et al., 1978) have a more centralized IS Governance function (Tavakolian, 1989). Hence, the negative relationship between organizational decentralization and IS Governance gives rise to a consistency between extant

literature and what was observed at SWEA. The idea of 'governance' was clearly felt as a mode of domination (Burrell and Morgan, 1979; Orlikowski and Robey, 1991) and without the presence of a centrally managed organization, the business units had the social capital and political power to rebel.

From the aforementioned themes and review of extant literature, the idea of *Jurisprudence* was seen as a logical explanation of the themes. Prevalent throughout the data was that a unilateral rule of law (e.g. when the receiver has little input) that caused significant discontent. The idea of *Jurisprudence* reveals multiple design conceptualizations. When a designer's focus is on designing a standardized practice for governance to create organizational best practices, they are inherently constructing the future knowledge, skills, and abilities that will be needed by the organization (*Design as Professional Practice*). In addition, as governance artifacts are developed, it imposes a process and process artifact that affects future outcome (*Design as Process, Product*).

Techné. A key distinction between the informants recollections of Case One versus Case Two were the types of artifacts the EA organization wished to develop. Case One was generally regarded as an effort to govern "how you build systems and scheduling when they will happen" and "defining the 'to-be' core systems". Thus, there was considerable emphasis on IT artifacts. The effort to build EA artifacts during Case One appeared ultimately concerned with what could be produced to demonstrate success. Some of these artifacts included operating models, data taxonomy, strategy maps/strategy views, enterprise context diagrams, critical process maps, investment plans, assessment tools such as Control Objectives for IT (COBIT) and Capability Maturity Models (CMMI), capability heat maps, EA portfolio standards, and EA vision and scope documents. The impetus for an artifact-centric approach was based on the Federal Enterprise Architecture Framework (FEAF) and

not on the "culture of the organization". The artifacts produced were to discern "right from wrong" and were of little perceived value to the business units.

Techné emerged from themes that referenced Case One as an emphasis on the form and function of material artifacts. For example, themes such as 'metrics to ensure high data quality', 'difficulty to maintain data quality across the enterprise', and 'difficulty identifying data facets' were recurrent throughout Case One data. Given the *Isolationism* felt from imposing a governance-heavy approach, artifacts were difficult to produce as it was difficult to collect data from the business units, and difficult to enforce.

> They would say we have delivery dates and we don't have time for this and what they don't realize is that they are doing that type of work anyways. A data modeler has to make up a process if one is not there….a process modeler has to understand what comes in and our of their process or they cant design the web pages or whatever else they are using for their interfaces…so they are already doing the work, its just haphazard and disconnected and takes a lot of time and effort to come together. If there was a more rigorous approach it might actually speed it up and make it more tight and less likely for error or disconnects. As of now, it will take a lot of work. – Principal EA in Marketing

This research uses the Foucouldian elidation of *Techné* rather than technology as is gives rise to "practical rationality governed by a conscious goal" (Foucault, 1978). Aristotle also used the word *techné* (the etymological root of technique) to refer to the "rules of skill and technical knowledge". Case One emphasized the production of artifacts and technology to govern the development of IT. The emphasis on *techné* stands in contrast to what is described as the mission of Case Two. The discussions on what systems will be built and what diagrams are to be produced emphasize the construction of material artifacts, what artifacts are to be produced, and how they are to be used. This is consistent with *Design as Product* as it specifically characterizes how much or how little the objects, entities, and artifacts that arise are imbued with meaning fit within a context. The discipline and practice of the designer is inextricably linked to the designed product (MacKay et al, 2012; Levy, 2012).

Knowledge Availability. This refers to the EA organization's ability to manage knowledge and make it available. The artifacts and general knowledge produced as part of Case One were considerably localized to the business units. This related to everything from software development standards, procedures for data recovery, and information about new company recruits.

> We have a ton of details in physical data models. Lots of people know this in their heads and the information with what they are dealing…but nothing is documented in a single place …recruiting and sourcing for example: How do you prospect candidates? There are many interesting things that go on there and it is now just based on tribal knowledge. – Principal EA in Accounting/HR

Several themes emerged on knowledge availability. Emphasized across the references to the Case One period was the desire to 'have a single knowledge repository' for EA. Themes such as 'where to find knowledge on the enterprise', 'knowledge repository', 'standards to eliminate tribal knowledge', and 'formalizing tribal knowledge' comprised the themes that were clustered to logically gravitate to this explanation. There also exists considerable extant literature on knowledge management (KM). For example, Alavi and Leidner (2001) describe four key issues with creating processes to establish a knowledge management practice. These four issues are as follows: (1) relationship between knowledge and firm-level competitive advantage; (2) relationship between knowledge and the individuals; (3) processes of knowledge management and the potential role of IT in these processes; and (4) organizational issues of KM and KMS initiatives. In addition, DeLong and Fahey (2000) describe four hypotheses related to cultural issues that impede a KM practice. In particular, (1) an organizational culture shapes assumptions about which knowledge is important, and (2) culture mediates the relationships between levels of knowledge. In turn, (3) culture creates a context for social interaction and (4) shapes the creation and adoption of new knowledge. The architects at SWEA felt it was critical to

create ‘standards to eliminate tribal knowledge’, create a repository where one can ‘find knowledge on the enterprise’, and create ‘information sharing to augment governance’.

From the perspective of the researcher, the culture at SWEA was extremely open about knowledge sharing within the central IT organization. However, it was fragmented when it came to knowledge sharing between business units. This aligns well with the hypotheses from DeLong and Fahey (2000). In addition, the architects seemed particularly concerned with KM for competitive advantage and in encouraging outside contributions to a KM repository. This is consistent with Alavi and Leidner (2001).

KM is particularly effective when process instruments have been enacted to discover patterns in organizational memory and in identifying the sum or range of what has been perceived, discovered, or learned (Schubert, et al., 1998; Alavi and Leidner, 2001). The architects at SWEA attempted to make EA knowledge discoverable and available so it can be enacted. In turn, if others outside the EA organization use EA artifacts, it increases perceived value. Making organizational knowledge available through a repository acts as an interface between EA artifacts and their recipients. This interface makes knowledge discoverable through a repository separate from the EA artifacts themselves. This is consistent with the idea of *Design as Communication*.

Summary

The following figure summarizes the process by which themes were gravitated to explanations in Case One.

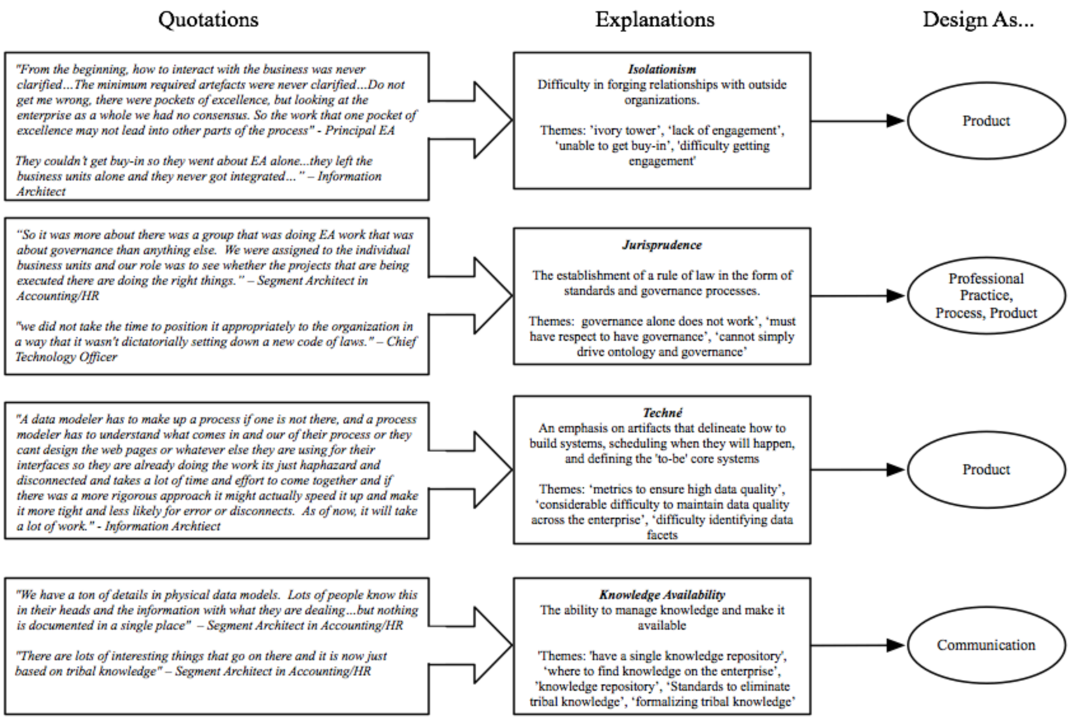

Figure 8: Case One Quotes, Explanations, and Design Perspectives

Case One revealed an organization that was isolated from its external environment when attempting to establish a rule of law that was about the standardization and governance of IT. The principal focus of the EA organization was to establish standards and governance processes, as well as minimize 'tribal knowledge' in the organization. This was carried out with minimal input from the business units at SWEA, and subsequently, when EA artifacts and their intended meaning were exposed to the business units, they were met with considerable resistance. The four explanations detailed above, *Isolationism*, *Jurisprudence, Techné, and Knowledge Availability,* reveal the inner environment of a design theory in Case One where the interface between an inner and outer environment (Simon, 1996) was based on designing the right products (EA as Artifact), and the outer environment was the business units themselves. The EA organization was not able to accomplish adapting to their outer environment and was subsequently rebuffed. This case provides a retrospective of a design of an EA organization that was found to not be viable in this particular organization. An explanation of what does not work should be considered a contribution. Conversely, Case

Two provides considerable contrast to Case One as EA as *Design as Value* was found to be the most salient design conceptualization.

Case Study Two: EA as Value

After surviving on a skeleton crew for nearly three years, funding to expand the EA organization at SWEA was procured in early 2009. Nearly half of the EAs are new to the EA organization and nearly 25% are new to SWEA. As will be shown in the analysis, the EA organization in Case Two has a considerably different emphasis, electing to concentrate exclusively on organizational acceptance as a pre-requisite to artifacts. The concentration on organizational acceptance centers on espousing the value of EA, hence the section title: *EA as Value*. In addition, the EA organization encompasses far more than an emphasis on technology. Rather than a team that is principally comprised of IT architects, the EA organization now consists of personnel who specialize in business architecture, information architecture, application architecture, and enterprise architecture. All of the architects are officially titled 'EA' who have specializations that synthesize the boundaries between the aforementioned architecture positions.

Throughout the Case Two interview analysis was an emphasis that sought to distance the EA organization of the present from one of the past. Rather than a focus on governance as a means to enforce standards and serve as an authority on IT development, the term commonly used was "influence without authority". To be influential without having official authority is of considerable challenge. Case Two themes detail a unique set of "soft elements" and "interpersonal skills" so that architects can 'sell the particular idea' they wish to espouse under the auspices of EA. EAs must build 'trust to have respect' so they can be influential to 'get those in the business units to give them the data'. Consequently, the EA organization has been focused on emphasizing how they can be of help to the business units while also seeking to "promote" data, applications, and processes to an "enterprise level".

Case Two Analysis

The analysis below employs the same methodology as was employed in Case One to reveal four explanations. These explanations are: *Social Engagement, Value-Based Understanding/Maturity, Group Ownership, and Interpersonal Skills.* In the same manner as Case One, themes were identified and as these themes began to cluster, a search of the extant literature was performed to assist in gravitating to explanations. Once explanations were identified, each explanation was compared with the *Design as* profiles from Table 11. The sections below explain the rationale for arriving at these explanations. In addition, each section ends with an analysis and identification of one or more *Design As* constructs.

Social Engagement. In contrast to developing EA artifacts in isolation, the EA organization has spent considerable time bridging the efforts of the EA organization and that of the business units. These bridges currently exist in the form of relationships; however, it is the desire of the EA organization to gravitate from informal relationships to formal "commitments".

> To have an EA implies that we have an engagement model between the corporate EA and the business unit or segment architectural groups. One would hope the business unit would have the architectural theme that would run all the EA roles…and then the corporate or enterprise wide enterprise architecture team would be in a cycle of connecting these units into a closed loop and having the iterations and passes on these on how they impact the ecosystem – Principal EA

The term *Social Engagement* stems from the social psychology works of the Tavistock Institute (Trist, et al., 1990) which gave rise to work on socio-technical systems (Trist, 1980; Mumford, 1995). Social Engagement refers to the mandatory and elective behaviors exhibited to foster group engagement. Several of the informants referenced the term "engagement model" directly, many of them claiming its importance. EA must be 'engagement-oriented' and that the EA organization must have a 'measureable engagement model'. The notion of an engagement model exists as a 'standard for interaction with

different business facets' and a way of "having formal means and standards for knowing all the aspects".

Interesting about the term "engagement model" was that the researcher was unable to obtain a precise definition from the data, though it was overwhelmingly claimed as important. At the end of each interview the question of "what am I missing?" or "what should I have asked?" was posed, and "engagement model" was frequently referenced. This forced an addendum to the interview guide. From the EA's perspective, an engagement model begins with "choosing the right projects" and "working as a team with stakeholders at numerous levels".

> There have been a lot of discussions within the group to have a better engagement model. We have been talking about having a more team approach where you pick highly visible areas and you go in there with more of a team and go in with more of a structure to take that on. – EA for Mergers and Acquisitions

Research in both the industry and practitioner domain contains several conjectures as to what constitutes a successful engagement model. Hinchcliffe (2009) views an engagement model as active in employing all types of architects throughout the business: "An EA group should use software, business, infrastructure, and information architects to cover the enterprise so that the central EAs are 'freed' to focus on engagement". This also "heals the chasm" between EA's, business architects, solution architects, and information architects to ensure they are part of a "single living unit".

From this perspective, 'engagement' must take place both intra- and inter-organizationally. Brown, (2004) and Fonstad and Robertson (2006) view IT Governance as an antecedent to an engagement model. According to Brown (2004), a model for engagement survives on (1) developing a center of excellence; (2) executive-level support; (3) buy-in from the business; and (4) iterative implementations. In contrast, Fonstad and Robertson (2006), who brought the notion of engagement models to the EA domain, consider an IT-

centric approach to align projects to business unit objectives and corporate-level strategy. Both of the aforementioned works emphasize a value-based understanding of EA. Brown (2004) is specifically a treatise on the value of EA, while Fonstad and Robertson (2006) emphasize the creation of linking mechanisms that provide business value and adjust architecture goals. The concept of an engagement model is something examined in detail in the between-case analysis section of this research essay.

From the aforementioned works and emergent themes, *social engagement* that produces value and has value 'designed in' was something keenly desired by the architects at SWEA. Stakeholders external to the EA organization must 'understand the value of EA' and feel as if their opinion is valued. This was seen as a prerequisite to the production of EA artifacts of strategic value. The *Design as Value* conceptualization targets utility, social significance, emotional, and spiritual as components of value. The concept of utility logically relates to the EA organization's effort to make contact with those in the business units and espouse the perceived usefulness, while social significance, emotional, and spiritual entail the desired individual and organizational emotions that would be felt by engaging with the EA organization if, in turn, they perceive they are valued.

Value-Based Understanding/Maturity. Also prominent in Case Two was how the EA organization defined maturity. Rather than mature artifacts or repeatable processes, maturity was perceived as being able to obtain outside belief in the "value of EA". The concept of value relates directly to the concept of engagement. Social Engagement refers to exhibited behavior, while *Value-Based Understanding* refers to cerebral or cognitive engagement. In a divisional organization such as SWEA, procuring either type of engagement has proven difficult. Promotion at SWEA is based on the degree to which individuals meet their explicitly defined "commitments". Consequently, those who have not

written EA into their yearly commitments are unlikely to lend any time to the EA organization.

