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Human-computer interaction and sociological insight: A theoretical examination and experiment in building affinity in small groups

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Human-computer interaction and sociological insight: A theoretical examination and experiment in building affinity in small groups

by

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Although the former decorum of using “we” in scientific writing to reflect that all science is the result of a community effort has lost popularity in favor of a more individualistic view of scholarship—ironically at the same time we see an increasing call for interdisciplinary teams of researchers, I must first thank the work of those scholars who have come before me and without whom my work would not have been possible. While it is always a tradition to thank one’s major professors and committee members, I am extremely grateful to Stephen Gilbert for funding me over the past few years over a variety of funding sources and allowing me the independence I needed to both cultivate my research and teaching as well as pursue my own personal growth. Bill Woodman inspired me to delve head first into social theory and to strengthen my skills as an intellectual and provided me with the mental challenge that I had felt was missing in my previous years of education. Dan Krier, who served as my mentor for Preparing Future Faculty mentor, encouraged me to strive to improve my teaching skills and advice on navigating through the sometimes-treacherous waters of academia. Brian Mennecke was instrumental in my first attempt at writing a grant both in terms of the insight he provided and in his defense of my interests. Finally, while I did not properly appreciate it while in his class, Tony Townsend’s lectures on the philosophy of science have had a profound impact on my work as a scholar in particular the way I have chosen to undertake my scholarly activities.

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ABSTRACT

The juxtaposition of classic sociological theory and the, relatively, young discipline of human-computer interaction (HCI) serves as a powerful mechanism for both exploring the theoretical impacts of technology on human interactions as well as the application of technological systems to moderate interactions. It is the intent of this dissertation to contribute to the knowledge of both HCI and sociology through a brief discussion of the state of sociological theory and its shortcomings, the design and evaluation of a system to promote social affinity in dyadic work, a method for empirically measuring affinity free from the social desirability bias of surveys, and a proposal for a new direction for HCI to include classic sociological theories. Ultimately, this dissertation serves as an introduction to a series of future research projects by laying the theoretical and methodological foundations for exploring indirect technological mediation of social interactions.

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CHAPTER 1. OVERVIEW

1. Introduction

Historically, technology has played a critical role in shaping society and was a central tenant in the work by early sociologists such as Durkheim, Marx, and Weber. While the technologies of the industrial era primarily impacted society through their impact on work practices and the economy, contemporary technologies penetrate society at all levels of social interaction and now have roots in all traditional social institutions including intimate relationships, family life, politics, and religion. Despite the large impact of contemporary technologies, sociological theories related to technology's influence are scarce and sometimes demonstrate a slightly misguided knowledge of the way digital technology operates. Some technologists have studied these phenomena; however, such studies are often uninformed by the classic sociological canon and often utilize atheoretical approaches such as ethnomethodology. In my research, I have sought to explore socio-technical systems by utilizing classic sociological theory combined with modern research and theories, such as Latour's Actor-Network Theory (Bruno Latour, 1996).

In her 2004 article, Yvonne Rogers discussed the current state of theory in human-computer interaction as it shifts from a cognitive model focusing on efficiency of work to a social model (Rogers, 2004). While earlier theories in HCI were primarily predictive and prescriptive, the current selection of theories suffers from being primarily descriptive in nature thus limiting their usefulness in explaining the impacts of technology on society and in aiding the design of future technologies. In chapter two, I discuss a similar trend for

contemporary sociological theory to trend toward the descriptive rather than the predictive while lamenting relative lack of contemporary theories that discuss the impacts of technology on society. Chapters 3-5 then detail the design and evaluation of a system that utilizes relatively simple concepts from social theory to illustrate how a small application of classic social theory can have powerful effects on improving group dynamics. Finally, chapter six lays the foundations for a new direction of human-computer interaction that results from a tight coupling of social theory and takes up Lester F. Ward's call for an applied sociology that positively shapes society (Ward, 1906).

Dissertation Organization

With the exception of this chapter and the final chapter of the dissertation, all papers included within this dissertation have been submitted for publication or have been published in print proceedings. I have indicated below each chapter title the state of the paper in terms of publication at the time of the defense. As later chapters provide extensive literature reviews, particularly chapters 2 and 6, the focus of this chapter will be to provide an introduction to the contributions, the framework that I have worked under, and a more thorough discussion of research methods and limitations.

2. Exploring a Transition

While I delve into an exploration of the field of human-computer interaction in more depth through my article in chapter 6, I have structured my dissertation under the framework that the discipline is in a state of transition. Successfully navigating this transition will lead to human-computer interaction continuing its rapid growth and help ensure its place as a valid

academic discipline pursuing answers to questions critical to our lives. Computation has become an integral element of our individual lives and society creating a need for a discipline that seeks to understand how we use computation and the effects it has both on the level of the individual mind and as a larger society. Such questions are unanswerable through the lens of a single discipline as looking at the questions through a technological lens alone only helps us understand the bits and bytes, while a lens from a psychological or sociological perspective helps us understand the human element but fails to understand the constantly changing technological landscape[1]. However, a failure to properly match the transition with the scientific and practical needs could doom a young discipline to extinction, fracturing, or to serve as a marginal discipline with few significant contributions to academia or society.

Human-computer interaction as a field encompasses a wide berth of topics and crosses a wide range of fields including design and engineering, as such it cannot easily be classified and the topics it encompasses have grown unchecked with time. In her essay, Yvonne Rogers warned of the possible collapse of the field without the emergence of new theories as a new field that grows rapidly with no unifying concept will be doomed to fracture and collapse: "A problem with allowing a field to expand in this eclectic way is that it can easily get out of control. No-one really knows what its purpose is anymore or indeed what criteria to use to assess its contribution and value to knowledge and practice" (Rogers, 2004). In fact, we have begun to witness this division with offshoot academic fields in design schools referring to themselves as "interaction experience design", or IxD for short (Russell-

[1] It is not sufficient to simply know how to program (I have heard this argument from social scientists before). Programming languages change and understanding the code is considerably less important than understanding the underlying theoretical components of

Rose, 2011). Some prominent human-computer interaction researchers have also seen this change and have left their former home departments in computer science for emerging iSchools they believe are better suited for the interdisciplinary research required of human-computer interaction (Sears & Jacko, 2008). In addition to the increasing academic division of the field by those in design, engineering, psychology, management and information science (MIS), etc. attempting to claim territory within a high growth field a growing division has also been seen emerging between practitioners and researchers as evidenced through the industry criticism of the annual CHI conference and the planning committee's attempts to appease its critics. Further, Rogers points out that the analytic "(high level conceptual tool for identifying problems and modeling certain kinds of user-interactions)" and generative "(provide design dimensions and constructs to inform the design and selection of interactive representations)" theories have been on the rise in the field while the predictive "(providing tools to model user behavior)" and prescriptive "(providing advice as to how to design or evaluate)" theories have been on the decline (Rogers, 2004). While not discussed in Rogers essay, some of the "theories" are essentially atheoretical, situated in the epistemology of constructionist thought—such as Suchman's situated action that emerges from the self-declared atheoretical "method" of ethnomethodology (L. Suchman, 1987). While the discipline is not in a state of chaos and the divisions, thus far, have been peaceful ones this lack of theoretical grounding during a shift toward social, tangible, contextual, and ubiquitous computing must be addressed. While some, such as Paul Dourish, recognize the emerging shift in the field and attempt to bridge the gap, they fail in their attempt due to an

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computer science and keeping abreast with technology that has the potential to change the way people interact with machines and each other.

unwillingness to embrace the scientific basis[2] of HCI that has laid invisible strings that held engineering, design, and psychology together during the current generation (Dourish, 2004). Indeed, the "seminal" human-computer interaction texts taught in HCI courses during this generation were both predictive (Norman's affordances in DOET) and prescriptive (Cooper's design guidelines, Nielsen's heuristics, etc.)

While the former theories and methods will continue to play an important part in studies of human-computer interaction, they are primarily geared toward an individual goal-oriented approach to systems in a fixed setting while computation has increasingly become more social, mobile, and ubiquitous. Additionally, while the previous focus was on goal-driven designs, attention has been increasingly directed to the design of the experience when utilizing computational systems, which the previous methods touch on primarily through esoteric means or fallible Likert scale surveys. While many aspects of the new form of human-computer interaction are still undecided, it is clear that the primary components include social interactions, computation in the environment, and a synthesis of both goal completion and experience[3].

It follows then that for the new generation of the field to unfold, the scientific foundations through predictive and prescriptive theories must first be laid down. The social

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[2] Others may argue the definition of "science", but I define it as the study of processes to determine their cause and effect relationships. Thus, scientific theories should be predictive (and following that, one should be able to apply a predictive theory to make it prescriptive).
[3] In reality, much of the work on experience actually ignores the efficiency of the goals and what ends up happening is rather than building on earlier foundations, we find ourselves reinventing the wheel. For more on this see Donald Norman's discussion of gestural interfaces (http://jnd.org/dn.mss/gestural_interfaces_a_step_backwards_in_usability_6.html).

sciences[4] have a wealth of theories, particularly in the sociological canon, that are both predictive and prescriptive which have either been ignored in HCI, dismissed by those who prefer atheoretical approaches (L. Suchman, 1987), or bastardized (e.g. Goffman's concept of front and back stage are used when discussing service design or "front end" computing vs. "back end" computing completely missing that the theory had to do with concepts of identity[5]). Aside from "obvious" theories to include from the sociologists who study technology, HCI practitioners and researchers need to be made aware of Durkheim's division of labor both in terms of designing work systems for groups as well as a new mechanism for understanding the division between computer processes and component/composite services (E. Durkheim, 1997). New analytic theories, easier to understand and utilize (and better "vetted") than activity theory may also have a place in HCI, particularly Weber's method of creating "Ideal Types" can play a pivotal role in understanding and generalizing social systems in much the same way that "Personas" have helped designers and researchers to understand and generalize the individual users[6] (Weber, 1904).

The goal in uncovering a scientific basis for human-computer interaction through importing theories from sociology and building off of those is three fold:

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[4] Here, again, I emphasize "science"—I should be clear that I draw a clear distinction between the social "scientists" who seek to understand the social world and its mechanisms and the social "activists" who seek "social change" and/or "social justice".

[5] This use is particularly strange to me, as I think it is obvious to anybody who has touched a computer or worked retail that there is a "front stage" interaction and a "back stage" interaction, so I am curious why Goffman has been watered down to such a simplistic level (a level where the use of his theory appears pointless).

[6] In fact, the processes are quite similar—looking at the common factors and then generalizing to one "ideal" version. However, where personas are used at the individual level and focus primarily on informing design, ideal types tend to focus on social systems and serve as a "measuring stick" or "ruler" by which social systems can be compared and analyzed.

1. It provides a base for the study of the impacts of technology on society that is currently underrepresented, proportionally to its impact, in both human-computer interaction and sociology.
2. By using predictive and prescriptive theories, it reduces the barrier for designers and engineers, a significant portion of the HCI community, to improve products.
3. Just as the use of cognitive theories provided a real-world testing environment for theories, researchers in the social sciences will be able to refine sociological theories based on the successes and failures of the theories when utilized in practice.

Through these three strands, we see that the importation of social theories will help meet a need in the HCI community and allow for continued growth of the discipline as well as new practical and scientific discoveries. The first point is particularly salient, as it would reestablish the scientific component of HCI that has declined in recent years as the discipline has shifted focus toward descriptive studies and the design of experiences. This is not intended to establish HCI squarely as a science, since its strength relies on its presence both in between disciplines as well as in between the philosophies of science, art, and engineering.

However, on this same token, I believe that it is critical for researchers in HCI to build upon an agreed upon core and work within social boundaries that establish what constitutes knowledge in the field. Failure to establish disciplinary boundaries and the framework for research leads to an unstable social structure (Coser, 1964), which may lead to hostile infighting (if resources are low) or a low consensus and slow to act discipline. Both of these problems can be seen within the current state of sociology as discussed in chapter 2 of this dissertation. As HCI is inherently linked to technology, which changes rapidly, both a

low consensus and slow production of knowledge would doom the discipline to irrelevancy as either a science or engineering discipline. Although, it could potentially survive as an artistic discipline through its contributions to interaction and experience design if the concepts are not extracted and imported into graphic design programs or the emerging interaction design programs.

The work presented in this dissertation utilizes this direction of HCI to reflect upon sociology's failure to conduct meaningful research on the impacts of contemporary technologies; the utilization of social theories in order to design evaluate and theorize about a simple computational system that powerfully impacts collaboration; and a reflective piece that examines the role technologists play in reshaping society. The last piece juxtaposes the modern theoretical work of Bruno Latour with classic sociological work, sadly mostly forgotten, of L.F. Ward's *Applied Sociology* (B Latour, 1992; Ward, 1906).

3. Philosophical and Ethical Overview

My work examines, for lack of a better word, manipulating people to behave in a desired way and my theory work discusses how technology has both intentional and unintentional impacts on individuals and social organizations. Given this focus, I feel the need to formally articulate the philosophical and ethical foundations I borrow from as I explore these issues. The short answer, as with most things in life, is simply that "it depends." This, in itself, is a philosophical approach, as it appears to reject any definitive answer; however, I am not a social constructionist and align myself with a post-positivist research philosophy. I do not believe there is any "pure" answer that is always true, rather that given certain conditions something can be true or at least agreed upon to be true.

Moreover, I believe that for science and society to be productive some baseline understanding must be established and in that baseline is where we can find objective truth, even though that truth may later change as historical circumstances change (E. Durkheim, 1997; Mill, 1864).

In terms of my ethical philosophy the phrase "you can't please everybody all the time" comes to mind; however, I think the reality is that you can never please everybody. There are too many conflicting goals and ideals in the world to ensure the happiness of every individual. More than that, I would argue that the happiness of the individual should be subservient to the health of human kind. In this way, I am primarily a utilitarian (Mill, 1864), but I exclude happiness from the goals we should work toward (this tends to lead to hedonism). Further, I believe that "greatest good" is a socially ambiguous term and has a wide range of meanings that prevent it from being a workable philosophy in and of itself and, like most things, if taken to a literal extreme can lead to more problems than solutions.

On this note, I oppose the idea of "universal" design in HCI as I believe it is a deceptive term. No design can be equally good across all cultures and ability levels, at least not without making it cost prohibitive or so complex that it is only universal insofar as nobody can use it. The goal of access is a noble one and something I have explored through my Masters research into an audio game for people with visual impairments (Oren, Harding, & Bonebright, 2008), but I contend that labels like "universal" serve no purpose outside of warm and fuzzy marketing statements. Taking all of this into consideration, it is my belief that our approach to the design of systems should try to be as inclusive as possible (again, depending upon circumstances) and that all research into system designs, including those presented in this dissertation, should be taken with the requisite grain of salt. Again, this is

not to imply that results cannot be generalized, rather that results and design solutions are unlikely to work in all circumstances and all situations. No matter the form of science, rarely do we find an absolute and this is the reason we measure variance and probability in statistics and something that critics of the scientific method seem to conveniently forget (Sokal & Bricmont, 1998).

Additionally, I believe there is sufficient evidence that technology has the ability to reproduce and modify societal values (Bainbridge, 2010)[7] and knowing this, we as designers, builders, and researchers of technology are under an obligation to ensure we consciously consider this as we go about our work. As stated previously, I do not pretend to speak to a universal "greater good," so the judgment of whether or not a product or design will negatively impact an individual or society must ultimately be determined by those involved in the design and release of the product. I do believe there are ways we can predict, to a degree, what impacts a new technology might have and I touch on this with more detail in chapter 6. However, I also fully admit that this is an area of budding research and will require at least several more years of work before all of the details reach sufficient maturity.

On a final note, an interdisciplinary background that allows me to seamlessly shift between otherwise seemingly disparate points of view informs my personal approach to examining problems. I have been trained in almost all core areas of the academy—the humanities (B.A. in English creative writing), the sciences (B.A. in computer science), and

[7] A particularly telling piece of anecdotal evidence supporting this was when I asked a class how they would react if all of the churches in the area suddenly shut their doors permanently, to which they very quickly to dismissed such an occurrence as unimportant. Following that, I asked them how they would feel about Facebook going offline permanently, to which they expressed outright horror. This linkage to online communities replacing traditional societal links can also be seen in Bainbridge's *Warcraft Civilization* (Bainbridge, 2010).

the social sciences (sociology). Further, my brief stints into industry have also allowed me to differentiate the ideals of the academy from real world practicalities. Through this, I make an effort to balance my research in a way that looks at things from a substantive level (humanities), a technologically practical level (computer science and industry experience), and from the perspective of the effects and affects on people and society (science and social science). While this intersection of disciplines is imperfect, it has allowed me to examine problems from various angles and evaluate research from both a removed position as well as from the position of an insider, which can honestly be intellectually frustrating because in many cases what appears to be a great idea by a disciplinary insider ultimately turns out to be uninspired (Mentis, Reddy, & Rosson, 2010) and sometimes seriously flawed (J. Daniels, 2007) when examining it from an outside perspective. Ultimately, I have found that regardless of the discipline individual authors come from, the majority (but not all) of scholarship on socio-technical/social computing/etc. systems is flawed from a lack of technological understanding, a lack of understanding of the social processes, or in serving only as a descriptive piece without an attempt to discuss the application or generalize the findings as discussed in more detail throughout this dissertation.