To understand EA was to understand "how it has value". Informants spoke considerably of how to obtain value and the difficulty in doing so. The idea of 'getting others to understand the value' was many times discussed in the context of impediments to realizing a mature EA practice. Themes such as 'tough to get the business units to agree to EA', 'need grassroots motivation', 'influencing without authority', and 'maturity as getting the organization to understand the value' were gravitated to the *Value-Based Understanding/Maturity* explanation.

The interviews that took place with internal stakeholders, such as the CTO, Chief EA, and EA Portfolio Manager, spoke explicitly of steps to designing a mature EA practice. In an "EA 1.0", the problems tend to be identified and solved by EA. Thus, the resulting artifacts and imbued values are only realized by the EAs themselves. In an "EA 2.0", the business units identify problems and bring them to the EAs. Thus, EA artifacts are worked on collaboratively. This contributes to EA becoming a "business function" versus a function inextricably linked to the IT organization at SWEA.

> I think at this point I would say [the users of EA are] the CIO and his staff. Now ideally going forward and this is part of our maturity evolution, it becomes a business function. It's not, we are not at that level of maturity today; as an aspiration it should be part of the business function. – CTO

The link between value and maturity stands in contrast to maturity assessments found in the practitioner literature. EA maturity models either assess EA practice by levels of awareness and involvement by external stakeholders (Schekkerman, 2006; GAO, 2012), or by levels of 'blueprints' and 'compliance' (NASCIO, 2003). At SWEA, designing value is a pre-requisite to not repeating the misfortunes of the past. The architects at SWEA desire a professional practice that is "self-organizing" with respect to engagement. This requires

behavior that only manifests when there is psychological engagement, and psychological engagement only comes when there is underlying value in the antecedents (Tyler and Blader, 2003).

The link between *Value-Based Understanding* and maturity refers directly to designing utility and usability into an EA. An EA practice must have communication with its user base and interpret the needs of the user throughout the design process. This relates directly to characteristics of *Design as User Experience* from the perspective of collaborative engagement and to *Design as Value* as the underlying antecedent.

Group Ownership and Accountability. This refers to outside ownership of EA artifacts. The EA organization desires the business units to own a portion of EA artifacts. To have an EA practice that is far reaching into an organization as large as SWEA, it takes more than an EA organization alone (Bente, et al., 2012); it takes the collaboration from multiple organizational perspectives, and those perspectives must be willing to approach the EA organization and own their portion of domain expertise.

In the case of SWEA, this specifically relates to 'business ownership of the data taxonomy' and to have 'product owners for each block of data'. In addition, the "business owners" should be the ones to "drive solutions" with the EA organization as the "process owner" and maintain a 'horizontal view' so that "business architecture, process architecture, information architecture, application architecture, and technology architecture" can persist across the enterprise.

> The biggest challenges are in getting sponsorship and ownership of the information. A lot of EA groups try to own and manage the info and then it becomes a sales job to convince the world you know what you are doing and its difficult because you don't really know their jobs better than they do. – Information Architect

> If you are trying to suggest changes to their jobs and tell them what they should be doing they don't react very well. So a better approach is to go to people and

> find an owner for each section. Then you begin engaging with them and explain why it is so important to participate in this because it will influence the reports they get, the products their people use to support the customer and to manage quotas, and so if you can identify folks that will work with you. You will be successful. If you try to do it yourself, it will be one person at a time selling – Enterprise Architect/Supply Chain

Group Ownership and Accountability centers again on the idea of promoting value and stimulating group engagement. Tyler and Blader (2003) target *procedural justice* and *identity judgments* as key antecedents to group engagement. Consequently, employees tend to feel empowered by the emotional and spiritual aspects of feeling socially significant amongst their peer group. This positive reflection of self is a key antecedent to agency (Eisenhardt, 1989). Divesting ownership and accountability designs an experience that deliberately seeks to integrate stakeholders from across the organization. Identified responsibilities are dispersed to those engaged in EA rather than just the EA organization. This was seen as a key maturity factor in an organization as large as SWEA.

The EA organization is engaging in the design of intentions and values to be exhibited as a specific type of behavior. In addition, they are seeking to establish a user experience that is more localized to the users themselves. In this case, those users are the segment architects, solution architects, and stakeholders in the business units. Multiple design conceptualizations arise as part of this explanation. *Design as User Experience* emerges as part of designing ownership and accountability that further integrates the eventual consumers of EA, *Design as Intention* emerges as a psychological aim towards spreading ownership of EA artifacts across the corporation, and *Design as Value* exists as the philosophical strand that underlies engagement, value-based maturity, and behavior to accomplish such objectives.

Interpersonal Skills. The final explanation that emerged detailed the interpersonal skills believed to be "key arrows in the architect's quiver". While the above explanations could be considered 'macro' and 'meso' perspectives, this explanation entails key micro-level

characteristics needed to succeed as an EA at SWEA. Architects must understand the 'relationship-based' nature of building trust and espousing value. 'Precision of communications' is key, as an EA must 'influence without authority'. EAs should be "leaders", able to 'gauge appetite for change', 'build consensus around leaders', and 'sell the idea, or journey' that needs to be taken. To do this, an EA needs to be 'sensitive to organizational culture'.

> The other thing is that as an EA you have to have courage. Part of you job is that you have to go up to people and you say really nice baby, but it's really ugly. You have to have the strength and courage to have really hard conversations. Because some of the things you are looking down at are things people made their career on, and we are going to tear it down…. that may have been the system that showed management they were also management material. – Principal Information Architect

Because the EA organization seeks those with strong interpersonal characteristics, they are given considerable autonomy to solve the problems they are faced with. An EA must have the organizational knowledge to "identify the folks they are going to work with" and figure out ways to earn their "trust and respect". These themes and quotations emphasize soft skills that were far less salient in Case One. This presents an interesting dichotomy between Case One and Case Two, as SWEA is predominantly an IT organization where technical prowess is key to peer recognition.

> An EA must understand who your individual stakeholders are, not just their names, but also their motivation. Who is this person? Where are they on Maslow's hierarchy? I use Maslow's in two ways, I look at people in their corporate life, and I look at organizations. An organization under fire, not meeting deadlines, they are in danger of being split apart, and they are at that food and shelter level. You don't talk to a person in that state about self-actualization. – Principal Information Architect

Interpersonal skills are the exhibited behaviors that result from values and intentions. An EA must have the right intentions as per the organizational context, make those intentions obvious, and understand the intentions of the receiver (MacKay et al., 2012). To design those intentions is to situate and adapt them to an organizational context. Similarly, designing

value means to situate ones own interpersonal values in context so that they have utility, social significance, emotional, and spiritual value. The right interpersonal skills will also persist the EA organization in providing a continuous business function as a service to the rest of the organization. Three design conceptualizations align with the interpersonal skills enumerated by the architects and the interpretations derived from the research: *Design as Intention, Design as Value,* and *Design as Service*.

Summary

The following figure summarizes the process by which themes were gravitated to explanations in Case Two.

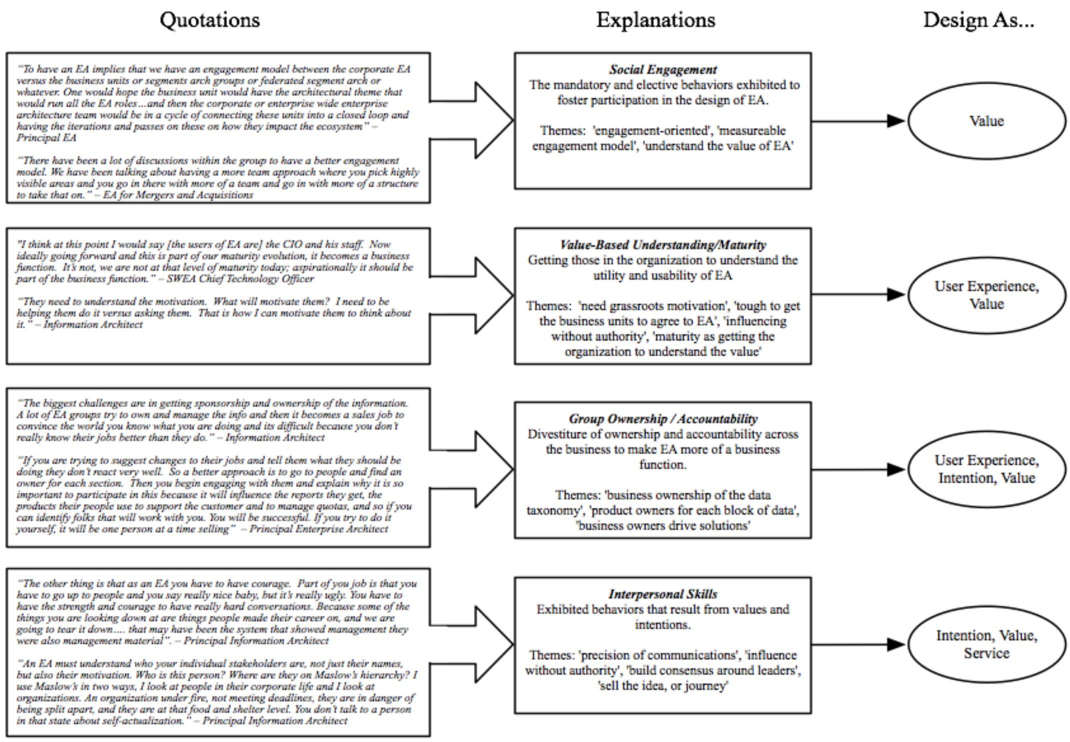

Figure 9: Case Two Quotes, Explanations, and Design Perspectives

The explanations from Case Two revealed an EA organization that was considerably focused on designing a professional practice that champion's organizational engagement as its centerpiece. Organizational engagement requires a cognitive understanding of why EA is valuable by those who the EA organization seeks to engage. From values, intentions can be

cognitively constructed, and it is these intentions the EA organization hopes will resonate as behaviors in the form of *engagement* and *ownership.* This requires a *value-based understanding* and a unique inter-personal skillset on the part of the architects that will foster *value-based maturity*. For Case Two, the inner environment or composition of an artifact consists of espousing the appropriate values of EA, having EA's with the right organizational skillset for the organization at-hand, and divesting accountability and ownership to the eventual business unit consumers of EA artifacts. The artifact is an engagement model that is matured based on the organizational context. The notion of an engagement model spans both cases. The lack of an effort to develop an engagement model may have contributed to *Isolationism* and a principal focus on *Techné* in Case One. In Case Two, considerable time and effort is being spent espousing EA value throughout the organization in an attempt to foster engagement. However, from the data analysis the definition of 'engagement model' was quite nebulous. This raises a research question to be addressed on our between-case analysis: W*hat is the meaning of an engagement model, and how is it developed in an EA practice?* The between-case analysis in the following section explores this question and presents a model from the emergent themes, explanations, and extant literature.

Between-Case Analysis

Several themes and explanations had applicability between cases. Some of the themes transcended across cases, and in some instances, the absence of a theme or explanation in one case and its presence in another provided insight for both cases. Given the circumstances that caused the Case One version of the EA organization to cease, a presence/absence or absence/presence of themes between cases can serve as the culmination of reflective knowledge.

MacKay et al (2012) draw from the breadth of design literature, predominantly outside the field of IS, to illustrate ten conceptualizations of design, and how these

conceptualizations can be applied to IS. These conceptualizations were summarized to design science profiles along with parameters that were used for logical comparison (Table 11). As explained above, the design science profiles were initially used as part of the research design, and once comparisons were made with emergent themes and explanations, it sharpened the design-based worldview of the research within cases. This emergent worldview will now be carried forward to perform analysis between cases.

Case One was dominated by a conceptualization of designing products that set standards and created processes to govern the development of IT artifacts. Case Two was dominated by a conceptualization of designing value into the EA organization and engaging business unit stakeholders by getting them to realize the value of EA. Case One was "governance heavy" and ended precipitously. Clearly, the value in a governance heavy approach was not accepted. Case Two has placed considerable emphasis on helping the business units realize their overarching commitments, while also guiding the architecture in business segments to "promote" to the level of the enterprise and align with strategic objectives. This is done with the expectation that it will help those outside the EA organization realize the value of EA and get them to increasingly demonstrate behavior that engages with the EA organization.

While this is what the EA organization perceives as designing value in their practice, an analysis of the theoretical conceptualizations between cases must determine what value means in the theoretical sense. *Design as Value* leads to an important question: What is value? Webster's dictionary has six different definitions of 'value' that largely chronicle what is valued as it relates to music, the arts, or monetary exchange. The definition of value can hardly be articulated without use of the word 'value' itself. From the extant philosophical literature, value is studied under the auspices of axiology or value theory. Value combines ethics, an understanding of moral standards of right and wrong; and

aesthetics, inquiry into 'beauty', as it applies to the sense, and logic, and inquiry into human courses of actions by what other perceive to be reasonable (Dewey, 1939; Findlay, 1970). Dewey (1939) ascribed 'goodness' as the outcome of value, while Kant considered value absolute versus relative (Aune, 1979). There are even popular novels on the theory of values; *Zen and the Art of Motorcycle Maintenance* and *Lila* (Pirsig, 1974; Pirsig, 1991) are some of the most widely read books on philosophy in popular media and contain theories that have permeated academic literature (Hall, 1976; Schneiderman, 1998). Pirsig equated quality with value and surmises that quality cannot be defined as it empirically precedes any intellectual construction of it. "Quality exists as a perceptual experience before it can ever be thought of in descriptive terms, and value is clearly only as 'real' as one's perception of it". Consequently, an EA organization may encounter divergent perceptions of value as they seek external engagement.

An 'engagement model' exists as the exhibited behaviors once value is realized. In both cases was a sense of challenge in finding a way to foster group engagement between the EA organization and the business units. This feeling of challenge was exacerbated by the divisional structure of the company, which makes direct authority a rare occurrence. Thus, the architects were tasked with finding innovative ways to be influential without authority. The theme 'influence without authority' can be thought of as an effect of group engagement. Once the desired group is engaged and a participating link is formed, it facilitates an exchange of ideas

Fonstad and Robertson (2006) and Fonstad (2006) present a model for IT Engagement. The term engagement is to mean "negotiating, influencing, educating, socializing, and interacting in other ways across organizational levels and functional boundaries to develop greater alignment and coordination throughout the company". An IT engagement model separates the business units and IT, and infers there are three levels of

business and IT: company, business unit, and project management. The crux of an IT Engagement Model is what Fonstad describes as linking mechanisms, because without linking mechanisms there is no engagement or strategic alignment. Different types of linking mechanisms exist in the IT Engagement Model. Project linking mechanisms should exist to connect projects to company and business unit strategies, architecture linking mechanisms to connect projects to architecture transformation efforts, and alignment linking mechanisms to connect IT with the rest of the business. Several high-level examples are given in Fonstad and Robertson (2006): program prioritization and early stage involvement, informal early stage project reviews, architecture exception management, and a 'demand-side CIO team'. Several examples are also provided from the IT Engagement Model at Toyota Marketing. The general IT engagement model from Fonstad and Robertson (2006) is presented below.