Intellectual Heritage & Theoretical Framework

While every paper that I have read has influenced my thinking to some degree, several articles in HCI and sociology require special attention as their work have provided the greatest influence on my scholarship. Probably chief among these is Yvonne Rogers' examination of the new theories of human-computer interaction as it helped draw my attention to some social theories being used in the discipline as well as touching on the

shortcomings that need to be addressed for the discipline to move forward (Rogers, 2004). Aside from providing a theoretical overview, Rogers also clearly articulates the importance of HCI not just as a field of basic research but as a means of informing industry practice, an idea that helped inform the development of my method of measuring social affinity (see chapters 3-5) since I took some measures intended to make it usable and useful to industry practitioners such as using pre-set time blocks instead of instances of interaction.

From sociology, the article that has had the most direct impact on informing my work is Bruno Latour's thought piece exploring the interactions between humans and very simple technology (B Latour, 1992). I have some fundamental disagreements with Latour's overall conception of Actor-Network Theory (ANT) since I think fully equating objects to people as social actors presents both ethical and theoretical problems as the objects do not have the full range of response freedom. Despite this flaw, I have found ANT to be the most useful frame of reference with the modification that objects, rather than being free social actors, are structural representatives since they make social facts a physical reality, as can be seen in Latour's discussion of seatbelts (B Latour, 1992). Through this theoretical lens, it is easier to see the role technology plays in shaping society and the special role that designers and engineers have in shaping the future structure of society as it becomes intrinsically dependent upon the production of the technological elite rather than just the political or economical elite (Bard & Söderqvist, 2002). While a full discussion of the implications of this new power elite is outside the scope of this dissertation, this argument is discussed in more detail within chapter 6.

Of perhaps equal importance to my experiments in building social affinity between collaborators are Bonnie Nardi's study on the instant message usage of a large telecom

company, particularly her description of affinity, and Erving Goffman's study of emergency room staff (E. Goffman, 1975; Nardi, 2005). While nether of these primarily descriptive studies gave any indication on how the findings could then be applied, they each provided critical information that helped me form a testable hypothesis in order to try to bond strangers together in a collaborative work environment. As an aside, one of the interesting things about my experiments is that the task of completing simple puzzles is often used as an icebreaker as an attempt to increase cooperation; however, as my data of the control groups suggests simply putting people together and having them work on a shared task is insufficient to bond individuals into a cooperative unit. This finding requires further analysis before it can be confirmed through testing with other tasks similar to other icebreaker tasks but if this finding holds true it could have significant implications in corporate training environments.

While his work was not directly applicable to the majority of my research, Lester F. Ward's pragmatic sociology, particularly as discussed in *Applied Sociology* and *Dynamic Sociology* serves as the greatest inspiration in terms of where I see the direction both sociology and HCI need to take (Ward, 1897, 1906). For Ward, simply uncovering social facts was not enough and the true worth of a science was its contribution to the improvement of human life. Unlike most contemporary sociologists, Ward believed that through uncovering the processes that produce social problems and creating appropriate interventions, we could build a better society(Ward, 1897). While Latour's ANT provides the theoretical framework at the core of human-society interaction proposed in chapter 6, it is ultimately Ward's sociological pragmatism that serves as its inspiration and ultimate foundations.

While I believe that Lucy Suchman's situated action work does have its merits in certain circumstances, I have ultimately found it useless as a practical theory although its importance in formally articulating that a person's routes to a goal change over time should not be ignored (L. Suchman, 1987). The primary fault I have found in Suchman's work is her dismissal of Durkheim's social facts in favor of Garfinkel's ethnomethodology, which in turn sets her work up as atheoretical and thus prevents it from being either fully predictive or prescriptive (E. Durkheim, 1982; Garfinkel, 1967). I still find Suchman worth mentioning here as she is the first sociologist to have made the transition to HCI and did so in a time when it was dominated by cognitive psychologists and thus helped lay the foundations of the social approach to HCI research.

To follow up, Emilé Durkheim's articulation of social facts stands at the basis of my approach to social research because even though it is popular to decry functionalism as dead, if we do not accept social facts as the foundation it becomes an impossible task of uncovering the structural elements of society and determining how they have changed and how we can impact them (E. Durkheim, 1982). While Durkheim's social facts provide a basis for examining social systems, it is Ward's ideal types that provide a clear lens for examining social facts and allowing comparisons of contemporary social facts, as opposed to Durkheim's historical comparative analysis (Weber, 1904). In fact, I would argue that Weber's ideal types provides the archetype both for the classic HCI method of persona creation as well as for content analysis based strategies, such as my technique for measuring social affinity.

4. Intellectual Contributions

The ultimate measure of doctorate degree is whether or not an individual has contributed new knowledge to one's chosen field. Given this, I feel compelled to formally articulate the intellectual contributions I feel my dissertation adds to the disciplines of sociology and human-computer interaction. Ultimately, my contributions boil down to four things:

1. A critique of contemporary sociological theory, particularly in terms of exploring technological impacts on society.
2. Introducing classic sociological theory to HCI and providing an overview of the contributions it can make as both a theoretical and methodological lens. As part of this, I work to expand upon the foundations of HCI and build a bridge toward the third generation.
3. The creation of a new software tool that data suggests improves the social affinity of strangers in working conditions.
4. A new framework for empirically measuring social affinity between collaborators working in the same physical or virtual space.

On the first point, I should note that I am not the first to critique the discipline of sociology (Cole, 1994; R. Collins, 1989, 1994; Gouldner, 1970; Porter, 2008) although I have not found any articles that critique it for its failure in addressing the role of technology. With regards to the second point, Durkheim has been introduced to human-computer interaction previously through the work of Lucy Suchman (L. A. Suchman, 2007); however, this was done in a dismissive way and other classical social theorists, such as Weber, have appeared in rare instances and limited in scope (Paccagnella, 1997) rather than an effort to

discuss their wider use in the discipline. On the fourth point, it should be noted that the method is still in the process of refinement in order to improve the ability of other researchers to utilize it and generalize it beyond the tasks users performed in my studies.

The third contribution requires some additional attention, primarily because while the current contribution of the software tool for exploring the possibility of increasing social affinity within working groups only brushes the surface of my larger plans. The software system, dubbed "ConvoCons", was designed to be a research platform to study a variety of potential means of mediating group dynamics in working situations using a variety of media from low bandwidth (text) to high bandwidth (videos). The general idea, however, is to allow for a wide range of studies that ultimately aim at finding ways of improving group decision making, creativity, and productivity. I should note that this does not necessarily mean increasing group cooperation as some level of competition is necessary depending upon the task and in some cases extremely high levels of cohesion can impair the ability of groups (Stasser & Titus, 1985).

Returning to the fourth point briefly, I should note that the purpose of creating a new method beyond allowing the comparison of software designed for improving social relations without the social desirability bias found in surveys, the method is also intended to provide a means of deep exploration of group behavior that can be quantitatively assessed. However, I have yet to use it for this latter purpose although I believe the potential it provides will allow for rich research findings in the future that go beyond the qualitative reporting of behaviors currently popular among researchers of CSCW and CMC systems.

5. Measuring Social Affinity

While I briefly describe the method I use to assess social affinity in chapters 3-5, the process of developing the method, justification for creating it over using existing survey metrics, and full description are detailed here in an expansion of a works-in-progress extended abstract (Oren & Gilbert, 2011). Additionally, this method serves as an example of how classic sociological theory can be utilized in human-computer interaction research (for more on this, see chapter 6).

Background

In our research into collaborative software systems, we found a weakness where several published papers did not measure any tangible improvements the system had in enhancing team work (G Fischer, Arias, Carmien, Eden, & Gorman, 2004; Riche, Riche, Isenberg, & Bezerianos, 2010; P Tuddenham & P Robinson, 2007). Nardi and Whittaker, in previous empirical studies of group work, have identified several factors they feel are key to successful collaborative work but later researchers have failed to further operationalize these factors into empirically measurable aspects that can be used to compare group effectiveness (Nardi, 2005; Whittaker, 2003). In both the social sciences and the computer supported cooperative work communities, several survey metrics have been developed to assess concepts such as rapport and common ground (G. Convertino, et al., 2005; Goudy & Potter, 1976). In using these surveys with dyads and comparing them with our empirical observations, we found they were prone to social desirability bias that resulted in obscuring the actual differences between groups, where groups that never spoke to one another during working sessions still self-reported high degrees of connection(Oren & Gilbert, 2010). In

addition, surveys only provide insight into the moment at which the survey is conducted and examining the depth of interactions over the course of a working session would only be possible through constantly administering lengthy surveys asking participants to rate the significance of actions or conversations.

The importance of affinity for effective collaboration can be seen in Schmid's discussion of affinity as the cornerstone to the development and use of social capital (Schmid, 2000). By creating a metric that can assess affinity, researchers will be able to more accurately assess the process of creating, storing, and using social capital, which is an essential element of cooperative and competitive work situations. Kellogg and Erickson (Kellogg & Erickson, 2002) suggest that social translucence, the idea that user activity needs to be apparent to other users, is a key to effective collaboration and our empirical measurement tried to place emphasis on actions that reflected transparency of work. In addition, Convertino *et al*. (G. Convertino et al., 2008) suggest that in order for group members to successfully collaborate, they must develop converging measures, which is the idea that they have a common ground or shared representation of the task. Both of these concepts are components of the third dimension of affinity identified by Nardi, that of a shared experience within a shared space (Nardi, 2005).

Aside from surveys that are prone to the possibility of social desirability bias, the only other commonly used method for reporting group differences consists of unquantifiable observations that capture the "big picture" interactions but do not seek to examine the details of interaction over time or provide a means of comparing groups in an experimental setting (Bao, Gerber, Gergle, & Hoffman, 2010; Cosley et al., 2008). Additionally, most observational approaches lack any attempt to validate the results. Our method uses a

customized form of protocol analysis to classify behavioral observations consistently. This approach removes the possibility of social desirability bias while still providing a means for quantifying results on a continual scale of affinity (based on frequency counts and proportion of time spent on affinity-related activity) in a way that can be validated by other researchers. By operationalizing the concept of affinity and using video and audio recording, we are able to examine different aspects of affinity over time and create a quantitative metric that allows comparison between groups.

Framework for Measuring Affinity

One goal of our research is the exploration of how software and hardware can be used to improve the group dynamics of diverse individuals that collaborate relatively infrequently—such as designers and engineers, disaster response teams, and personnel from different branches of the military. Currently, we have been working to create an applied solution designed to manipulate affinity bonds between strangers collaborating for the first time in a system we refer to as ConvoCons (Oren & Gilbert, 2009). In exploring ways of evaluating the effect of ConvoCons on groups, we sought a new method for measuring affinity.

Nardi (Nardi, 2005) defines affinity as a "feeling of connection between people." The issue of empirically measuring affinity is similar to the problem Goudy observed with “rapport” where there are multiple, sometimes conflicting, definitions and limited clearly defined metrics for measurement (Goudy & Potter, 1976). With this problem in mind, we adapted Nardi's definition and framework and narrowed it to the "convergence of thoughts, actions, or ideas" and made the following operationalized assumptions for measurement

purposes within a collaborative multitouch context, which we later generalized to remote collaboration.

Operationalized Definition

Using the above definition, we have used the following indicators of affinity to create specific observational tags that can be counted. It can be inferred that a group that lacks affinity will have group members that are more likely to work independently from one another and more likely to enforce personal space. One sign of independent work is a high level of "fixing" conversations—where partners discuss how to get unstuck from a series of uncoordinated or failed actions. Increasing affinity leads to increased reaching into a partner's personal space (this can be virtual or physical). Personal space has been defined by Hall as anything within an arm's reach of a person with intimate space being within eighteen inches (Hall, 1966). In a virtual collaboration context, personal space is better defined as any object a user is currently manipulating or indicated intention of manipulating through directed movement toward an object. For creative tasks, joint work, where individuals build onto each other's work, is also a sign of affinity as coordination is required. Leader-follower interactions, where one partner directs the activity of the other, *may* be a sign of affinity *if*, in an exit survey, the partners rate the work as equally each other's and the product as representing one another's goals, since the leader-follower dynamic can demonstrate that the partners understand each other's roles and skills. Communication indicating agreement and affirmation of actions are also indicators of a group that has acquired a degree of affinity. Within a creative task, discussion about what to make and how to make it are indicators of a group that has acquired affinity—a group where one member begins working without any discussion or both work independently on the creative task is an indication of lower affinity.

Incidental communication (unrelated to the task) is an indicator of affinity, according to the dimensions of affinity identified by Nardi and Whittaker (Nardi, 2005; Whittaker, 2003). Shared laughter is also an indicator of increased affinity.

Formulating the Tags

Peshkin has suggested that qualitative methods are the most useful means of observing social interactions (Peshkin, 1993). While we agree that the level of detail provided by qualitative research is needed to fully understand social interactions, we also see a need to be able to compare groups in order to assess whether or not a technology improves the interactions, and that comparison requires quantitative measurements. To quantify the affinity based on the signs of affinity described above, we used an approach based on Anfara et al. in their discussion of making qualitative data gathering techniques transparent (Anfara, Brown, & T., 2002). Videos of dyads were tagged with codes according to the behavior observed.

Working under our operationalized definition formed primarily by previous research of Nardi, Convertino, Goffman's work on role distance, and Goudy (G. Convertino, et al., 2005; E. Goffman, 1975; Goudy & Potter, 1976; Nardi, 2005)[4, 6, 10, 19], we then sought to identify key empirical elements from previous observations of groups at work. Five tag categories were established based partially on a) observations of over forty college student dyads performing collaborative puzzle-solving and creative tasks and b) the aforementioned literature (Hall, 1966; Richmond & McCroskey, 1995). An instructional definition of each of these tags was given to two independent coders, as follows:

High Affinity Conversation (See Figure 1)

- **Playful Conversation** - joking around, teasing, etc.

- **Conversation About Partner** - Asking about name, year in school, classes, etc. (anything about the partner).
- **Planning Solution (not fixing)** - If the conversation about how to solve the puzzle does not start when they find out the solution they were working on does not work, it is planning.
- **Discussing Freeform** - Discussing what to make, e.g., "Let's make a house," "What do you want to make?" etc.)
- **Directing Partner** - One partner is telling the other partner what to do.
- **Affirmation / Gratitude** - Confirming that the other partner did the right thing or showing appreciation for help given by the partner. Self-affirmation is excluded.

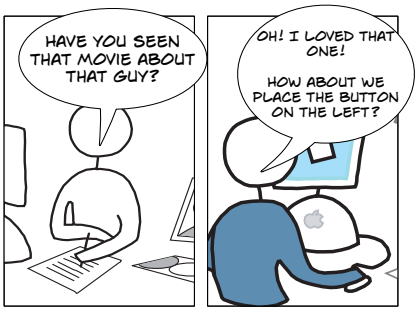

Figure 1 An illustration of high affinity conversation demonstrating both Conversation About Partner (movies) and Planning Solution (where to place the button).

Low/No Affinity Conversation (See Figure 2)

- **Getting Unstuck** - If they realize their solution was not working and start talking about how to fix it.
- **Teaching** - If one person does not both know about an application feature or action and another partner shows the other how to perform the function.
- **Other Talking** - Any other talking (in the column after the stop block, quote the line or type a brief summary about what the conversation was about).

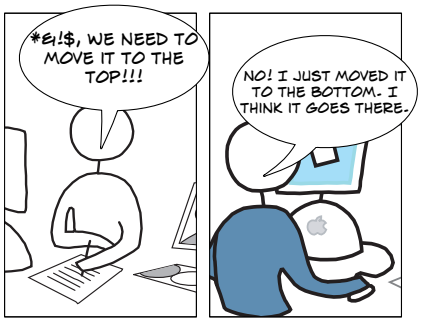

Figure 2 An illustration of low affinity conversation demonstrating Getting Unstuck.

High Affinity Behavior (See Figure 3)

- **Turn Taking (one places, other adjusts)** – Users take turns in a way where they are assisting one another in a small workspace.
- **Directing-Following** - One partner is taking actions under the direction of the other partner (usually only one partner is doing the work).
- **Close Proximity (hands)** - Their hands are close to touching / within three inches.
- **Shared Plan** - For puzzle tasks, both partners clearly have a shared idea of how to solve the puzzle and are working on getting the pieces into place--this is almost always associated with planning conversation or getting 'unstuck'. This can also be for creative tasks when they have discussed what they want to make and have a clear vision.
- **Building** - Adding on to the other's work (Creative tasks only) when they don't really have a plan but one person has placed blocks and the other is adding on to them for a shared vision; there should be some signs that they are collaborating (e.g. if they are tearing apart the other’s work as they add on, then this is not building).