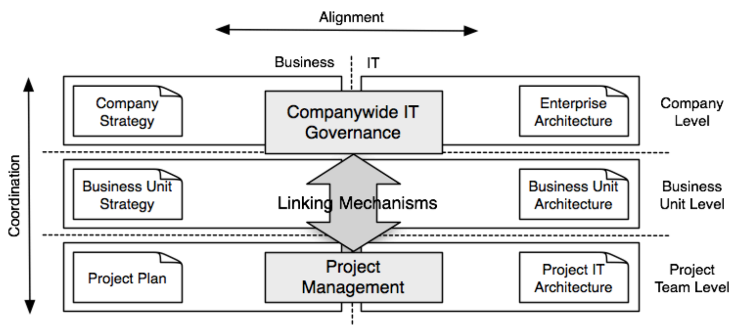

Figure 10: IT Engagement Model (Fonstad and Robertson 2006; Fonstad 2006)

The topic of engagement is clearly important, whether for IT, EA, or any technology based organization. While Fonstad and Robertson (2006) and Fonstad (2006) spend considerable effort explicating the IT Engagement Model, they devote very little effort in explicating how to create linking mechanisms. In the Social Psychology literature, the Group Engagement Model (Tyler and Blader, 2003) refers to understanding what shapes the relationships that people form with groups. The Group Engagement Model identifies three antecedents for group engagement: Procedural Justice, Identity Judgments, and Psychological Engagement. Procedural Justice (Lind and Tyler, 1988) refers to the fairness

and transparency of the processes by which decisions are made. Identity Judgments refers to the degree to which people merge their sense of self with the group (Tyler and Blader, 2000), while Psychological Engagement refers to the merger of self and the group. Also factoring into Identity Judgments are Resource Judgments, where the exchange of material resources is one of the principal reasons one engages with the group. Tyler and Blader's Group Engagement Model is presented below:

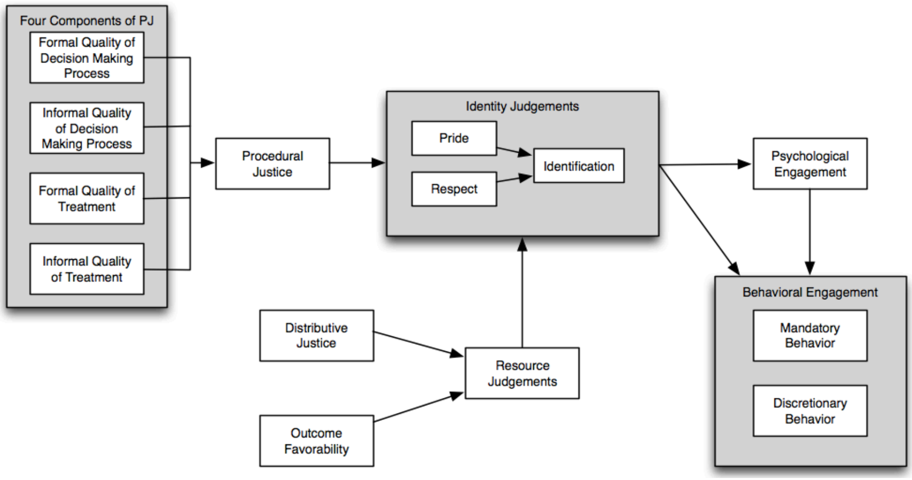

Figure 11: The Group Engagement Model (Tyler and Blader, 2003)

The above model presents the idea of engagement with potential antecedents for linking mechanisms. In Case One, engagement was non-existent as there was no evidence of incorporating outside stakeholders, and thus was absent the above antecedents of Procedural Justice and Identity Judgments. In contrast, the EA organization in Case Two placed central focus on ideas that resemble Procedural Justice by seeking to involve outsiders in the EA design process. The EA's sought to demonstrate how they can be of help to the business units while also including them in EA type conversations such as architectural review boards and architecture insights. In providing assistance, the EA organization and the business units were able to have an exchange of ideas that met the needs of both parties. In addition, as part of what was termed 'reachback', the EA organization has facilitated architecture review boards to review programs, and architecture insight meetings to collaborate on best practices.

Incorporating the outside opinions of the eventual consumers of EA artifacts improves the formal and informal quality of the decision making process in addition to the business unit stakeholder's perception of how they are treated. Case One resulted in a disbandment of the EA organization because governance and compliance were thrust upon those in the business units. The business units felt little procedural justice, as they were not involved in the development of an EA they would later be forced to consume. In Case One, EA was viewed as an 'additional burden', a 'tax', a 'bureaucracy', and a 'dictatorship'. This sharply contrasts with the aspects of Procedural Justice and Identity Judgments found in Case Two. "Respect must come before governance", and must "come from building trust" by "listening" to "understand culture" and have "owners in the business space" so that "business owners can be the ones driving solutions".

This research hypothesizes that the consideration taken to improve Procedural Justice and Identity Judgments in the EA organization has improved psychological and behavioral engagement. The CTO, Principal Architect, and EA Portfolio Manager at SWEA pointed to the fact that "business owners were now approaching the EA team" about participation in architecture and status review boards, and "engaging with EA to build future architecture". Thus, by virtue of the EA organization taking steps to improve the antecedents to engagement, it can be inferred that the level of psychological and behavioral engagement is also improving. This offers insight for both academics and practitioners who wish to perform further research on IS Engagement, or who wish to foster group engagement in developing an EA practice.

Designing an Engagement Model for Enterprise Architecture

This research has revealed themes and explanations that point to *Design as Value* as a key discriminator to advancing the maturity of an EA practice. In large divisional organizations such as SWEA, influence sometimes must be pursued without authority, and at

SWEA, engagement is seen as a key ingredient for an EA organization to be influential. At SWEA, it was felt that EAs should be "process owners", with the business unit consumers of EA owning the data and being an integral part of the decision making process. Similar hypotheses were illustrated in the Fonstad and Robertson (2006) Model for IT Engagement and how to create 'linking mechanisms' between IT and business at varying levels of the organization. Fonstad and Robertson (2006) also provide seven guidelines for good engagement in his example of IT Engagement at Toyota Marketing.

Table 13: Seven Principles for Good Engagement (Fonstad and Robertson, 2006)

Seven Principles for Good Engagement	
1.	Build on a foundation of good IT governance and project management
2.	Make strategic objectives clear, specific, and actionable
3.	Motivate to meet company goals
4.	Define enforcement authority
5.	Emphasize early intervention and prevention
6.	Maintain transparent, regular, two-way communication
7.	Involve the right people

In contrast to (1), the architects at SWEA viewed engagement as a prerequisite to governance. In addition, (4) delineates defining 'enforcement authority'. In contrast, the EA organization at SWEA has no such enforcement authority and must be influential without it. Influence without authority (Cohen & Bradford, 2005) describes an influence model that uses a metaphor of 'currencies' that stands for something that is valued, or what might be offerred to a potential ally in exchange for cooperation. These currencies rarely have anything to do with material goods, but rather qualities that logically relate to *Design as Value* and *Procedural Justice*. Currencies can be inspiration-related, task-related, position-related, relationship-related, or personal. Understanding what currencies will work entails figuring out what is valued by "diagnosing the world of the other person." This model of influence without authority was pervasive throughout the interview data and typifies the underlying

strand of *Design as Value* that was noticably absent in Case One but significant in Case Two. In summary, while the pioneering work of Fonstad and Robertson has been instrumental to EA research, the data collected in both cases does not corroborate with their model. Consequently, this analysis contrasts sharply with Fonstad and Robertson (2006) to offer a newer and more insighful model that principally focuses on linking mechanisms as an antecedent to IT Engagement.

The identification of *Design as Value*, antecedents for group engagement, and Fonstad's IT Engagement Model creates the foundation for a design theory (Levy, 2012; Levy and Hirschheim, 2012). Simon (1996) defined human artifice as the thin interface that exists between an inner environment (the substance and composition of the artifact itself) and the outer environment in which the artifact seeks to adapt. Levy (2012) and Levy and Hirschheim (2012) explicate a design science lens in the Simonian tradition. These works viewed design science through the lens of a Rortyian neopragmatist perspective, and human artifacts through a Bhaskarian Critical Realist perspective. This research proposes an amalgamation of influential ISDS frameworks to offer a new framework for ISDS. The model from Paper 1 is displayed in Figure 12:

In relation to the above model, an IS design theory must first define the artifact and whether it seeks an explanatory or normative contribution. Once the artifact has been defined, an explication of the inner and outer environment becomes key parts of a scientific process and contribution to knowledge. Whereas influential frameworks in ISDS have presented explanatory and normative design science as a dichotomy in the explication of human artifacts, this research employs a critical realist perspective that views explanatory and normative statements as inseparable (Bhaskar, 1975). This research uses the Levy (2012) lens of design to synthesize the data from both cases as well as extant literature to offer a new model for IS engagement.

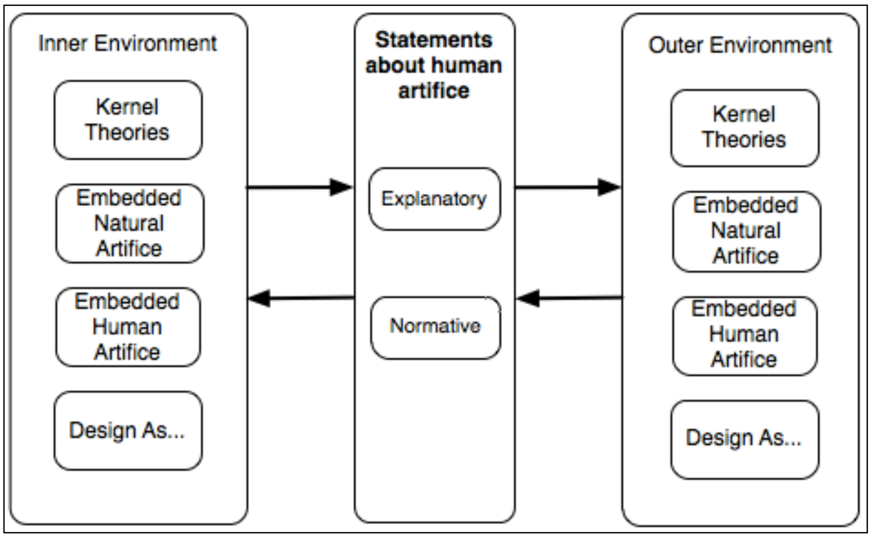

Figure 12: Framework for an Information Systems Design Theory

As previously mentioned, the main issue with the IT Engagement Model is the absence of insight on how linking mechanisms come to be. While examples are provided on how to create policy for linking mechanisms, little is mentioned on how to actually get people engaged. To augment this model, this research uses the Tyler and Blader (2003) antecedents to group engagement. A model is provided in Figure 13 and an explanation is provided below:

The model in Figure 13 contends that Procedural Justice and Identity Judgments act as psychological linking mechanisms for a general model of IS Engagement. Procedural Justice, Identity Judgments, Psychological Engagement, and Behavioral Engagement work in a continuous loop to incrementally engage members from outside the organization. The bi-directional arrows for Procedural Justice and Identity Judgments indicate that both concepts must exist from both the engagement-seeking organization and from those they seek to engage. Both Psychological and Behavioral Engagement must also be bi-directional between both parties. The ordering of arrows from 'inside out' is also important, as Procedural Justice and Identity Judgments precede Psychological and Behavioral Engagement. However, missing from this model is a breakout of the salient design conceptualizations that comprise

the inner environment, and a breakout of the outer environmental artifacts to which an IS Engagement Model must seek to adapt. In Figure 14, the design science lens from Levy (2012) is used to depict the inner and outer environment.

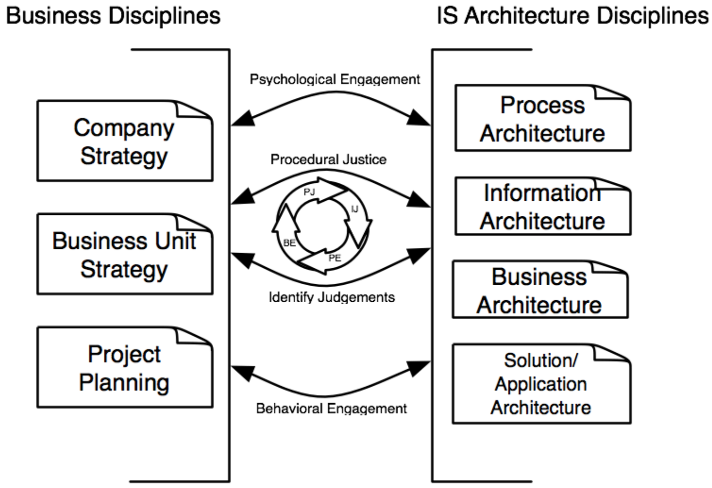

Figure 13: Model of IS Engagement

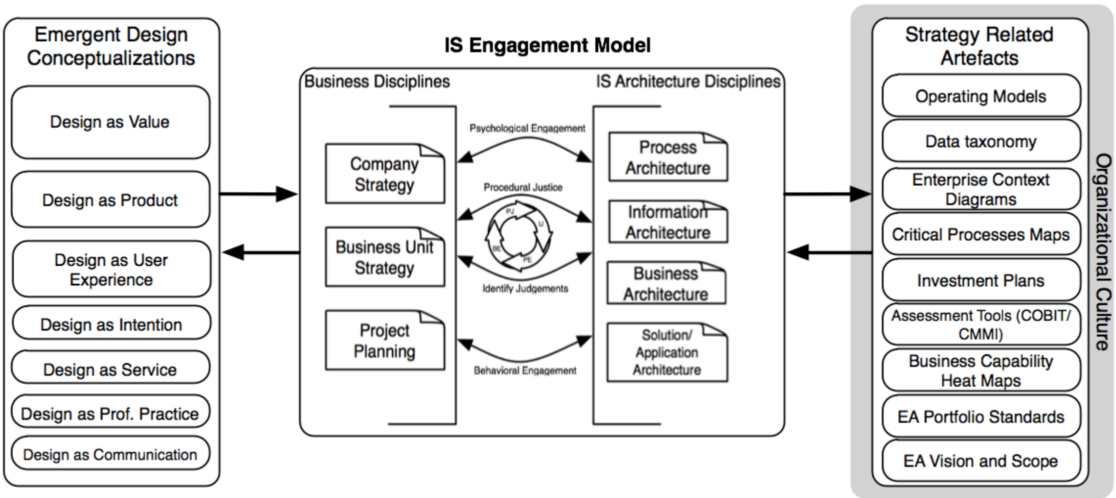

Figure 14: Design Science View of IS Engagement

Figure 14 provides the design science view of an IS Engagement Model. Levy (2012) and Levy and Hirschheim (2012) describe design science as a lens that offers a unique perspective to phenomenological inquiry. Anything can be viewed from a lens, but it is ‘what shows up’ when applying that lens that may offer additional insight. The design view above allows the research to separate out the underlying *Design as* cognitive

conceptualizations that comprise the inner environment, as well as the strategy-related artifacts the EA organization at SWEA was using as a basis for adaptation to the outer environment. With respect to the inner environment, *Design as Value* was the most salient design conceptualization that emerged and is depicted as the largest block. Additional *Design As* conceptualizations were also salient in the data analysis and listed as slightly smaller blocks. The outer environment depicts the guiding cognitive and material artifacts that were established for the EA organization. Artifacts such as operating models, data taxonomy, enterprise context diagrams, critical process maps, business capability heat maps, etc. depict artifacts the EA organization must 'architect to'. These artifacts existed as themes across both cases, however, while Case One gave artifact creation a principal focus, Case Two gave principal focus to softer forms of human artifact as an antecedent. Underlying the outer environment is an understanding of organizational culture, which was an important theme that emerged with respect to *Interpersonal Skills* for the EA organization.

Implications

Very little knowledge is known on how EA actually manifests itself in organizations and how it is used to align with strategy. While EA can be considered a well-defined discipline in terms of its frameworks, there is very little information in terms of how organizations create the link between EA, organizational stakeholders, and organizational strategy. The above synthesis of IS, design science, and social psychology identifies salient themes for the practitioner that can be 'designed' into an EA practice An emerging EA practice must focus considerably on designing value. At SWEA, this meant incorporating business unit stakeholders and the consumers of EA in the EA development process. However, this was difficult as these individuals were not initially willing to participate until they were shown that the EA organization was there to help them rather than impose

additional constraints. This helped build group ownership of EA and is considered a key milestone in the EA organization's maturity at SWEA.

To achieve group ownership and engagement requires understanding the necessary interpersonal skills an EA organization needs and acquiring those resources. These resources are critical to communicating how the EA team will help, espouse a value-based understanding, and bring the right people 'to the table'. The EA organization struggled considerably when it tried to produce EA in isolation; there was zero tractability and significant rejection. In a divisional organization such as SWEA, there is considerably less top-down authority and a governance-heavy approach must first have the approval of the governed, rather than imposing systems of governance and compliance and expecting the governed to follow suit.

The EA organization also identified that EA is considerably more than 'blueprints for technology'. In contrast, an EA organization should consist of information, technology, process, and application architects that work just as much to eliminate redundant business processes as they do developing architecture that gets realized in technological solutions. Re-architecting a business process may be necessary so it can be better suited to be augmented by technology. Fledgling EA organizations should incorporate a variety of architects to help realize the right business, process, information, applications, and technology architecture for strategic alignment. Knowledge about EA should also be made available to those outside the EA organization. An EA practice should take steps to stand up a repository for EA knowledge early on and make it available.

The model created in the between-case analysis dissects the important social aspects to create linking mechanisms for an EA practice in the form of an engagement model. An EA practice is more likely to 'design value' into an organization if those they are seeking to engage feel involved in a quality decision process and are treated fairly in their interactions.

Individuals who feel involved in a quality decision-making process are more likely to have a sense of pride and respect and identify with the mission of the organization. Hence, these individuals tend to exhibit greater levels of engagement and ownership.

Engagement and ownership are also interesting topics as it relates to understanding vehicles for strategic alignment. EA is seen as a vehicle for strategic alignment, however; simply producing EA artifacts does little good for this realization. Engagement models, as they relate to IS topics, is one such area of research. This research is particularly limited in that it only examines two EA organizations within a single company and additional research is needed to incorporate other theories on stakeholder involvement and to add additional perspectives and other organizational contexts. This research is also explicit in its use of design science as a lens to qualify what aspects were important for SWEA to design into their EA practice. The design science worldview offers new perspective as a method of inquiry. With respect to this research, it permitted the identification of an artifact (the IS Engagement Model) to extract salient design conceptualizations and factor them into a single model. Design science is much more than a discipline or workflow. It encompasses a worldview that identifies much of what is investigated in science as human manifestations. This research offers a considerably different approach to design science and can be used as a practical guide for design science research in the Simonian tradition. Rather than a design science being used as a framework or workflow such as the research commonly spawned from Walls et al. (1992), March and Smith (1995), or Hevner et al. (2004) this research applies the design science lens to the initial research design and weaves it through analysis and theory development.

Conclusion

This research presents two distinct cases of an emerging EA practice at a large technology corporation. The EA organization in Case One was rebuffed by the organization,

while Case Two detailed a resurrected EA organization that has sought to learn from past misfortunes. While EA is a well-defined discipline in terms of the available frameworks and guides for the production of EA related artifacts, little is understood as to how to get EA to realize its ultimate goal as a vehicle for strategic alignment. This study utilizes a design science worldview combined with an interpretivist epistemology to allow design conceptualizations and human artifacts to emerge from data. The concept of an engagement model was a key concept the research process revealed as an artifact of an EA practice, and was subsequently used as a vehicle to derive theory. The nature of any research contains limitations. The use of a single company to investigate EA has considerable limitations towards generalization. This research does not seek to generalize, but to develop theory for research and practice based on what was discovered. Additional research is certainly warranted to apply, revise, and extend this theory to different organizational contexts. Future research trajectories should focus on additional vehicles to create linking mechanisms in EA organizations, applying this model to different organizational structures (e.g. Command and Control), quantifying linkage in EA organizations, or developing prescriptive models for fledgling EA organizations.

The notion of an IS Engagement Model can also be extended to other IS-related practices. For example, an organization with the desire to establish an organization centered on Service-Oriented Architecture (SOA), or the transitioning of traditional IS architecture to Cloud Computing would also need a model for IS engagement that would enable the SOA or Cloud Computing organization to gather the high quality data needed to develop the 'to-be' architecture. Thus, a more general model for IS engagement is an important topic for future IS research that should be explored.

In the context of theory augmentation, this research provides contributions to both research and practice that affords practitioners a reference point as to how to design an

emergent EA practice. An EA practice in an organization that seeks engagement both inside and outside the organization should find this research applicable as it seeks to build value. The emergence of this type of model also illustrates the practical and academic contributions that design science can provide, and illustrates a different way to conduct design science research outside the confines of the three influential ISDS frameworks. Rather than design science operating as a surrogate for engineering, as it currently does in much of ISDS research (Levy and Hirschheim, 2012), design science holds the potential to offer unique perspectives for explanatory and prescriptive research to build design knowledge.

PAPER 3: CONSTRUCTING THE DISCIPLINE AND PRACTICE OF ENTERPRISE ARCHITECTURE: LESSONS LEARNED FROM A QUALITATIVE CASE STUDY

> The broad definition is that EA covers all aspects of the architecture domain – Business architecture, process architecture, information architecture, application architecture, and technology architecture. – Business Architect

Introduction

From the academic and practitioner literature, Enterprise Architecture (EA) is widely espoused to be a vehicle for IT-organizational strategic alignment. EA's roots stem from the Clinger-Cohen Act of 1993. This act was designed to improve information resource planning to better align with the strategic mission of US government agencies. Several years after the Clinger-Cohen act was passed, the Federal EA Framework (FEAF) was established to depict IT architecture using a common nomenclature as it relates to business, applications, information, and technology. In turn, several years after FEAF, researchers at MIT produced what is widely considered the doctrine on EA – Enterprise Architecture as Strategy by Ross et al (2006). This book has been integral in providing overarching guidance on how to develop EA, and in particular, demonstrating the potential EA has for strategic impact. Since the publishing of Ross et al (2006), several process-oriented frameworks such as The Open Group Architecture Framework (TOGAF), Zachman, and the EA Center of Excellence (EACOE) have been developed to offer an explicit path to the development of EA artifacts. An architect now has several choices regarding EA frameworks to go about his or her business. However, these frameworks miss an important point. The Clinger-Cohen act, FEAF, Ross et al (2006), and the multitude of frameworks available have been principally about the production of EA artifacts and not about how EA can be used to bridge the gap between architecture and solutions. For example, the TOGAF Architectural Development Methodology (ADM) defines an order to produce artifacts for business, IS, technology, change management architecture, and solution architectures; the Zachman framework

provides a matrix to produce business, systems, and technology models; while FEAF produces reference models categorized by investment performance, business, service components, data, and technology. None of the aforementioned frameworks speak of the strategy or socio-technical aspects to establishing a discipline for EA within an organization. This gives rise to the principal topic of this paper: *How do organizations build a foundation for the practice of EA?*

EA is the product and process of creating a blueprint of the 'as-is' and 'to-be' states of the organization and how to transition from the former to the latter. It is an ever-evolving activity to produce artifacts that translate business vision and strategy into enterprise level change. Enterprise Architects (EAs) are commonly performing the function of gathering data to map complex business processes and drawing on that data to make inferences about linking business and IT structure. The 'enterprise' includes the entire socio-technical system of people, information, technology, and business operations, both internally and externally facing to the organization. EA defines what an organization does, who is responsible for individual functions within the organization and for functions with respect to market value chain. EA must answer the questions of how these functions are performed and how information and IT are leveraged and can be leveraged for organizational improvement. Building an EA takes considerable time and enacting EA entails significant organizational change. Especially important is the proper 'phasing in' of the EA effort and the EA organization. Planning is essential. This includes taking the necessary steps and having the right human resources to achieve stakeholder buy-in. If EA is able to make this link from both a people and IT perspective, it holds the potential to improve the efficiency and effectiveness of the business as it relates to organizational structure, centralize or federate business processes and IT, improve the quality of business information, and properly justify IT expenses.

This paper is motivated by the literature found in both the academic and practitioner domains that have yet to discuss this topic. In one example, Fonstad and Robertson (2006) describe what they refer to as an 'IT Engagement Model' for alignment and coordination issues between business and IT. The paper lists six stakeholder groups at the 'company strategic', 'business unit strategic', and 'project planning levels' on the business side, and 'enterprise architecture', 'business unit architecture', and 'project IT architecture' on the IT side. Moving between these stakeholder groups requires an engagement model that has 'linking mechanisms'. These linking mechanisms take three different forms, 'alignment linkage', 'architecture linkage', and 'business linkage'. While these linking mechanisms are described in Fonstad and Robertson (2006), very little information is given as to how they can be created. This paper utilizes case study research on EA to offer practitioner guidance on how linkage can be created between business and IT organizations in developing an EA practice. An EA practice can be defined as *the community of practitioners within an organization that seeks to establish a common set of governance, methods, and tools to achieve an EA and leverage EA to affect change*. In addition to the aforementioned work of Fonstad and Robertson (2006), a few others describe the act of standing up an EA practice. Van Den Berg and Steenberger (2006) offer guidance in how to build an EA practice with respect to choosing a framework, conducting SWOT analyses, and assessment by a maturity matrix. Barrera et al (2011) describe the EA practice at Intel as a framework that centers on governance, common tool sets, standard definitions, and development methodology. While Markus and Tanis (2000) describes those who implement systems at the enterprise level as organizational-level actors that must understand how to articulate the goals they are trying to achieve, and the factors outside their control, such as the performance of vendors and the reactions of customers and competitors. This research differs from Van Den Berg and Steenberger (2006) by depicting an organizational context that has chosen to integrate the EA

organization before an EA framework has been adopted. It also differs from Barrera et al (2011) as it depicts an EA organization that has chosen to espouse the mission of EA before it chooses to leverage governance, and lastly, this research echoes the call by Markus and Tanis (2000) on the importance of evangelizing the EA organization's goals when establishing an EA practice.

This article takes the position that an EA practice must be reasonably established in an organization before it can achieve strategic impact. This notion of an established EA practice is something that looks to be ignored in the extant literature. While the academic and practitioner literature is flush with articles and books that espouse the positive impacts to business strategy, far fewer articles illustrate what EAs actually do to design the 'EA organization'. This is especially important for organizations wishing to start an EA practice. This article bridges the aforementioned divide by offering a framework for organizations wishing to establish an EA practice. This framework is derived from a large qualitative case study performed on an EA organization. This article tells the story of the EA organization, identifies pitfalls an EA organization may encounter, highlights the critical characteristics needed to develop an EA organization, and provides a framework to guide EA practitioners. This article also looks at the use of EA frameworks. Frameworks such as TOGAF, Zachman, FEAF, and EACOE are intended to provide definitive guidance for EA, but while these frameworks offer a methodology and workflow to produce artifacts, little is mentioned regarding the cultural and cognitive shifts required to establish an EA organization. The case study used in this article revealed string opinions about when frameworks should be employed. It is believed that organizations must reach a certain level of maturity before frameworks become tractable for use.

This essay proceeds as follows: the following section provides an overview of the discipline and practice of EA at (pseudonym) SWEA and based on the SWEA case study. In

the sections that follow, three dimensions for developing an EA practice are described and these dimensions are brought together to offer a framework for establishing an EA practice. Lastly, the final section offers additional conclusions and recommendations for fledgling EA organizations.

Enterprise Architecture at SWEA

The story of EA at SWEA presents a fascinating twist. On the outside, SWEA appears as a single organization producing a multitude of software products and online goods. On the inside, SWEA is seen as the corporate umbrella in which 20+ organizations reside. The members of the current EA organization at SWEA have a unique horizontal view across the enterprise and see SWEA as many different standalone businesses with very little corporate reachback. This was the leadership style of their former founder and CEO. The CEO pushed near complete autonomy down to the business unit level as it was thought to maximize innovation. For nearly 20 years, this approach worked as SWEA built revolutionary products for many different industries and expanded considerably. However, it is envisaged by those in the organization that the outyears hold a variety of competitive threats. The software industry is a rapidly changing marketplace. Competition, both large and small, is now armed with near ubiquitous levels of cloud computing infrastructure and have begun to offer cloud services that are accessible from a variety of desktop, mobile, and web applications. In many cases, these services offer businesses new perspectives on reducing corporate IT costs. For example, data, applications, and technology can now be offloaded to external providers, and software updates can be pushed from the service vendors themselves to desktop, mobile, and web platforms. With near ubiquitous amounts of cloud infrastructure supplied by organizations such as Amazon (Web Services), Rackspace, Voxel, Heroku, and Google, the software industry is undergoing a paradigm shift. This cloud-based paradigm is of considerable threat to an organization such as SWEA. While SWEA hosts a

small collection of cloud-based applications, they have yet to truly embrace the 'cloud services model'.

It is envisaged the cloud services model offers new and lucrative streams of revenue for SWEA. Through online marketplaces, services such as Google Apps and Force.com offers hundreds of add-on services for minimal cost. For example, from the Google Apps marketplace one can instantly add project management services such as Smartsheet and Gantter for a monthly subscription fee. SWEA has not yet adopted this model and instead relies on sales of packaged software. A move to a cloud based service model stands to offer near ubiquitous access to users from a variety of desktop, mobile, and web applications, and perhaps most importantly, it offers a single customer experience that lowers barriers to entry for customers to move from application-to-application.

A single customer experience is one of the key ingredients to a successful cloud services model and is the key impetus behind EA at SWEA. A single customer experience makes it easier for other service vendors to integrate and upsell additional services and for users to seamlessly move between these applications. Using this model, customers can easily access services using a single identity and have a similar user experience between the applications. User specific data is also centrally located and easily accessed between applications. The applications themselves, which could also be considered 'service interfaces', offer a similar user experience between the aforementioned desktop, mobile, and web platforms. In turn, with data more centralized to the applications, a service vendor can leverage additional revenue streams, such as targeted marketing based on user behavior.

A horizontal view of the enterprise at SWEA is what is needed to realize a single customer experience. The EA organization at SWEA has a formidable challenge. It must architect the products and processes to move a mid-sized geographically dispersed organization to a cloud-based data, applications, business, and technology infrastructure.

Moreover, it must do so in a manner that leverages the cloud as a foundation for execution. This is critical for SWEA to remain competitive and establish itself as the exemplar in the software industry.

EA at SWEA: Past, Present, and Future

The challenges described above are anything but new to the SWEA EA organization. These challenges were realized over six years ago when the SWEA IT organization (SWIT) first attempted EA. Unfortunately, SWIT's initial EA effort ended quite precipitously. While opinions differ on exactly why it ended, it was generally agreed upon that EA was perceived as a governance and compliance instrument. The architects were perceived as 'ivory tower' and as 'paper tigers'. SWEA's autonomous culture made it near impossible to instantiate an EA organization that was governance-heavy. The EA organization was also perceived as never taking the time to evangelize the value of EA to the SWEA business units. This gave them little reason to pay attention. Governance was equated to 'compliance' and 'dictatorship' and noisily rejected. This led to the near disbandment of the EA organization.

Of the few who remained, several important lessons were learned and embedded into the mantra of the current state of affairs: An EA organization must be about much more than IT governance, it must be about being influential without being perceived as authority. An architect must have the interpersonal skills to walk this fine line. In addition, an architect must also have the interpersonal skills and political will to sell how they intend to provide demonstrable value. In the current state of affairs, architects are both dispatched to business-units and work with a central EA organization. Architects that are dispatched to business units must be explicit in showing how they can help, and even lend themselves out as free resources. In turn, the EA organization also believes that it must be much more than a coffer of technology insight. It must be an organization with a formal engagement model to offer a variety of architecture services as it relates to business, application, information, and

technology architecture to the organization. This requires tacit, in-depth knowledge of technology, data, and business processes.