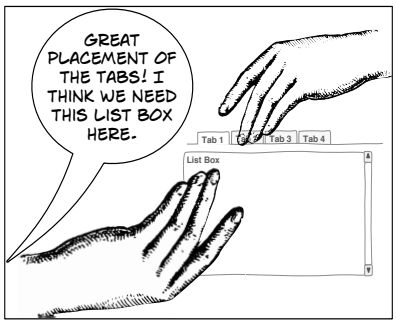

Figure 3 An illustration of high affinity behavior where partners are working within Close Proximity

Low/No Affinity Behavior (See Figure 4)

- **Independent** - Working simultaneously but without any type of shared plan, just placing shapes trying to get them to fit in the portion of the puzzle they are working on individually.
- **Turn Taking (independent)** - One takes an action and pulls away and then the other partner takes an action unrelated to the partner's action and without communication.
- **Avoidance (hands)** - One person looks like he/she is going to do something but then stops at the partner's hand (or pulls away).
- **Grabbing (taking pieces from other's personal space)** - This does not count when all the blocks are near one partner at the start, only if one partner takes a shape near the other partner.

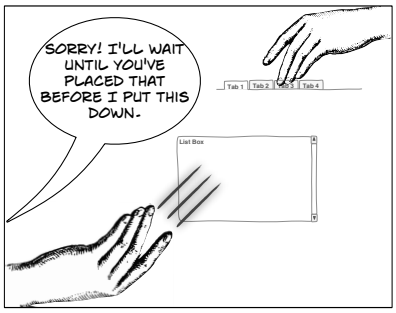

Figure 4 An illustration of low affinity behavior where Avoidance of partners occurs.

No Talking or Action

Example Usage

Using the video recordings of the hand movements and voices of dyads collaborating on simple design tasks (these videos were different from the pilot videos used to construct the affinity tags), we divided the videos up between each task (Play/Training, Task 1, Task 2, Task 3, and Freeform/Creative). The researchers then classified each five-second block of the video based on two overall constructs: the type of **behavior** (9 tags) and type of **conversation** (9 different tags). For conversations, the tags were then grouped into two larger categories: *affinity* (Conversation About Partner, Directing Partner, etc.), and *low/no affinity conversations about task* (e.g. Getting Unstuck, Teaching, etc.) Participants' behaviors were coded as *affinity-related* (e.g. Close Proximity (hands), Turn Taking (one places and the other adjusts), etc.) or *low/no affinity* (e.g. Avoidance, Independent).

Each five-second block of video received one tag related to dyad behavior and one related to dyad conversation. The total number of affinity-related blocks were then calculated and divided by the total number of blocks for each task. The overall affinity score is based on two parts: the proportion of affinity conversation and the proportion of affinity work (all affinity blocks / all blocks that exhibited some conversation or behavior). The proportion of affinity was then compared for each task between the experimental and control group through a Student's T-Test. The affinity results in this example are documented fully in (Oren & Gilbert, 2010). Results showed that the affinity measure corresponded with affinity observed casually and provided a potentially useful method for documenting affinity in more precise detail.

It should be noted that there are limitations of using a timed block approach as opposed to utterances; however, we believe that the block approach has its merits in both enhancing reproducibility and the ability for practitioners to utilize this method. By utilizing pre-defined block sizes, we reduce the disagreement about the start of an utterance and enhance the ability of a researcher to quickly review the accuracy of codes. Additionally, the block method requires less training as identifying the subtle cues of the start and end of utterances can be difficult and can be overly cumbersome in an industry setting where results are needed quickly.

A total of 5,149 blocks were given conversational and behavioral codes by a single coder, one of the researchers. In order to ensure the coding method was valid, two videos (674 blocks) were randomly selected and the category codes for behavior and conversation were compared between the researcher and a second coder. The second coder was an undergraduate who was not informed about the purpose of the experiment. She was trained for approximately an hour, where training consisted exclusively in making her familiar with the tools used for tagging. For the behavior category codes across both videos, there was a 90% agreement between coders with a Cohen's Kappa of 0.612. For the conversational category codes across both videos there was a 90.7% agreement with a Cohen's Kappa of k=0.708. Both of these Kappa scores fall into the range of scores that Landis and Koch referred to as "substantial agreement" (Landis & Koch, 1977).

CHAPTER 2. MOVING FORWARD WITHOUT MOVING BACK: THE PLACE OF CLASSIC SOCIOLOGICAL THEORY IN MODERN TIMES

Modified from a paper to be submitted to the *American Journal of Sociology*
Michael A. Oren

Abstract

I examine the purpose and methods of sociology as the founders of the discipline defined it and examine the way contemporary sociologists have remained true or deviated from the sociological roots. From there, I explore ways of restoring sociology to the sciences, improving its public image, and defining a future research agenda that returns sociology to its core purpose of understanding social systems through the mechanisms that constrain and define mutual intelligibility and social action.

1. Introduction

As sociologists, we must accept that our discipline is dead. We have killed it by the very mechanisms of socialization, organizational strife, etc. that we have sought to understand and make salient. Conflict, division, inequality, individuality, and the inability to accept the reality (or the perception of it) that allows the rest of society to operate have become the obsession of contemporary sociology and the downfall of the discipline. No longer do we look at the causal processes or the shared understanding of groups within society, instead we use lenses that try to uncover individual viewpoints, repression, and the consequences (though, curiously, rarely the mechanisms) of those in power maintaining the order that has been created. This is a bleak picture of a discipline unable to move past the

epistemological wars of the '60s, unable to recall the solutions to structural and interactional problems it once sought to explore and solve.

The bleak picture painted above is one view of the field, and I will admit a compelling one. However, I do not believe it is time to take sociology off of life support and read the eulogy of the discipline just yet. Undeniably, the field has long suffered from a crisis of identity and the damage to the field's reputation, structure, and ability to contribute to academia and society has been the cost. In order to save sociology, we must look to the past at the foundational work of Marx, Durkheim, and Weber. However, when we look at the past, I am not contending that we should do so in a way that sets these classic theorists on a pedestal to be constantly analyzed and evaluated while their theories are deified, as has been trendy at times[8]. It is the right of every field to redefine its core knowledge and theories as new discoveries are made. Freud, once the central figure in psychology, now stands as a marginal and historical figure, his time long since passed (Thompson, 1984). Rather, a look to the past must seek to restore the central focus of sociology, the object it wishes to understand and its core values. We do not have the right to deviate from the foundations of a discipline, or, if we do, we develop a new discipline with tangential relations to the original discipline. In this way, psychology, despite its distancing of Freud, still seeks to understand the human mind and processes of the human mind (Baumeister, Dale, & Sommer, 1998). Of course, on the flipside, that is not to say that those portions of the classic theories and methods that have found to be effective should be dismissed. On the contrary, they should

[8] However, I do believe that it is critical for students of sociology to understand the historical contexts of the theories. I think one of the greatest intellectual crimes of the discipline has been those who try to apply modern values on to historical figures. As sociologists, we

continue to make up the core of the field as long as they still prove effective explanations and have not been proven false. Thus, while biologists now rely more heavily on phylogenetics for classification, the classic taxonomical approach is still used (and taught) alongside phylogentics since (with some notable exceptions, such as the platypus) it serves as an effective and easy to use lens of understanding.

To begin, I must first explore the foundational definition of the discipline and the way contemporary sociologists have followed these foundational ideas and deviated from it. The goal of this examination is to determine the theories and theorists that have stayed true to the foundations of the discipline and which have deviated into new or adjacent realms. However, this will not be an exhaustive examination of all contemporary theorists as such a feat is beyond the scope of this paper. Rather, this establishes a metric, of sorts, by which contemporary theory can be evaluated to determine its sociological merit. By the end of this paper, I hope to have established a clear definition, based on the foundational ideas of the field, of what is sociology, to trim some of the bloating of the field (thereby strengthening the core and providing structural integrity), and to lay the foundations for returning the field to a focus on scientific inquiry and discovery[9]. In this way, it is my hope that we will discover that we do not stand at the brink of doom but rather at the precipice of a new sociology whose foundations have been laid even as the majority of the discipline sought to tear itself apart in a constant state of conflict within.

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should know that societal values change and should understand the consequences of societal values on thinking.

[9] This is clearly a lofty goal with a certain air of pretentiousness about it. Perhaps an impossible task, particularly for an individual on the fringes of the field, but if the field is as doomed as some paint it then the task must be taken up, even if the task is not completed

2. Defining Sociology

At its root, sociology can be defined as "the study and *classification* of human *societies*"[10] (emphasis mine). The italicized words are the key to understanding sociology as it was first established as a discipline. Classification is the first key, as it has its root in the empirical sciences where the ultimate object of science was to determine the similarities and dissimilarities that composed an organism or compound. Work in classification is critical for the purpose of comparing traits and being able to speak about a subject with greater precision to avoid confusion. Societies, then, are the subject of sociology; they are the proper unit of analysis that sociologists, traditionally, have taken on in an attempt to classify and understand in greater detail.