The current EA organization takes a very different tact than the previously governance-heavy incarnation. Rather than emanating 'thou shalt' the EA organization chooses to be the organization that leads by example. Architects actively work with the businesses to realize architecture that meets both the individual business objectives and builds a foundation for execution at the enterprise level. The architects have tacit knowledge of what tools are the right tools to solve enterprise-class problems and have the liberty to use whatever tool is necessary to get the job done and provide demonstrable value for the organization. The architects are also extremely affable. This makes it easier for the EA organization as a whole to work with the individual business units and provide some central EA functions such as conducting architectural review boards, architecture standards groups, architecture insight sessions, and working groups that invites architectural and executive leadership from across the organization. This social affability also makes it much easier for the EA organization to evangelize EA value to executive leadership. Getting those across the organization to understand EA value is critical to being afforded access to the data needed to produce EA artifacts.

The current EA organization has also chosen to temporarily eschew the use of any artifact set or EA framework. This potentially makes the EA organization seem relatively immature. The EA organization has no prescribed framework, nor does it have a standard suite of artifacts, or even a single knowledge repository it is mandated to use. While it anticipates gravitation towards a framework such as TOGAF, the EA organization has decided there are a few necessary pre-requisites that must be met before a framework can be adopted. For example: (1) An organization-wide engagement model between the EA organization and the rest of the corporation must be in place, and (2) there must be a single

taxonomy for the EA organization. Without these two qualities, the EA organization believes it would be extremely difficult to consistently gather the high quality data needed for EA artifacts and create repeatable architectural practices. The EA organization believes there is still considerable salesmanship warranted at a person-to-person level before the architectural process has the proverbial 'legs to stand on' to produce a consistent set of processes and products.

From the case study at SWEA, three dimensions are revealed with respect to the qualities necessary to establish an EA organization. These dimensions are summarized as follows: the *organizational design* of an EA organization, the *interpersonal skills* required for membership in an EA organization, and the *core artifacts* that are critical to an EA practice. The sections below elaborate these three dimensions and coordinate them to provide a framework for EA practitioners.

Critical Dimensions for Developing an EA Practice

The case of EA at SWEA reveals three key dimensions needed within an organization to set up an EA practice. The three dimensions mentioned above, *organizational design, interpersonal skills,* and *core artifacts* each contain several components to comprise the dimension. Each dimension also contains a critical underlying behavioral component that provides linkage between each dimension. The sections below describe each of these dimensions.

EA Organizational Design

An EA organization should be comprised of architects from a variety or architectural practices. The EA organization at SWEA principally consists of information, business, solution, and enterprise architects. The architects reside both within the core EA organization and within business units. Examples of business units at SWEA include sales and marketing,

mergers and acquisitions, and financial services. Ironically, the EA organization at SWEA contains very few employees that are officially titled 'EA'. The sections below profile each of the aforementioned architect positions and their tasking.

Information Architects

The Information Architects at SWEA have the task of developing and maintaining a "master data model" for the entire corporation. One of envisaged functions of the master data model is to bridge the data gaps necessary to realize single customer identification. SWEA's different business units have had significant difficulty unifying the customer experience between products. With conventional software applications, this may not be terribly noticeable, however, when moving between applications in the cloud, this gap becomes significantly more pronounced. The Information Architects must be particularly concerned with how data will manifest itself to the end user. With enterprise level tasks such as creating a single customer experience, the information architecture at SWEA stands to become an integral part of its cloud-based offerings. The "master data model" defines a taxonomy and management structure to govern data definitions across the enterprise. While changing application architecture can be considered relatively 'cheap', changing the data structure is significantly more time and resource expensive. Thus, it is critical the Information Architects capture all necessary definitions. The capture process requires buy-in and open interaction between the Information Architects and the individual businesses to ensure the quality of information received is current and complete. The issue of assuring data quality holds true for Business Architects and Solution Architects alike.

Business Architects

A Business Architect has a much more process-oriented focus to complement the historically techno-centric view of an EA organization. An EA effort must be about much more than technology in the 1-way interaction of mapping strategy to capabilities and

capabilities to processes. It must be about process optimization to ensure efficient employment of technology. Traditionally, the Business Architect's responsibility is process-optimization within the business and aligning strategy down to technical components. They identify the strategies of the organization, how they morph into capabilities, and how to implement them in terms of people, process, technology, and information. Business Architects spend considerable amounts of time mapping out the critical processes at SWEA, specifically, those that span the individual businesses to identify business segments. They also spend considerable time identifying deliverables that need to be supplied to various stakeholders. This includes both internal business stakeholders and external partners.

The EA organization, individual businesses, and business segments all have Business Architects, each with their own unique methodology. Many times these methods are ad-hoc and dependent on the business problem and ranges from strategic development, process documentation, and analysis. In contrast, the Business Architects within the core EA organization have developed a much crisper definition of business architecture methodology with respect to policies, process, and training. The business architects in the EA organization maintain the only enterprise-wide governed taxonomy of critical business capabilities at SWEA and have leveraged this to develop a core set of business capabilities that cover the entire SWEA enterprise. The business architects feel they have a specific mission to realize greater business value. The end-to-end business designs they create are strategically driven. They are aligned to investment plans for the corporation and aligned to execution timelines. The designs they create must be prescriptive and detailed so they can be executed upon. One of the methodologies they use to align business designs with strategy is with Kaplan-Norton Strategy maps. Many of the business architects also come from consulting and know what works across a variety of organizations. The Kaplan-Norton balanced scorecard is the preferred methodology to map strategy to capabilities and capabilities to business processes.

Many times this is done using capability ‘heat maps’. Areas in the organization that have low levels of maturity but are highly strategically aligned are of peak interest. When these areas are discovered, it is flagged as an area of work to create role clarity around various levels of execution, and subsequently, how to train people for these roles. For example, if solution managers, service managers, and development managers all engage in the practice of collecting requirements the organization should not have three different training programs on requirements collection for each of them. The business architects provide the business a 360-degree view of EA. Rather than simply taking strategy and required capabilities as-is, business architects work to architect the business to streamline strategically aligned technology development. Before business architects were a part of the EA organization, there were copious amounts of "shelfware" regarding what processes could be made more efficient, no methods and training programs, and nobody on-board to make anything actionable. How to make EA actionable is what separates the SWEA EA effort and what makes this EA case study unique. To quote one business architect, ”until you can pull the view and drive recommendations out into the organization to build solutions, what we produce is shelfware”.

Solution Architects

The Solution Architects within the EA organization drive the testing of technology applications to be deployed across the enterprise. Solution Architects within the business segments make the link between EA and engineering, while Solution Architects within the core EA organization are principally responsible for developing technology-related standards across the enterprise. Solution architects also work within the core EA organization to incubate new technologies for use across the enterprise and develop innovative ideas for technology architectures that will better support strategic alignment. For example, technologies such as an enterprise service bus can be made into a common platform for use

across the enterprise. The Solution Architect's job is to abstract out what those common platforms can be based on common requirements throughout the business. The Solution Architects both within the EA organization and across the business segments represent the first line of defense in testing new products that may be applicable for the enterprise. By attempting to adopt technologies for such a federated business model, it stands to provide valuable feedback to the business units. As members of the EA organization, the Solution Architects know what product capabilities that are needed and are able to map technology to the needs of the business.

Principal Enterprise Architects

The role of a Principal EA can be thought of as an architect that works at the seams between the Information, Business, and Solution Architects to guide enterprise level transformation. The intent of EA is inevitably to transform organizations. The Principal EAs are the architects charged with guiding this transformation and are ultimately responsible for aligning business processes. In addition, the Principal EAs are also responsible for establishing the overarching function of business process management for the EA organization. This subsequently guides the management functions for information, business, and technology architecture.

Summary

Organizational design for an EA organization must consist of architects that possess a range of experience in information, technology, and business architecture. The Information Architects represent the body of knowledge as it relates to key data issues across the organization and are responsible for promoting data to an enterprise level. The Business Architects are responsible for identifying key components across the organization that needs business process improvement. This serves to clarify the way strategies map to capabilities, and how capabilities map to business processes. The Solution Architects represent the

standards body for enterprise level technology by incubating technology and determining whether the technology meets enterprise level requirements. The Segment Architects provide the above three functions at the level of business process segments and provide much needed reachback to the core EA organization. Lastly, the Principal EAs serve as the functional leaders within the EA organization and are charged with developing EA as a transformative entity. Figure 15 below illustrates the relationship between Information Architects, Business Architects, Solution Architects, and Enterprise Architects that exist at both the segment/business-unit level and the core EA organization.

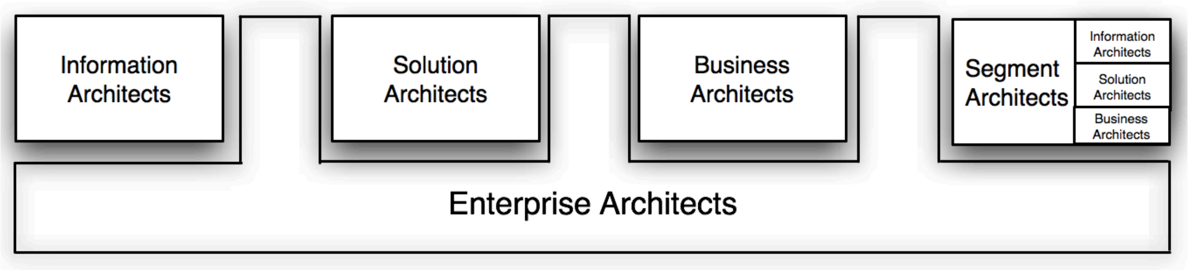

Figure 15: Organizational Design Dimension

Interpersonal Skills for the EA

The architects at SWEA many times spoke of what it takes to 'do' EA and what it takes to be an architect in general. The architect has the privileged vantage point of having a horizontal view across the enterprise. Given this, the architect many times has the most knowledge in the room as to what it is going to take to promote business, information, applications, and technology infrastructure to an enterprise level. In contrast, to be influential an architect must possess the social wherewithal to temper his opinions in favor of bringing compromise and consensus. This also helps forge relationships since the ideas are the ideas of a group of organizational leaders, architects, and engineers within the individual business units. Thus, a key quality an architect must possess is to be able to build relationships across the business within and around a consensus of ideas. In addition, this very same attribute migrates the EA away from being perceived as trying to be an authority figure and more

towards being influential. This is the second critical attribute for an architect: being able to influence without having direct authority. An architect must be able to relate to organizational leaders, architects, and engineers in their respective domains. To be an effective architect in a highly federated organization such as SWEA, an architect must possess deep-level knowledge of the business units they are working with. This was stressed by many of the architects.

The combination of the above attributes must be leveraged to disseminate the value of EA to a variety of stakeholders, architects, and engineers throughout an organization. The architects at SWEA, in particular the Principal EAs, Chief EA, and CTO spoke considerably about an architect's ability to explain EA at the strategic, operational, and technical levels based on their audience. An architect must be able to 'sell the value proposition'. The architects considered this a key interpersonal skill to growing an EA practice.

Underlying each of the aforementioned interpersonal skills is a value-based understanding of EA as it relates to a specific organization, and being able to articulate that value. Getting organizational stakeholders to understand the value in EA is critical to procuring future EA funding. It also moves the EA practice from simply being a service that may provide governance or answer questions to an organization that is proactive in identifying enterprise wide gaps as they relate to strategic initiatives. The EA must have an end-to-end view of the enterprise and understand the end-state of a 'planful' transformation of the enterprise. The ability to 'design value' into an EA practice and for organizational leadership, architects, and engineers to easily understand the value of EA was one of the most recurrent themes identified throughout the case study. Figure 16 below illustrates the interpersonal skills dimension.

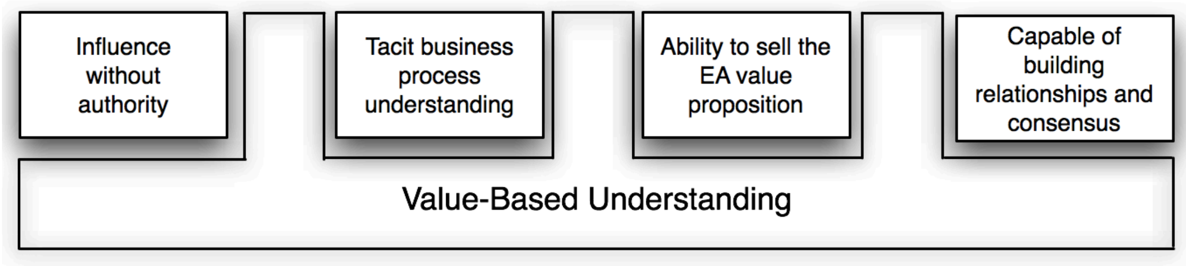

Figure 16: Interpersonal Skills Dimension

Core Artifacts for an EA Practice

One of the major goals of an EA practice is to produce repeatable sets of EA artifacts. This is usually done with the assistance of an EA framework. However, there are also a few prerequisites that must be established before an EA framework can be reasonably employed. The first artifact is enterprise taxonomy. Taxonomy is an agreement between the EA organization and the consumers of EA on terminology. This terminology must be agreed upon for all varieties of architecture (e.g., business, information, technology, etc.). The lack of an enterprise-wide taxonomy at SWEA was targeted as a principal reason for the organization not officially adopting an EA framework. The architects at SWEA firmly believed that a framework is destined to fail if there is not an agreed upon set of definitions. Having an agreed upon vocabulary is critical as a foundation to build repeatable processes and products.

In addition to enterprise-wide taxonomy, the EA organization must have a clear picture of an operating model for the strategic interests of the organization. Corporate level strategy must be mapped to capabilities, and those capabilities must be mapped to business processes. The business architects in the EA organization were charged with producing these artifacts and suggested the use of Kaplan-Norton strategy maps. In line with Ross et al (2006), the operating model feeds EA. Thus, it is critical that an operating model provides these mappings so that an EA organization understands at a defined process-level what information it has to promote to an enterprise class solution.

Also critical to establishing an EA practice is to have an enterprise level view of information architecture. While many of the EA frameworks capture this at some level, the EA organization felt it imperative to have an enterprise level model of information as a key first step. Producing an enterprise model of information architecture also goes hand-in-hand with producing taxonomy as in conjunction with agreed upon vocabulary is an agreed upon set of data definitions. In addition, there must be an agreed upon repository for taxonomy and any other artifacts. Within an organization such as SWEA, an EA knowledge repository and its artifacts must be easily discoverable by anyone in the enterprise or else it stands little chance of use. Thus, another critical characteristic in this dimension is to define a structure for an EA body of knowledge. This body of knowledge houses the seminal artifacts described above, as well as a structure for the discoverability of all future artifacts.

Underlying these core artifacts is an engagement model between the EA organization and the rest of the organization. An engagement model can be defined as a system of governance mechanisms that bring together key stakeholders to ensure projects achieve both business level and enterprise-wide strategic objectives. An engagement model for EA consists of three components. The first component defines how the EA practice itself is to be governed. The second component defines deliverables and checkpoints to hold both the EA organization and the individual businesses accountable for providing the necessary data points to develop accurate and complete EA artifacts, and the third component links EA to the activities in the individual businesses at the project level. The architects at SWEA much desired an engagement model that would be endorsed by corporate level leadership. Without an engagement model, acquisition of data to produce enterprise level knowledge remains both a challenging and personal activity with little repeatability. Figure 17 illustrates the core artifacts necessary to establish an EA practice.