Marx, in his discussion of the alienation of the worker, had an interest in the social psychological aspects, although in Marx's case this interest in the micro level was primarily to explain the effects from the larger macro level changes of society through capitalism (Tucker, 1978). In Marx, we see a focus of sociology on examining the processes that define societal inequalities through power relations. The key to Marx's sociology comes not from conflict, as many ascribe to him, but in his detailed analysis of the social processes that drive capitalism and *predictions* based on his understanding of the causal processes at work and the character of society. Even today, Marx's analysis of the processes that drives capitalism and leads to its own periodic downfall rings true, even while these problems are multiplied in our current speculative economy (Krier, 2005). The failing of Marx comes from his lack of

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here—it is my hope that this contributes productively to the discourse that will save a discipline that has and can contribute much to the world.

[10] sociology. (n.d.). WordNet® 3.0. Retrieved April 19, 2009, from Dictionary.com website: http://dictionary.reference.com/browse/sociology

empirical research with actual factory workers. Had Marx taken the time to visit a factory, perhaps he would have been able to see the internal divisiveness that prevented worker solidarity and allowed the structure to remain intact (Coser, 1964). Despite this failing, Marx helped establish the field as one interested in the causal processes that defines human interactions.

The father of sociology as an academic discipline, Emilé Durkheim defined sociology when he stated: "[c]omparative sociology is not a special branch of sociology; it is sociology itself, in so far as it ceases to be purely descriptive and aspires to account for facts" (E. Durkheim, 1982). The key to this definition is that it provides a method for conducting sociological research. Further, this method—comparative techniques—requires one to first create classifications, a key to any science. Also found within this definition is the exclusion of the purely descriptive. Thus, it is not, as ethnomethodoligists claim, enough to simply report the actions that are observed, it is necessary for sociologists to move beyond the observations and try to understand the processes that define and constrain interactions. These are the social facts that Durkheim defined in his methods as: "any way of acting, whether fixed or not, capable of exerting over the individual an external constraint; or which is general over the whole of a given society which have an existence of its own, independent of its individual manifestations" (E. Durkheim, 1982).

Additionally, Durkheim, while best known for his macro sociology, does not exclude the social psychological aspects of society, stating that "[t]he primary origin of social processes of any importance must be sought in the constitution of the inner social environment" (E. Durkheim, 1982). Despite Garfinkel's claim that Durkheim reversed the order of importance in regards to his definition of social facts, this definition properly

matches the view of sociology as the study of society—and not of the individual (Garfinkel, 1967). Thus, the facts within the field must pertain to the societal level mechanisms that promote, constrain, or shape actions and *not* the individual actions themselves[11].

Rounding out the classic trinity of theorists, Max Weber defines 'sociology' in terms of a lower level of analysis as "the science whose object is to interpret the meaning of *social action* and thereby give a *causal explanation* of the way in which the action proceeds and the effects which it produces" (Weber, 1994). Through this definition, Weber moved the interest of sociology from the study of the society to the study of the actions of *social*[12] actors within society, or at least broadened the field of interest for sociological research to include a more micro level of social organization (Woodman, Unpublished). Further, by clarifying the definition to focus on the causal explanations, Weber defines sociology in a way that brings it in line with the sciences proper whereas both Marx and Durkheim straddled the line between interpretive philosophy and explanatory science. However, that is not to remove the interpretive philosophizing from sociology as every scientific field has theories based on empirical observations and (in some cases) predicted observations when it is not yet possible

[11] I should note that I am not excluding individual action as an object of observation—individual actions/interactions with the social setting and other individuals are a critical empirical tool to understanding social facts. However, individual actions are not of analytical interest insofar as they are viewed as having limitless possibilities. The criticism of the "cultural dope" of social facts fails to take into account that all of science places constraints that seek to classify and understand the object from a general perspective but (in only very rare cases) is that general perspective always the case—it just needs to be the case "often enough" (this is why we look at statistical significance and never make claims of proving—rather we discuss trying to falsify a claim).

[12] Emphasis here is placed on the word social, implying that the actions involve or relate to other people. The study of the individual mind falls within the confines of psychology.

to test the causal processes[13]. Weber also established an improved version of Durkheim's comparative sociology through his ideal types methods, thus allowing sociologists to easily create classification systems necessary for the budding science (Weber, 1904).

While each of these three canonical sociologists define the object of sociology in slightly different terms, similarities exist that bring us back to the root definition that began this section. First, all three theorists treat and/or define sociology as a science[14] and separate it from the former metaphysical traditions of philosophy. Second, they firmly ground it within that which is meaningful to social actors; all three canonical theorists place an emphasis on the idea that generalizations can be made in order to examine structures and interactions. Third, all three canonical theorists understand that the socially constructed world could have taken different paths, but the focus is on why the world is constructed the way it is and not another (E. Durkheim, 1982; Tucker, 1978; Weber, 1994). Without this focus on the social forces that are in operation, rather than all possible actions, sociologists would simply find themselves in an endless debate of phrases and words rather than the world as it actually exists[15]. As such, the focus of sociology for all three theorists is the study of (e.g. forming an understanding, establishing knowledge of) society (defined here as any organization of two or more individuals and the rules and interactions that allow them to establish mutual intelligibility[16]). [17]

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[13] Theoretical physics is a great example of this, where many of theories are currently impossible to evaluate. Theories about the origin of the universe also fall under this category.
[14] By science, I mean an attempt to understand the causal processes through empirical means of observation, data collection, and/or historical analysis.
[15] I will touch on this more in an evaluation of contemporary theorists. Derrida and his academic descendants were particularly guilty of this.
[16] In using the terms mutual intelligibility, I do not mean to exclude conflict and disagreement from the proper domain of sociology as they are equally important to the

Examining the Contemporary Definition

While contemporary sociology has broadened considerably since Weber, the core definition of the field still exists. One of the leading contemporary theorists, Randall Collins, defines sociology's intellectual justification as "the formulation of generalized principles, organized into models of underlying processes that generate the social world" (R. Collins, 1989). Collins, however, appears as just one among a slew of competing views in sociology and he also stands as one of the contemporary theorists working to build on top of the classic theorists' works. I mention this here to show that not all of sociology has rejected its roots and some branches remain attached to the tree. It is the branches that have grown free from the trunk that must be sawn off in order to restore sociology to the sciences and end the epistemological wars that every other discipline has managed to move past by now.

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concepts of cooperation and agreement. However, I do think that some level of mutual understanding of interactions is necessary for it to be social—even if that understanding is a *mis*understanding that may lead to conflict or a *dis*agreement where the actors understand each other but have different ideals, goals, etc.

[17] This definition of society is admittedly broader than the common dictionary definition, which primarily classifies societies as a higher level of organization (e.g. community); however, as all canonical theorists do discuss, at least briefly, the social psychological interactions I felt it important to expand the definition to include dyads and small groups. It should also be noted that a key part of this definition is what is *excluded*, namely individual meaning making appears of no interest to any of the canonical social theorists—and for good reason, as what one individual thinks or constructs is of no social use or meaning unless there is agreement by at least one other individual at which point it becomes social for that group. There is no unit of analysis, in the social sciences, smaller than a dyad and the dyad should be treated as a single unit—as what each individual thinks is irrelevant, what is relevant is what each understands that allows for interaction to occur (Runciman defines this as meaningful action; Weber 1994:7). Thus, the table does exist so long a interactions with two or more social actors form a mutual meaning of the table. It is irrelevant if their internal image of the table is different so long as they are able to utilize it within the course of interacting. Also, noteworthy, is the focus is on *understanding* the structure or rules that confine, define, construct, etc. the social world as it currently exists.

At the extreme opposite end, stand the relativists/deconstructionists who reject the classic theories as inherently incorrect. Among these, Edwards in his piece on "Death and Furniture" discusses the deconstructionist view that there is no reality and that all "social facts" can be deconstructed so that a table only "actually exists" for the individual pounding their fist on the table and even then only the portion of their fist actually touching the molecules of the portion of the table, etc. (Edwards, Ashmore, & Potter, 1995). As seen from the foundational definitions of sociology (that which we do *not* have the right to change) this squarely falls outside of the domain of interest to the discipline. These are irrelevant arguments of semantics that do not seek to gain greater understanding of the social system that people, wishing to interact with other people, must take into account[18].

The argument that those who reject the classic theorists make is that by looking only at mutual intelligibility and shared action; we constrain a plurality of voices into the single voice of the analyst. Such opinions put far too much value on individual humans and take away from the collective nature of the species, which serves as the focal point of sociological research per the definition of the discipline. Every individual does have a distinct voice and opinion that may differ from the collective whole; however, each individual must constrain one's actions to fit within the social mechanisms or consciously break the mechanisms and form new social bonds in order to avoid being ostracized. One social theorist in this camp promoting a plurality of voices, Bakhtin, has a discussion of plurality of voices in the novel

[18] A point of clarification here is that sociology does, and should, take into account antiprograms and subcultures; however, such studies need to take into account that individuals who act against the social mechanisms typically must do so *consciously* and the area of sociological interest is in groups that participate in these antiprograms, not individuals who independently reject the social mechanisms (as previously stated, the study of individuals should fall under the realm of psychology—or partnerships with psychology).

versus the synthesis of one voice within poetry[19] and how this plurality of voices is the proper lens to view the world (Bakhtin, 1981). Again, while the plurality of voices in a social situation is, of course, present what matters is not what each individual thinks or does but what each individual thinks or does as it relates to a mutual intelligibility of the societal group or frame in which the actions or speech occurs—that which exists as the true social reality (E. Durkheim, 1982). The "truth" of the matter is that if we act or speak in a way that is *not* intelligible to the group or society we fail to affect the situation and other social actors and, as such, we fail to perform a social act[20]. However, if that said failure in mutual understanding results in actions to try to create mutual understanding—such as a tourist in a foreign country gesturing to fruit she wishes to buy in order to help the merchant understand her desire to buy the fruit—then these actions of failure to create and the process of creating the mutual understanding do become part of sociological studies. Only when the actions or thoughts occur on the individual level without the intent of mutual intelligibility or shared action does it fall outside of the domain (e.g. when the intent is to explore how an individual understands an act rather than how the group, as a whole, understands an act then that is

[19] Having a creative writing background, I have to say that I find his conception of the novel and poetry somewhat ill-informed. Poetry, as a form, is considerably more versatile than the novel which still has an underlying structure even in some of its most experimental forms as our understanding of a novel requires certain elements to be present for it to be accepted as a novel. A poem though is essentially a picture painted by words and the versatility of the poem in its ability to convey multiple meanings and expressions while still being recognized, as a poem is almost endless. It is true that many traditional forms of poetry, such as haikus, are incredibly restricted in form, but the modern poem is anything but restricted. I should add the caveat that my knowledge of poetry is somewhat limited—my primary focus as a creative writer was in the dramatic works of screen and stage plays (where the author's voice is all but non-existent in favor of the characters, director, actors, etc.).

[20] This is not to deny that the socially unintelligible does not occur, that is simply to state that since it is not social (no social understanding occurs), it is outside of the domain of sociology.

outside of the realm of sociology as the unit of analysis then becomes the individual rather than the social).

One last argument of deconstructionism will be mentioned here in Baudrillard's discussion of neo-realism, hyperrealism, and simulation (Baudrillard, 1983). In this discussion, Baudrillard claims that social actors are being deceived into believing they live in a reality that no longer exists through the hyperrealism of places, where places like Disney Land exist to reassure social actors that because Disney Land is a place of fantasy the world in which they live, work, and interact is the real (Baudrillard, 1983). Once again, I do not contend to reject the argument (since this is a relatively recent phenomena with no historical parallel, Durkheim is mute on the subject), but I do contend that Baudrillard, like other deconstructionists, is asking the wrong question for a study of society.[21] In this case, whether the world that social actors live in is real, neo-real, hyperreal, or simulated is not the point—the point is what the social actors in their interactions with each other establish as existent or factual. If two social actors within a virtual reality simulation (to make a true simulation of the argument) think and act in a way that treats a virtual table as a table, is not the table a real social fact within the mutually intelligible system of interaction? Even if they are fully aware of the non-existence of the virtual, simulated table it still exists as a fact within the context of their interaction within the social world. However, the question of how social actors are able to deceive other social actors into accepting the neo-real, hyperreal, and simulated world as

[21] While not a question for sociology, I believe that these questions should be explored whether in philosophy or a new branch of sociology that focuses on issues of inequality, since many of these issues of reality vs. hyperreality are directly tied to inequality and the power elite's manipulation of the masses.

real *is* a question for sociology as it is looking at what establishes a socially grounded mutual understanding of why the social world is constructed the way it is and not another.

As we examine this issue of the multiple threads of "sociology" that have emerged in contemporary thought, we will discover that those who reject the foundational conceptions of the discipline in favor of a "new" sociology do so by simultaneously rejecting sociology as a scientific discipline. Indeed, deconstructionists and other, less deviant, branches not only reject the discipline's traditional focus on scientific inquiry but also reject empirical evidence as a valid source of knowledge. In doing so, these errant branches falsely claim to represent sociology whilst simultaneously rejecting the elements of sociology that define the field—namely the examination and classification of social mechanisms that define social action. Rather, these branches recall a time before the Enlightenment and move out of sociology into philosophy, or (finding themselves rejected there), should start up a new discipline where they can accept all forms of knowledge without anyway of qualifying it—so long as it is logically consistent (Tierney, 2002). Furthermore, this lack of examination of causality through contemporary theories that fall outside of science return to pre-Aquinas descriptive reporting accepted at face value (Stump, 2003).

3. Sociological Methods

This problem of what constitutes knowledge in the discipline brings up the issue of sociological methods. Namely, it is necessary to establish ways of collecting and analyzing data in order to test hypotheses and have a uniform acceptance of knowledge in the discipline. Without establishing valid forms of inquiry, in addition to establishing a core

definition of the field, members of a discipline cannot hope to be able to properly evaluate contributions to the field and build on to the understanding of the object of study[22].

Methods, unlike definitions and core disciplinary values, change fairly fluidly within disciplines as disciplinary concepts become better defined and new tools for measurement are invented. It is both the right as well as the imperative of scientific disciplines to invent new and improved ways of answering the core questions. However, this is an area of significant weakness in sociology, one that Randall Collins attributes to the disciplines inability to find technological tools to improve the rapid discovery and high acceptance of disciplinary knowledge (R. Collins, 1994). Of course, this stagnation of methods is likely intimately tied to the division in the field over what constitutes knowledge—a problem associated with a deviation from the founding concepts of the discipline. The reason for this stagnation in methods, associated with lack of agreement on an epistemological and theoretical core to tie all branches of sociology together, is due to the fact that methods must fit in with what a discipline sees as its form of knowledge (epistemology) in order to be accepted and thus advance. Despite sociological methods essentially stagnating, it has managed to import and adapt methods from other fields including structural equation modeling, ethnography, and simulation—among others.[23] I should clarify that I am not contending that sociological

[22] The obvious protest here is that by doing so, we exclude voices; however, if the knowledge our discipline has acquired teaches us nothing else, we should understand that in order to have a functioning social unit there must be mutually agreed upon conceptions. A state of anarchy, while great for individual freedom (until somebody, armed to the teeth, subjects everybody), is not conducive to academic disciplines—particularly ones whose definition focuses on that which is shared.

[23] This is not contending that sociology had no role whatsoever in redefining these methods for its own discipline, but these methods were primarily developed in other social science fields including economics, psychology, and anthropology. The field of statistics has also helped advance quantitative methods in sociology just as it has with many other disciplines.

methods have been stagnant since Weber, sociologists were critical in the creation of focus group methods (Kaufman, 2003), advancement of survey design (Salant & Dillman, 1994), and refinement of the methods created prior to the epistemological wars of the 1960's.

Qualitative methodologists may disagree with this assessment of sociological methods since many of the qualitative methods have only seen real advancement in the post-1960's era with the downfall of pure positivism. However, Garfinkel's ethnomethodology lacks any theoretical underpinnings and does little to advance the state of the discipline, although it has uses in applied work (Rogers, 2004). In fact, since qualitative methodology (to be separated from methods) is conducted under an epistemological framework that does not allow for generalizations, I contend that it is only useful in either the exploratory stages of research and in heavily applied research intended to find a solution for a specific problem within a specific location where a quantitative approach would be too time consuming or costly. Additionally, the methodological debate has already happened at least twice historically—once between Plato and his student Aristotle and again with the end of the medieval period and beginning of the Enlightenment. Both times, scientific disciplines have adopted objectivist stances in the advancement of knowledge. Returning to the epistemological wars of the 1960's, psychology and other social science disciplines opted to adopt stances closer to positivism than constructivism, albeit with some modification to better account for individual differences. While sociologists can "fight the power" and reject the accepted epistemological stances in the sciences, doing so would also reject the core of what sociology was defined as, forming a wholly new discipline that should take on a different core and different name. Additionally, such a rejection and a discipline formed on epistemologies that do not allow for generalizations and only narrow descriptions or

applications would be unlikely to fair well in a competition for the scarce resources at universities and the world at large and would likely have a short lifespan unless it forms a properly applied mission (much as engineering disciplines do not contribute to knowledge, proper, but are highly successful due to the problems they solve).