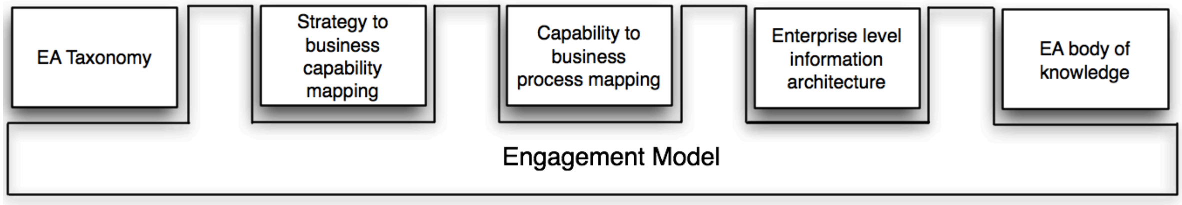

Figure 17: Core Artifacts Dimension

Higher-level organizational leadership must take steps to enable an EA practice with the above dimensions. This leadership must support the EA organizational design, the hiring of EAs with the right interpersonal skills, and an EA practice empowered to produce a core suite of artifacts in an attempt to adopt an industry-wide framework to make processes repeatable and solve enterprise class problems. The following sections outline the leadership structure of the SWIT division that plays host to SWEA's EA organization.

Leadership Profiles

The EA organization at SWEA combines the disciplines of business, information, process, application, and technology architecture to operate under the auspices of EA within the SWIT organization. The EA group has six people in leadership roles, including the CTO. The following section briefly profiles the leadership within and around the EA practice at SWEA.

The leadership in the EA organization at SWEA is heavily invested in strategic initiatives and helping the organization to meet those goals through the enablement of technology. While the EA leadership has considerable discussions about technology, there is equal discussion about an understanding of the culture, the business, and business strategy. To EA leadership, EA embodies just as much organizational design as it does IT. To some, the best architects come from the non-technology related parts of the business. This section profiles the core leadership body: The CTO, Chief EA, and EA Manager.

The Chief Technology Officer (CTO)

At the top of the food chain for SWIT is the CTO. The CTO represents the c-level executive leadership. The CTO's overarching responsibility is to leverage human capital to achieve organizational objectives. For EA, this means building an investment strategy so that corporate-level stakeholders will continue to invest in EA initiatives. For the CTO to be able to sell an investment strategy he must sidestep the inherent ambiguities with EA in favor of metrics to denote measureable accomplishments. Many times an EA initiative is multi-year in nature; thus, metrics must be appropriately calculated on a fiscal year basis to measure the organization's accomplishments. This affords the CTO metrics to effectively sell EA success that is critical to the organization's survival, especially given the misfortunes of the EA organization's previous incarnation.

So how does the CTO envisage a mature EA can be realized? To him, the first step is an agreement on key terms and data definitions through enterprise taxonomy. Solution architects need clarity, and with an IT background, this is what the CTO believes they need to actually need to do their job effectively. Taxonomy provides the precision of communications needed for successful engineering activity. This is seen as one of the most effective artifacts an EA organization can provide. The development of a taxonomy pre-dates engineering and most importantly pre-dates the selection of an EA framework. If this can be done; if the CTO can facilitate enough agreement to generate an enterprise-level taxonomy and evangelize metrics that promote the successes of the EA organization that map to strategic objectives, it solidifies SWEA's IT investment strategy in EA and moves the corporation one step closer to its strategic goals.

The Lead EA

The Lead EA at SWEA is charged with building the right type of architecture and making it actionable so that it is used to bridge impediments and forge ahead on strategic

initiatives. The Lead EA's focus is highly targeted at making the necessary cultural changes throughout the corporation so the individual businesses understand the additional burden to produce solutions that have reachback to the enterprise. The Lead EA sees his job as the leader in providing forward thinking about the value of EA and bringing the EA organization towards an engagement model that is proactive in identifying organizational gaps that directly correlate to strategic initiatives and move the needle for the organization. This is what he refers to as moving from EA 1.0 to EA 2.0.

The Lead EA also believes the EA organization is far too siloed. This is partly because of the lack of more business-oriented diversity, partly because the EA organization is embedded within the IT organization, and partly because segment architects are deployed exclusively to different process segments. Missing from EA efforts are 'enterprise unifying goals'. Historically, an EA will be focused on business objective 'A', where another is focused on 'B' and another focused on 'C' with little cross-pollination. With enterprise unifying goals, segment architects are working towards common objectives. This dynamic has begun to change, as there are now linkages between artifacts, business objectives, and business segments. There is also an inextricable linkage between systems that reside inside business segments and how the architects within the core organization are working with architects in the business units to bridge architectures. Getting the EA organization to think more as business and strategy architects is what the Lead EA sees as his overarching mission. This goes far beyond technology and directly into cultural change both within the EA organization, across business segments, and amongst the major stakeholders in the organization.

The EA Manager

Organizations such as SWEA usually possess exemplar employees that are well known across the industry. The EA organization as one, and when issues across the EA

community are debated, he is usually at the forefront of the debate. His focus for SWIT and the EA organization is geared towards six key components that are all inextricably linked to how EA can best provide value to the rest of the corporation. These six components are Value Proposition, Engagement Model, Clearly defining the Service of EA, Acquisition of Stakeholder Buy-in, Holding yourself (as an EA) accountable, and developing a training program. To the EA Manager, setting up an EA practice is also like creating a start-up within a business. The idea is nebulous, there are no funding categories or colors of money directly applicable to this type of work, there is no incentive structure for the 'partners' (so you have to create one), and most importantly, there is no implicit understanding as to how an EA practice equates to value. The EA Manager represents the voice of the EA organization, and consequently, when you are the voice for an EA organization such as SWEA, it is possible to end up with a lot of lessons learned that also stand to make you a voice for the EA community.

He is also one of the community leaders in providing viewpoints on EA. He believes that one way of looking at EA is the set of artifacts that we produce. However, just developing a set of artifacts does not make it EA. While that knowledgebase is very valuable, it is the business practice of people going out and collecting information to fill that knowledgebase and then producing insight because of it that people in the organization know how to leverage that makes EA valuable. This is where an EA must accept the role of a change agent. An EA alone cannot bear the burden of designing and developing every artifact that can have use at the enterprise level. This goes for documentation and technology development alike. The insight developed by an EA impacts a many different business processes and practices within and across the organization, so to make EA effective he believes you have to change the business processes, the business practices, and incrementally, change the business culture. What it currently does versus what it could do in the future is

the boundary where he sits. The EA Manager truly believes it is about the people and cultural change within an organization. An EA must clearly align people as well as technology and articulate how solution engineers should be using the artifacts an EA organization produces. In addition, an EA must listen first so that he can be hands-on in helping them understand how. This is the challenge he believes is the biggest problem for the individual EA – they *think* they know the answers, and though they might, they must exhibit restraint so that they can listen and internalize what their customers are telling them. This is why the EA Manager has been successful in his EA efforts for the business units within SWEA and why the EA organization is in the position they are now – a position that is at the cusp of moving to a cloud-based model and single customer experience.

Recommendations for Establishing an EA Practice

The above dimensions of organizational design, interpersonal skills, and core artifacts can be brought together to describe and overarching framework for beginning a practice of EA in an organization. These are critical first steps an organization can take. This ensures they have the right design for their EA organization, they are selecting employees with the right set of interpersonal skills, and they are generating the proper set of artifacts. These artifacts can supply a fledgling EA practice with a core set of data and core body of knowledge to proceed with making future process and product repeatable with an EA framework.

An EA practice must embody an organizational design that encompasses the full range of data, applications, information, and technology architecture. In addition, an EA practice might consider it useful to have a central EA organization, as well as architects that are dispatched to the segments of the business for extended periods. In the case of SWEA, a segment architect is nearly doing everything an EA in the central organization might be doing, except at the segment level as opposed to the enterprise. In a smaller organization, a

segment architect could still provide considerable value, as they become the point of contact for having an in-depth knowledge of operations within that segment. In both cases, the segment architect provides reachback to the central EA organization ensuring that business level IT architecture is designed with the enterprise in-mind.

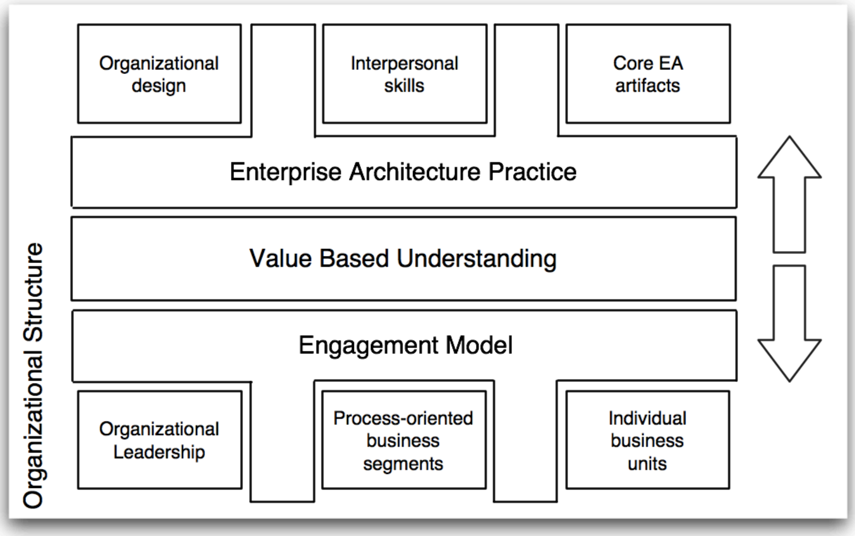

Figure 18: A Framework for EA Practice

The EA organization must also be designed with the interpersonal skills of the employees in-mind. If possible, the seminal members of an EA practice should have the intellectual curiosity needed to engage with the business to get a deep level of understanding of business processes. EAs must be prepared to accept the challenge of building long-term relationships with the business and be particularly careful to not be perceived as an authority figure. Instead, the EA must be both humble but influential in showing how they can help, actually helping, and helping the group reach consensus on technology decisions that directly correlate to the capabilities and processes identified in an operating model. Collectively, this creates a tacit value-based understanding as to what the contribution of EA means to those in the rest of the business, and in return, lowers the barriers to collecting the data needed to build core EA artifacts.

One of the most critical artifacts to establish for a fledgling EA organization is a formal engagement model. It is also critical the EA practice does not seek to do this too soon, else they run the risk of being perceived as an authoritative entity attempting to impose additional structure. The definition of an engagement model implies some form of governance and due care must be taken to ensure this is not perceived as an additional imposition. Ideally, this is one of the last of the dimensions to be established in beginning an EA practice. SWEA has been working on building their EA practice for over six years. They have learned some valuable lessons in trying to impose too much governance too early. An engagement model should not be established, or even discussed, until individuals in the individual business units are actively and autonomously working towards an enterprise class of needs.

Conclusions

This article offers practitioner guidance from a large case study in an EA organization. With a complex and federated organizational structure, the EA organization at SWEA provides valuable lessons for anyone wishing to establish an EA practice. The EA organization at SWEA is extremely holistic in that they perceive their own value to be about developing architecture that actually drives solutions that meet strategic objectives. Rather than their principal objective being the development of models and diagrams, the architects at SWEA are driven to demonstrate value and drive architecture towards solutions. The above recommendations for an EA framework are based on the implicit assumption that EA organization must be about much more than the production of artifacts. They must be about the production of artifacts that are actionable and driven to solution architecture and engineering that provides valuable technology for the business. SWEA finds itself in tight competition in the software industry. However, with unparalleled expertise and an

organization driven to build architecture for the future, the EA organization is confident they will achieve their strategic objectives.

CONCLUSION

Through many different avenues, the IS field has witnessed several different research streams that frame how organizations pursue strategic alignment. Previous to the widespread use of the term 'strategic alignment', IS topics such as Participatory Systems Design was envisaged as a way to get IT and end-users aligned so that these users were better equipped with technology to support the needs of the business. In addition, ERP could be seen as another vehicle to support strategic alignment. Research on ERP naturally takes on a technological focus as it explicitly deals with the implementation of systems. ERP systems are viewed as an organizations strategic computing platform (Hong and Kim, 2002) as it serves to unite data and applications for use across an organization. EA represents the next iteration in the pursuit of strategic alignment. EA acts as an explicit buffer to connect business strategy and IT implementation.

Strategic alignment is unequivocally an important topic for IS research and one of the top challenges faced by CIOs (Chan et al., 1997; Bartholomew and Caldwell, 1995). EA is simply the next such vehicle to go about achieving it. It is possible that EA could be considered just another management fashion (Abrahamson, 1996) and that industry groups such as the Open Group and Object Management Group are the fashion setters. Even if this is the consensus within the IS research community, it does not make a topic such as EA any less important for scientific enquiry. Regardless if a topic is considered a fad, if IS organizations are spending considerable effort and resources on new initiatives such as EA, cloud computing, outsourcing, etc. it is important that we as researchers seek to generalize to theory and/or seek to move research towards useful generalizations to advance the state of the art in both academia and practice.

This research provides a contribution to knowledge on the topic of EA and offers implications for strategic alignment. Little is currently understood about how EA

organizations actually function, as well as the activities undertaken to develop an EA practice. Through the case studies presented in Paper 2, it was understood that an EA organization must engage in the practice of demonstrating the value of EA to others in the organization. This was seen as key to creating a collaborative environment with the business. Developing EA artifacts requires enormous quantity and quality of data. Creating a collaborative environment is envisaged as a key factor in being able to obtain this data, create artifacts that are timely and accurate, and increase the likelihood that EA artifacts will be leveraged to develop solutions for the business. Case One in Paper 2 taught us that an EA organization wishing to establish itself with a governance heavy approach could face considerable backlash in a highly decentralized organization. Rather than emphasize governance, a fledgling EA organization must work to establish the aforementioned collaborative environment. This is what is referred to in Paper 2 the 'engagement model'.

The informants envisaged the concept of an engagement model as the culmination of establishing a collaborative environment with the business. Given the informants emphasis on this topic, it was keyed upon for theoretical development. An environment ripe for IS engagement must make those in the business feel they have a right to participate in the decision making process and that they are going to be treated well in doing so – a concept identified by Tyler and Blader (2003) as 'procedural justice'. In addition, the external stakeholders who represent potential participants in the EA organization must feel they can merge their sense of self with the group – a concept referred to as 'identity judgments'. Both of these factors contribute to individuals feeling psychologically engaged and exhibiting behaviors that indicate they are engaged with the group. The IS Engagement Model developed in Paper 2 represents one of the principal contributions of this dissertation, and a contribution to research on EA and strategic alignment.

While the notion of IS Engagement could be considered the main 'plot' in Paper 2, there were also several subplots that could be considered useful contributions. For example, the underlying struggle of the EA group being embedded within the IT organization was seen as a potential limiting factor. There was also considerable emphasis on identifying the right interpersonal skills that an architect should possess. With such large amounts of contextually rich data in a qualitative study, these subplots represent streams of research that could also be explored. However, it was identification of the concept of IS Engagement that represents a significant contribution to research on EA and even research on strategic alignment. In reference to Henderson and Venkatraman (1993), current research on strategic alignment has yet to explore *how* linkage is created, nor has it explored the concept of 'linking mechanisms' found in Fonstad and Robertson (2006). An understating of how companies have either successfully or unsuccessfully attempted to create 'linkage' or 'linking mechanisms' may very well hold the keys to better understanding both how EA manifests itself in organizations, as well as how strategic alignment manifests itself in organizations. Because of this dissertation, significant amounts of research should be undertaken to explore the concept of linkage.

The dissertation also represents a more theoretical contribution from the work performed in Paper 1. ISDS has been considerably centered on a small triumvirate of research frameworks that have served to possibly limit ISDS research. While the research of Walls et al. (1992), March and Smith (1995), and Hevner et al. (2004) should be applauded for bring design science to IS research, it is also time for it to be evolved to incorporate the full definitions of design and design science. In researching the intentions of Herbert Simon as well as exploring design science outside the IS discipline, it was learned that ISDS leverages extant literature on design science in an overly techno-centric and positivist manner. The full spectrum of the design science discipline should be brought into IS to

include many different forms of human artifacts that can be investigated. Paper 1 represents a theoretical contribution that can be applied to many different types of IS related phenomena. An explication of how it can be applied is depicted in Paper 2. Additional lenses hold the potential to yield different types of findings, thus the development of such a lens should be valued to foster alternative forms of research. The lens developed in Paper 1 can and should be applied to a variety of IS phenomena. For example, cloud computing. One potential research question could be *how do cloud architectures manifest themselves?* Alternatively, *how does the IS and larger business organization come to be represented in the cloud?* Applying the lens to different IS phenomena stands to foster its maturity through a dialectic of research, not to mention yield a variety of findings across an IS research stream.

Lastly, this dissertation culminated in providing a practitioner oriented Paper 3. This paper served to take the major and minor plot and subplots discovered in the two case studies and provide guidance for fledgling EA practices. Research on a topic such as EA can learn just as much from an immature EA organization as one that is very mature. The EA organization in Case One was extremely immature and unfortunately met its demise. In contrast, the EA organization in Case Two learned valuable lessons from Case One's misfortunes. These important lessons were captured and disseminated in Paper 3 to develop a framework for a fledgling EA practice.

In conclusion, it is of sincere hope this research can be used to mature the ISDS research field, mature our understanding of how EA manifests itself in organizations, and offer practical guidance for fledgling EA practices. EA is a fascinating topic in IS practice that has yet to be fully explored. It is of hope this research ignites further interest in the topic. It is also of hope that the topic of IS Engagement is further explored. Lastly, it is of hope the theoretical contributions from all three papers are leveraged to widen the aperture of design science in the IS field.

REFERENCES

Ahituv, N., Neumann, S., & Zviran, M. (1989). Factors Affecting the Policy for Distributing Computing Resources. *MIS Quarterly , 13* (4), 389-401.

Alavi, M., & Leidner, D. (1999). Knowledge management systems: issues, challenges, and benefits. *Communications of the AIS , 1* (2).

Alavi, M., & Leidner, D. (1999). Knowledge management systems: issues, challenges, and benefits. *Communications of the AIS* .

Alavi, M., & Leidner, D. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly , 25* (1), 107-136.

Ashforth, B. (1998). Becoming: How does the process of identification unfold? In D. Whetten, & P. Godfrey, *Identity in Organizations: Developing Theory Through Conversations* (pp. 213–222). Thousand Oaks: Sage.

Aune, B. (1979). *Kant's Theory of Morals.* Princeton, NJ: Princeton University Press.

Avison, D., Jones, J., Powell, P., & Wilson, D. (2004). Using and validating the strategic alignment model. *Journal of Strategic Information Systems , 13*, 223–246.

Baskerville, R. (2010, May). Explanatory Design Theory. *Business & Information Systems Engineering* , 271-282.

Bayazit, N. (2004). Investigating Design: A Review of Forty Years of Design Research. *Design Issues , 20* (1), 16-29.

Beimborn, D., Franke, J., Wagner, H. T., & Weitzel, T. (2007). The Influence of Alignment on the Post Implementation Success of a Core Banking Information System: An Embedded Case Study. *Hawaii International Conference on System Sciences* (pp. 1-10). Maui: Hawaii International Conference on System Sciences.

Bente, S., Bombosch, U., & Langade, S. (2012). Collaborative Enterprise Architecture: Enriching EA with Lean, Agile, and Enterprise 2.0 Practices. Waltham, MA: Elsevier.

Bhaskar, R. (1975). *A Realist Theory of Science.* Abingdon: Routledge.

Billig, M. (1999). Whose terms? Whose ordinariness? Rhetoric Ideology in Conversation Analysis. *Discourse and Society* , 543–558.

Boland, R. (2004). *Managing as Designing.* Stanford, CA: Stanford Business Books.

Boland, R., Collopy, F., Lyytinen, K., & Yoo, Y. (2008). Managing as Designing: Lessons for Organization Leaders from the Design Practice of Frank O. Gehry. *Design Issues , 24* (1), 1-26.

Boudreau, M. C., & Robey, D. (2005). Enacting Integrated Information Technology: A Human Agency Perspective. *Organization Science , 16* (1), 3-18.

Bozetepe, S. (2007). User Value: Competing Theories and Models. *International Journal of Design , 1* (2), 55-63.

Brown, C., & Vessey, I. (2003). Managing the Next Wave of Enterprise Systems: Leveraging Lessons from ERP. *MIS Quarterly Executive , 2* (1).

Brown, T. (2004). *The Value of Enterprise Architecture.* Retrieved from MODAF: www.modaf.com/file_download/19

Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues , 8* (2), 5-21.

Burrell, G., & Morgan, G. (1979). *Sociological Paradigms and Organizational Analysis.* London: Heinemann.

Chan, Y., Huff, S., Barclay, D., & Copeland, D. (1997). Business Strategic Orientation, Information Systems Strategic Orientation, and Strategic Alignment. *Information Systems Research* , 125-150.

Charmaz, K. (2006). *Constructing Grounded Theory.* London: Sage.

Checkland, P. (1981). *Systems Thinking, Systems Practice.* Lancaster: Wiley.

Churchman, C. W. (1967). Guest editorial: Wicked problems. *Management Science , 14* (4), 141-142.

CIO Council. (2001). A Practical Guide to Federal Enterprise Architecture. Washington, D.C.: GAO.

Cohen, A., & Bradford, D. (2005). *Influence Without Authority.* Hoboken, NJ: John Wiley and Sons.

Corbin, J., & Strauss, A. (2008). *Basics of Qualitative Research.* Thousand Oaks: Sage.

Cresswell, J. (2003). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Thousand Oaks, CA: Sage.

Cross, N. (1982). Designerly Ways of Knowing. *Design Studies , 3* (4), 221-227.

Crowston, K. (1997). A Coordination Theory Approach to Organizational Process Design. *Organization Science , 8* (2), 157-175.

DeLong, D., & Fahey, L. (2000). Diagnosing Cultural Barriers to Knowledge Management , 14 (4), 113-127.

Dewey, J. (1939). Theory of Valuation. *International Encyclopedia of Unified Science , 2*, vii-67.

Dilnot, C. (1982). Design as a socially significant activity: an introduction. *Design Studies , 3* (3), 139-146.

Dilnot, C. (1984a). The State of Design History, Part I: Mapping the Field. *Design Issues , 1* (1), 4-23.

Dilnot, C. (1984b). The State of Design History, Part II: Problems and Possibilities. *Design Issues , 1* (2), 3-20.

Eisenhardt, K. (1989). Agency Theory: An Assessment and Review. *Academy of Management Review , 14* (1), 57-74.

Findlay, J. (1970). *Axiological Ethics.* London: Macmillan.

Fishbein, M., & Ajzen, I. (1975). Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Menlo Park, CA: Addison-Wesley.

Fonstad, N. (2006a). Build the Foundation One Project at a Time. In J. Ross, P. Weill, & D. Robertson, *Enterprise Archecture as Strategy: Creating a Foundation for Business Execution* (pp. 117-142). Boston: Harvard Business School Publishing.

Fonstad, N. (2006). Transforming a Company Project by Project: The IT Engagement Model. *MIS Quarterly Executive , 5* (1), 1-14.

Fonstad, N., & Robertson, D. (2006b). Transforming a Project by Project: The IT Engagement Model. *MIS Quarterly Executive , 5* (1), 1-14.

Foucault, M. (1978). The History of Sexuality Volume I: An Introduction. New York: Pantheon Books.

GAO. (2012). Organizational Transformation: A Framework for Assessing and Improving Enterprise Architecture Management (Version 2.0) . Washington, D.C.: GAO.

Gartner. (2012). *Definition of Enterprise Architecture*. Retrieved September 15, 2012, from IT Glossary: http://www.gartner.com/it-glossary/enterprise-architecture-ea/

Goldkuhl, G. (2011). Design Research in search for a Paradigm: Pragmatism is the answer. *Proceedings of the European Design Science Symposium* (pp. 1-12). Berlin: Springer.

Goldkuhl, G. (2004). Design Theories in Information Systems - A Need for Multi-Grounding. *Journal of Information Technology Theory and Application , 6* (2), 59-72.

Graeber, D. (2001). *Toward an Anthropological Theory of Value.* New York, NY: Palgrave.

Gregor, S., & Hart, D. (2007). Enterprise architectures: enablers of business strategy and IS/IT alignment in government. *Information, Technology, and People , 20* (2), 96-120.

Hall, E. (1976). *Beyond Culture.* New York: Random House.

Henderson, J., & Venkatraman, N. (1993). Strategic Alignment: Leveraging Information Technology for Transforming Organizations. *IBM Systems Journal , 32* (1), 472-484.

Hevner, A., March, S., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly , 28* (1), 75-105.

Hinchcliffe, D. (2009, August 11). *Pragmatic new models for enterprise architecture take shape.* Retrieved September 21, 2012, from ZDNet: http://www.zdnet.com/blog/hinchcliffe/pragmatic-new-models-for-enterprise-architecture-take-shape/674

Hirschheim, R. (1985, December). User Experience with and Assessment of Participative Systems Design. *MIS Quarterly* , 295-304.

Hirschheim, R., Murungi, D., & Pena, S. (2012). Witty invention or dubious fad? Using argument mapping to examine the contours of management fashion. *Information and Organization , 22*, 60-84.

Hong, K. K., & Kim, Y. G. (2002). The Critical Success Factors for ERP Implementation: an Organizational Fit Perspective. *Information and Management , 40*, 25-40.

Ives, B., & Olson, M. (1984). User Involvement and MIS Success: A Review of Research. *Management Science , 30* (5), 586-603.

Järvinen, P. (2007). Action Research is Similar to Design Science. *Quality & Quantity , 41*, 37-54.

Järvinen, P. (2007). Action Research is Similar to Design Science. *Quality and Quantity , 41* (1), 37-54.

Kazmierczak, E. (2003). Design as Meaning Making: From Making Things to the Design of Thinking. *Design Issues , 19* (2), 45-59.

Kearns, G., & Lederer, A. (2000). The effect of strategic alignment on the use of IS-based resources for competitive advantage. *Journal of Strategic Information Systems , 9*, 265-293.

Klein, H., & Myers, M. (1999). A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly , 23* (1), 67-94.

Krueger, C., & Cross, N. (2006). Solution Driven versus Problem Driven Design: Strategies and Outcomes. *Design Studies , 27* (1), 527-548.

Löfqvist, L. (2010). Product and Process Novelty in Small Companies' Design Processes. *Creativity and Innovation Management , 19* (4), 405-416.

Levy, M. (2012, 12 1). Expanding the Dominant Worldview of Information Systems Design Science. *Unpublished PhD Thesis* . Baton Rouge, LA, USA: Louisiana State University.

Levy, M., & Hirschheim, R. (2012). Removing the Positivist Straight Jacket From Information Systems Design Science Research. *Proceedings of the European Conference on Information Systems.* Barcelona: ECIS.

Lind, E., & Tyler, T. (1988). *The Social Psychology of Procedural Justice.* New York: Plenum Press.

Lindlof, T., & Taylor, B. (2011). *Qualitative communication research methods.* Thousand Oaks, CA: Sage.

Luftman, J. (2000). Assessing Business-IT Alignment Maturity. *Communications of the Association for Information Systems , 4*, 1-50.

Lunenfeld, P. (2003). The Design Cluster. In B. Laurel, *Design Research: Methods and Perspectives* . Cambridge, MA: MIT Press.

MacKay, P., Marshall, J., & Hirschheim, R. (2012). The Design Construct in Information Systems Design Science. *Journal of Information Technology , 27*, 125–139.

MacLean, L., Meyer, M., & Estable, A. (2004). Improving accuracy of transcripts in qualitative research. *Qualitative Health Research , 14* (1), 113-123.

Malone, T., & Crowston, K. (1990). What is Coordination Theory and How Can It Help Design Cooperative Work Systems? *CSCW '90* (pp. 1-15). Los Angeles: CSCW.

March, S., & Smith, G. (1995). Design and natural science research on information technology. *Decision Support Systems , 15* (1), 251-266.

Martin, N., & Gregor, S. (2002). Enterprise Architectures and Information Systems Alignment: policy, research and future implications. *ACIS 2002.* Association for Information Systems.

Marxt, C., & Hacklin, F. (2005). Design, product development, innovation: all the same in the end? A short discussion on terminology. *Journal of Engineering Design , 16* (4), 413–421.

Mason, J. (2002). *Qualitative Researching.* London: Sage.

Meng, J. (2009). Donald Schön, Herbert Simon and The Sciences of the Artificial. *Design Studies , 30* (1), 60-68.

Meng, J. (2009). Donald Schön, Herbert Simon and The Sciences of the Artificial. *Design Studies* , 60-68.

Miles, R., Snow, C., Meyer, A., & Coleman, H. (1978, July). Organizational Strategy, Structure, and Process. *Academy of Management Review* .

Mingers, J. (2004). Realizing information systems: critical realism as an underpinning philosophy for information systems. *Information and Organization , 14*, 87-103.

Mumford, E. (1983). *Designing human systems for new technology The ETHICS method.* Manchester: Manchester Business School (UK).

Mumford, E. (1995). Effective Systems Design and Requirements Analysis: the ETHICS Approach. London: Macmillan.

NASCIO. (2003). NASCIO Enterprise Architecture Maturity Model. Lexington: NASCIO.

Oliver, D., Serovich, J., & Mason, T. (2005). Constraints and Opportunities with Interview Transcription: Towards Reflection in Qualitative Research. *Social Forces , 84* (2), 1273-1289.

Orlikowski, W., & Robey, D. (1991). Information Technology and the Structuring of Organizations. *Information Systems Research , 1* (2), 143-169.

Pereira, C., & Sousa, P. (2005). Enterprise Architecture: Business and IT Alignment. *2005 ACM Symposium on Applied Computing* (pp. 1344-1345). Santa Fe: ACM.

Pirsig, R. (1991). *Lila: An inquiry into morals.* New York: Bantam Books.

Pirsig, R. (1974). Zen and the Art of Motorcycle Maintenance: An inquiry in values. New York: HarperCollins.

Popper, K. (1963). *Conjectures and Refutations.* New York: Routledge.

Presley, A. (2006). ERP investment analysis using the strategic alignment model. *Management Research News , 29* (5), 273-284.

Redstrom, J. (2006). Towards user design? On the shift from object to user as the subject of design. *Design Studies , 27* (2), 123-139.

Robey, D., Ross, J., & Boudreau, M. C. (2002). Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change. *Journal of Management Information Systems , 19* (1), 17-46.

Rorty, R. (1979). *Philosophy and the Mirror of Nature.* Princeton, NJ: Princeton University Press.

Ross, J., Weill, P., & Robertson, D. (2006). *Enterprise architecture as strategy: Creating a foundation for business execution.* Cambridge, MA: Harvard Business School Press.

Ryan, D. (1997). Enzo Mari and the Process of Design. *Design Issues , 13* (3), 29-36.

Sabherwal, R., Hirschheim, R., & Goles, T. (2001). The Dynamics of Alignment: Insights from a Punctuated Equilibrium Model. *Organization Science , 12* (2), 179-197.

Sandelowski, M. (2001). Real qualitative researchers do not count: The use of numbers in qualitative research. *Research in Nursing & Health , 24* (3), 230-240.

Schekkerman, J. (2006). *Extended Enterprise Architecture Maturity Model Support Guide.* Retrieved September 21, 2012, from http://www.enterprise-architecture.info/: http://www.enterprise-architecture.info/Images/E2AF/Extended%20Enterprise%20Architecture%20Maturity%20Model%20Guide%20v2.pdf

Schneiderman, B. (1998). *Designing the user interface.* Bangalore: Pearson Education.

Schubert, P., Lincke, D., & Schmid, B. (1998). A Global Knowldge Medium as a Virtual Community: The NetAcademy Concept. *Proceedings of the Americas Conference on Information Systems.* AIS.

Simon, H. (1980). Cognitive Science: The Newest Science of the Artificial. *Cognitive Science , 4*, 33-46.

Simon, H. (1996). The Sciences of the Artificial. MIT Press.

Stich, S. (1993). Naturalizing Epistemology: Quine, Simon and the Prospects for Pragmatism. *Philosophy and Cognitive Science , 34*.

Stich, S. (1993). Naturalizing Epistemology: Quine, Simon and the Prospects for Pragmatism. *Philosophy and Cognitive Science* , 1-17.

Tavakolian, H. (1989). Linking the Information Technology Structure with Organizational Competitive Strategy. *MIS Quarterly , 13* (3), 309-317.

Trist, E. (1980). The Evolution of Socio-Technical Systems. *Organizational Design and Performance* (pp. 5-60). Philadelphia: Centre for the Study of Organizational Innovation.

Trist, E. (1981, June). The Evolution of Socio-Technical Systems. 1-60. Toronto, Ontario, Canada.

Trist, E., Murray, M., & Trist, B. (1990). The social engagement of social science: A Tavistock anthology, Vol. I: The socio-psychological perspective. Baltimore, MD: University of Pennsylvania Press.

Tyler, T., & Blader, S. (2000). Cooperation in groups: Procedural justice, social identity, and behavioral engagement. Philadelphia: Psychology Press.

Tyler, T., & Blader, S. (2003). The Group Engagement Model: Procedural Justice, Social Identity, and Cooperative Behavior. *Personality and Social Psychology Review , 7* (4), 349–361.

van Aken, J. (2004). Management Research Based on the Paradigm of the Design Sciences: The Quest for Field-Tested and Grounded Technological Rules. *Journal of Management Studies , 41* (2), 219-246.

Vough, H. (2012). Not All Identifications Are Created Equal: Exploring Employee Accounts for Workgroup, Organizational, and Professional Identification. *Organization Science , 23* (3), 778–800.

Wagner, H. T., Beimborn, D., Franke, J., & Weitzel, T. (2006). IT Business Alignment and IT Usage in Operational Processes: A Retail Banking Case. *Hawaii International Conference on System Sciences* (pp. 1-9). Maui: Hawaii International Conference on System Sciences.

Wagner, H. T., Weitzel, T., & Koenig, W. (2005). Modeling the impact of alignment routines on IT performance: an approach to making the resource based view explicit. *Hawaii International Conference on System Sciences*, (pp. 1-10).

Walls, J., Widmeyer, G., & El Sawy, O. (1992). Building an Information Systems Design Theory for Vigiliant EIS. *Information Systems Research , 3* (1), 36-59.

Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems , 15*, 320–330.

Walsham, G. (1995). The Emergence of Interpretivism in IS Research. *Information Systems Research , 6* (4), 376-394.

Wastell, D. (2010, June). Managing as designing: ‘opportunity knocks’ for the IS field? *European Journal of Information Systems* , 1-10.

Weick, K. (1995). *Sensemaking in Organizations.* Thousand Oaks: Sage.

Willem, R. (1990). Design and Science. *11* (1), 43-47.

Yin, R. (2009). *Case Study Research Design and Methods.* Thousand Oaks, CA: Sage.

Zachman, J. A. (1987). A Framework for Information Systems Architecture. *IBM Systems Journal , 26* (3), 276-292.

APPENDIX 1: CASE STUDY INTERVIEW GUIDE

Before recording:	Tell the informant what you are interested in
Kick-off Question(s):	What is EA at [organization]? Tell me a little about your experiences with EA and 'doing' EA?
Design as Problem Solving	Transforming and improving the material environment, solution-oriented, finding solutions to field problems and implementing those solutions. What are the main problems you encounter in your EA practice and how to do you go about solving them?
Design as Product	Objects, entities, artifacts that arise and are imbued with meaning within those contexts, designer inextricably linked to the designed product. What are the artifacts that arise from your EA practice (frameworks, products, models, diagrams, etc.)?
Design as Process, Action	Processes and actions that lead to the realisation and implementation of an artifact in a particular context, design involves action taking and change. What are the processes used to develop EA? What types of processes (if any) are you developing?
Design as Intention	Deliberate thought processes that enable the designer and user to see connections between problem and possible solutions, the intent driving the design activity and the impacts this has on the realized artifact. What is the intent that drives the design of EA, and what is the intent you espouse to others?
Design as Planning (Modelling, representation)	Working hypothesis (or plan, model, etc.) that captures and formalizes the designer's intentions. How are certain techniques and/or methodologies used? What are they?
Design as Communication	Conceptual characteristics (form and content) of artifacts that resonate with users, the ways meaning is reconstructed by users. How is EA communicated (artifacts, benefits, values, etc.) across the organization?
Design as User Experience	The range of experiences (both manifest and latent) created for and received by the user of an artifact, the meanings and experiences a user constructs with an artifact over time. How is EA taken and used? How much does the eventual user of EA have input?
Design as Value	The value (often symbolic and/or social) placed on the artifact and the experiences of that artifact by a user, and how this changes over time. What is the perceived value of EA across the organization? How do you build value into what you do?
Design as Professional Practice	The broad responsibilities and activities of designers who inevitably change the world through their actions, an attitude towards a 'problem', consideration of the knowledge and skills required by designers. What are the roles and responsibilities of an EA? What do you do to mature the professional practice of EA at [organization]?
Design as Service	Day-to-day problem solving, ability to understand and help others resolve or ameliorate problems, mindful of contextual forces and

	constraints. What do you perceive as the service you provide to [organization] as an EA? How do others view the service the EA organization provides?
Additional Questions	[Added] Describe the engagement model at [organization]? What is an engagement model and what do you do to create it? What would the naysayers say about your EA efforts? What were some notable events in the history of EA at [organization]? What was the impetus for EA? What was life like before EA? What are some notable changes that have happened because of the EA organization's efforts? What am I missing? What could I have asked that may have better captured the essence of your role as an architect? EA development at [organization]? Or EA in general? Can I contact you with any questions?

APPENDIX 2: CASE ONE – SELECT THEMES AND EXPLANATIONS

Isolationism		Techné					Knowledge Availability			Jurisprudence		Design As...
No time for EA (by the business units)	Getting buy-in	Subject area model as EA product	Simulations	Roadmap perspective	Not just a collection of models	data models	Standards to eliminate tribal knowledge	Body of knowledge	Business processes currently only tribal knowledge	Advisory standard	EA as governance instrument	Problem Solving
Decisions should not be made before the architects show up	No measures for not following process	Data facets as EA artifact	Data definition as an important standard	EA must produce artifacts that are measureable in the execution phase	Not just a collection of models or else the only user will be the EA	process models	EA must have good hooks into delivery	Repository on where to find knowledge on the enterprise	Knowing all the tentacles	Tracking models and standards	Must have respose to have governance	Product
Unable to get buy-in	Capturing Redundant processes (eliminating silos)	Vision and scope	Retention, archiving, and backup	Need to have a measureable engagement model	We need an architecture delivery model	Body of Knowledge	EA as facilitator [of integration of BUs]	Identification of data facets	Reuse of widgets	Governance alone does not work	Respect only comes from building trust	Process, Action
Lack of engagement	Currrently different groups with similar processes (eliminating redundancy)	Impact analysis	Important to build a framework for data archtiecture, standards and definitions	Metrics to ensure high data quality	EA needs a process model a la Arch. Delivery Model (ADM)	Reference Architectures	Segment Architecture	Compressing organizational data Masters	Documentation of information flow	Taxonomy - list of business terms	Can't be big brother	Professional Practice [DAPP]
Architects as producers of EA	Governance alone dosen't work	Metrics	Systems mapping	Business entity (capability) model	Heaviliy leaning towards TOGAF ADM	Designing by principles	EA integrating business impact	Knowledge Repository	Knowing all the tentacles of IT	Taxonomy must precede the use of framework standards	Ivory Tower	Planning (Modelling, representation, etc) [DAP]
Architects as consumers of EA	No integration	Heat map for metrics	Capability Mapping/Models	difficulty to maintain data quality across the enterprise	From a business model, an operating model is derived	Functional Specificaton	Where to find knowledge on the enterprise	Enterprise level data model	Value proposition in reusability	Formal engagement model as a standard for interaction with the businesses	Must have accountability	Communication [DAC]
EA as dictatorship	Ivory tower	Kaplan-Norton Strategy Maps (aka balanced scorecard)	Heat map for capabilities mapping	[HR] Process and information models for informed decisions	Engineering Design Document	Engagement model needed	Systems need to be built so they can talk to each other	Enterprise level data analysis	Unified knowledge repository	Understanding the standard business processes	Goverenance, compliance / doing the right things	User Experience [DAUE]
Never clarified artifacts	Ensuring IT at enterprise level	Conceptual and Logical Data Model	EA should have common deliverables across all segments	Applying process engineering	Requirements Documents	Difficulty identifying data facets	Organizational data master	Formalizing tribal knowledge	Single knowledge repository on EA	Cannot simply drive ontology and governance	Oversight	Value [DAV]

- Themes are contained in cell values
- Titles are located across the top cells
- Cell colors denote ‘design as’.
- If more than one ‘design as’ was identified an estimated combined color combination was used.

APPENDIX 3: CASE TWO – SELECT THEMES AND EXPLANATIONS

Social Engagement						Value Based Understanding / Maturity				Group Ownership / Accountability		Interpersonal Skills			Design As...
Engagement model	Owner in the business space	Needs to be an engagement model	Promoting us within the organization as the thing to use	Identify the folks that will work with you	Business process-centric view	Lower maturity - still trying to architecture where it dosent exist	Immature perspective of the architecture role	Mature in best practices	Maturity as getting the organization to understand the value	Product owner for each block of data	Business ownership of the data taxonomy	EAs should be leaders	Selling the particular idea	Precision of communications is key	Problem Solving
Must have accountability - engagement model provides this	EA must have an engagement model with the business	An understanding of the operating model	EA support enterprise transformation	Formal engagement model as a standard for interaction with the businesses	Multi-year roadmap (to align with business needs)	Scoring metrics on maturity	We do more than just answer questions (is an EA 1.0 service)	Getting others to understand the value	Influencing without authority	Must have accountability and engagement model provides this	Owner in the business space	EA as person with tools and techniques	Must be able to guage appetite for change	Communicator of thoughts to get EA realized	Product
To get there the EA needs to understand business strategies	Enterprise architect as the process owner	No engagement model. Needs to be one, particularly in the M&A space	Getting buy-in	Engagement oriented	Identifying with the business how to increase customer base	Need to have maturity cycles	EA 2.0 about identifying enterprise wide gaps	tough to get the business units to agree to EA	'Pulling the view' and drive recommendations	Enterprise architect as the process owner	Product owners for each block of data	Use of the businesses methodology (agile, waterfall)	Respect only comes from building trust	Able to understand theend-to-end process	Process, Action
EA needs to be strategic information wise and technology wise	Let business owner drive the solution	Getting them to give you the data	EA needs to be engagement oriented	Designing for the future of the business	Understanding channels, revenue streams	Need to have governance cycles	There's not much repeatability in what we do	Must be transparency of the team through clarity about what we are going after	need grassroots motivation	EA as process owner	Let business owner drive the solution	Can't tell them their baby is ugly	Building consensus around leaders	Understanding culture	Professional Practice [DAPP]
EA needs to meet broader strategies	Business ownership of data taxonomy	Understanding the value drivers	Logical review points with the business	need to have a measureable engagement model	EA needs to know the business impact	Original team dispatched to individual BUs	Forming an engagement model that works	Shouldn't have to tell us what to do!	Hard to identify who owns the data	Business Ownership of data taxonomy	Architects as drivers of solutions	Must be ways to earn trust and respect (listening, etc)	EA as person with tools and techniques	From the business analysis ranks	Service
engagement model	Finding promoters of what we are doing	Hard to identify who owns the data	measureable engagement model'	Business owners must understand the motivation behind EA	Personal focus on business architecture	Currently less governance	Hard to define what EA is	Who gathers the data	Ensures it is of high quality	EA maintains horizontal view across the organization	Finding promoters of what we are doing	Understanding the standard business processes	Can't be elitist (egalitarian)	individuals must be able to deal with ambiguity	Intention [DAI]
Must be ways to earn trust and respect (listening, etc)	EA needs to drive a planful transformation of the enterprise	Understanding value proposition	must show strategic value	Can't be big brother	EAs for Segments (HR, Legal, Corp Affairs)	EA in MSIT (as opposed to in the segments) will always be an outsider	EA cannot self-identify	Immature in communication and business understanding	difficult to maintain data quality across the enterprise	Promoting us within the organization as the thing to use	Business, process, information, application arch.	Soft elements, interpersonal	Good analytical skills	Cant be engineering mindset	User Experience [DAUE]
understanding the standard business processes	EA must be embedded in business-level processes	Getting people to come back to the EA group after lots of anonymity	building consensus around leaders	Can't do standards without consensus	Must look at specific business problems	Understanding the motivation behind EA	Immature that people assume EA related to IT	Maturity	Must be clear on what the targets are	Failed oversight	Correlated with revenue	Able to pick the right problem	Selling the particular idea	Calling things by appropriate names to avert bad connotations	Value [DAV]

- Themes are contained in cell values
- Titles are located across the top cells
- Cell colors denote 'design as'.
- If more than one 'design as' was identified an estimated combined color combination was used.

APPENDIX 4: EXAMPLE OF USE OF WORD CLOUDS AS A VISUALIZATION TOOL

APPENDIX 5: IRB APPROVAL

ACTION ON PROTOCOL APPROVAL REQUEST

Institutional Review Board
Dr. Robert Mathews, Chair
131 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.6792
irb@lsu.edu | lsu.edu/irb

TO: Rudy Hirschheim
ISDS

FROM: Robert C. Mathews
Chair, Institutional Review Board

DATE: February 7, 2012
RE: **IRB#** 3237

TITLE: The Design of Enterprise Architecture in Organizations

New Protocol/Modification/Continuation: New Protocol

Review type: Full ___ Expedited X **Review date:** 2/7/2012

Risk Factor: Minimal X Uncertain ______ Greater Than Minimal______

Approved X **Disapproved**_________

Approval Date: 2/8/2012 **Approval Expiration Date:** 2/7/2013

Re-review frequency: (annual unless otherwise stated)

Number of subjects approved: 60

Protocol Matches Scope of Work in Grant proposal: (if applicable)______

By: Robert C. Mathews, Chairman Robt C Mathews

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. SPECIAL NOTE:

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

VITA

Matthew Levy was born in Washington, D.C. and was raised on Reston, VA. He received a Bachelor of Business Administration from Texas Tech, majoring in Information Systems and Quantitative Sciences in 1999. Upon completing his bachelors, he ventured into software engineering where he worked on everything from project management software to advanced sensor and image processing applications. Much of his practitioner experience comes from the defense industry where he also was the founder and CEO of his own company as well as served in the role of CTO for a mid-sized defense contractor. In the later years of running his own firm, he decided to pursue his Masters in Business Administration with a focus in Information and Decision Sciences. He completed his master's in 2007 and within the next year began his spinning down his company so that he could pursue his PhD. Ultimately, it was his desire to educate and perform research that he saw as one of the most valuable things he could do given his experiences.

Matthew joined the doctoral program in information systems and decision sciences at Louisiana State University in Baton Rouge, Louisiana, in the fall of 2008. In the doctoral program, he has done research on service-oriented architecture, enterprise architecture, and design science. He will complete his doctoral degree in the spring of 2013. He currently resides in Encinitas, CA where he enjoys surfing, yoga, rock climbing, running, and just about anything else outdoors.