Historical Foundations of Methods

Qualitative methodologists seem to lack historical perspective of the intellectual origins of the framework they work under, often dating it no further back than a few hundred years (Dourish, 2004). However, the origins are more properly attributed to Plato, specifically his Allegory of the Cave, where he discusses how one's understanding of the world depends on the context within which one acquires knowledge (Plato, 1963). It would be difficult to find a modern social scientist, regardless of epistemological or methodological stance, who would completely dismiss this premise. Indeed, the classic theories acknowledge these individual differences as well and were part of the motivation behind Weber's ideal type method (E. Durkheim, 1982; Weber, 1904). Thus, constructionists have not really discovered some new way of looking at the world or some new "truth," rather; they have sought to revert sociology from a scientific discipline back to a philosophical one. In order to make this case, I will look at the historical foundations of scientific study beginning in the transition into the Enlightenment.

How the Enlightenment shaped the rise of the modern social sciences has both a straightforward and complex answer. The straightforward, simple answer is simply that the Enlightenment gave the modern social sciences an objectivist viewpoint and empirical methodology that has given it scientific rigor and broken it from its humanistic roots of

earlier periods where the great minds of the day would simply write about their observations of man made by the great philosophers (Woodman, Unpublished). Even more simply put, without the Enlightenment, it is very likely that the social sciences would not be classified as a science and instead fall under the umbrella of the humanities. Furthermore, I would contend that the foundational theories of the social sciences would not have been possible without the Enlightenment since previously there had been little effort to analyze observations in a way they could be applied to phenomena and social structures, but due to the thinkers such as Comte and Hobbes efforts were made to analyze the elements of social systems and rationalize them (Bobbio & Gobetti, 1993; Lenzer, 1998). Thus, the simple answer to the question: everything that makes the social sciences a science and upholds the social sciences to the rigor, objectivism, and validity of scientific research comes out of the Enlightenment. Furthermore, while previous social philosophers such as Plato and Aristotle sought to understand the world, it was only during the Enlightenment that the philosophers, turned social scientists, sought to *change* societies and free them from religious oppression (Louden, 2007).

While it is true that late Medieval and early Renaissance thinkers such as Thomas Aquinas and William of Ockham had rationalized theories to explain the world and a requirement that arguments must be backed up by proof, it was not until the Enlightenment that rigorous methods and support for rigorous evaluation were developed with the work of Kant and others (Louden, 2007). The Enlightenment also gave positivism to the social sciences through the work of Comte, and while modern scholars reject many of the premises of positivism the influence it had on forming modern social thinking cannot be denied (Lenzer, 1998).

The consequences of the Enlightenment's influence on modern social thought and the current backlash by some social scientists who appear to want to discard the advancements to the social sciences made during the Enlightenment represents a good portion of the disciplinary struggle. As Louden notes in his introduction to *The World We Want*, the criticisms of the Enlightenment range from charges of sexism and racism, that the ideals seek to teach conformity and suppress individuals, to the fact that many of the ideals have fallen short of the predictions and desires of Enlightenment figures (Louden, 2007). I, personally, find some of these criticisms at best ignorant as they fail to take into account historical context of the societal norms of the time (that Enlightenment thinkers were already getting thrown into jail for pushing the boundaries of) and at worst destructive to the progress of the social sciences. To be clear, I do not believe these followers of constructionism and subjectivism will destroy social thinking, but I do strongly believe that they are misled in their belief that they are advancing social thinking and theory as the act of observing, documenting, and providing personal interpretations of social activity is as old as Greek philosophers such as Plato (Crotty, 1998).

It should be noted that while constructionists do not usually reject the findings brought out by Enlightenment-grounded social sciences, they do take individualistic interpretation of data to an extreme point that is at once very modern and very Western, although I think it would be a hard fought battle to get a constructionist to admit the Western philosophical groundings of the epistemology. In some ways, in fact, constructivism carries on some of the Enlightenment ideals by advocating for thinking to enact change, not just explain phenomena, and by advocating for an anti-authoritarian stance on research--only now

the sciences and rational thinking are viewed as the authority to rebel against rather than church dogma (Vogel, 1996).

Just as constructionists are wrong to completely reject empiricism, I believe it is equally wrong to completely dismiss constructionism as a misguided attempt at creating social justice. There is validity to the claim that a purely empirical approach ignores, or at least does not fully account for, irrational behavior, immeasurable entities such as feelings, and effects on individual actors taken apart from the whole (Vogel, 1996). While a pure empiricist may argue that such irrational, immeasurable variables are not in the realm of science as they cannot necessarily be generalized or predicted, I would argue that they still inform the situation and taken with empirical evidence as well as measures that convert some qualitative data to quantitative data, such as video coding, the data become more powerful and new solutions may become apparent. Mixed methods are, of course, nothing new, but if you not only use diverse methods of data collection but also use diverse epistemological foundations in interpreting the data, then researchers may find powerful interpretive evidence to convince policy holders and other scientists of the presence of social problems and back these problems up with stronger theories and actionable plans aimed at solving the problems.

In sum, if not for the Enlightenment, the social sciences would not exist and the observation of human organization would be left to the humanities where they would discuss how things are but neither theorize on the why nor how of it nor use those theories to create solutions to human problems. This world, in the absence of the Enlightenment, is alarmingly similar to the direction I view followers of constructionism to be taking. Constructionists seem to be obsessed with wanting to reinvent the wheel, and the social sciences seem doomed as a science if this epistemology ever becomes dominant. Despite this, the past two

hundred years since the Enlightenment has taught us that a pure positivism cannot explain all social behaviors and structures let alone offer solutions and theories that capture all social activity.

Classic Sociological Methods

Having established the historical foundations of sociological methods, I turn now to a summary of the classic sociological methods inherited from Durkheim and Weber. The focus of this evaluation will be both on how these methods may still be utilized in modern sociological research as well as ways these methods have been replaced or extended by more contemporary methods imported from other disciplines. Since theory and methods are intimately linked, an evaluation of the methods is necessary as we begin to look at how sociology can be resurrected and reestablished as an instrumental scientific discipline of understanding and a lens for fixing social problems.

In *Division of Labor in Society*, Durkheim establishes the social facts that cause the division of labor: "The division of labour varies in direct proportion to the volume and density of societies and if it progresses in a continuous manner over the course of social development it is because societies become regularly more dense and more voluminous" (E. Durkheim, 1997). Here, Durkheim established the forces (social facts) that lead to the division of labor as increasing density and voluminous in society, which he establishes as often mistaken for the effect of the division of labor when it is, in fact, the cause that necessitates the development of labor division. In these ways, Durkheim established the meaning of a social fact and the process of establishing a social fact that social scientists still use today.

However, unlike Durkheim's use of historical societies as a means of comparison, contemporary sociologists use experiments or examine modern societies more often when looking to make comparisons. For example, contemporary theorist Cecilia Ridgeway discusses small group experimentation that isolated the causes that lead small social organization to discriminate against members through "diffuse characteristics" (such as gender) that leads members to perceive a collaborator as less than equal despite the metric having no direct relation to the task (Ridgeway, 1993). The exact model that Ridgeway posits is that expectations are formed by social actors within a system by other social actors based on "status characteristics" and these expectations are then used by the group to determine how much weight to give the opinions of that social actor (Ridgeway, 1993). In a similar way, Sapp conducted comparative sociology through a field experiment that had one set of participants receiving no literature on food irradiation and another set of participants receiving literature from trusted organizations supporting food irradiation and other organizations opposing food irradiation, through this experiment he was able to demonstrate that innovation diffusion theory operates in the same way the model predicts (Sapp & Korsching, 2004).

In his *Rules*, Durkheim makes the key statement that "the utility of a fact does not explain its origins" (E. Durkheim, 1982). Ridgeway follows this rule her work as she discusses how social expectations have an effect on group decision making; however, she makes clear that these expectations are in turn caused by status characteristics, which are mitigated by sanctions on non-normative behaviors and through the activation of legitimacy claims (Ridgeway, 1993). Similarly, Lewis Coser in his discussion of the social function of conflict in society discusses how conflict can play an invaluable role in maintaining society

by preventing a major split between two ideas--the utility of conflict (Coser, 1964). The origins of conflict are explained less explicitly but it seems to be assumed that in Coser's argument conflict is a natural state resulting from differences between individuals that takes on different forms based upon the structure of the group—in this way his argument is somewhat tautological as the structure of the group partially determines the way conflict is handled but conflict within the group is responsible for maintaining its structure (Coser, 1964).[24]

Rules references *Division of Labor* where Durkheim discusses how he had previously established the utility of a social fact in the manner he prescribes, "we have explained the constant development of the social division of labour by showing that it is necessary in order for man to sustain himself in the new condition of existence in which he is placed as he advances in history" (E. Durkheim, 1982). In this way, division of labor has been established as a social fact with the original utility of ensuring the continued existence of society so it both has utility and is a social fact. However, this explanation that Durkheim gives in *Rules* based on *Division of Labor* ends up breaking a later rule: "when one undertakes to explain a social phenomenon the efficient cause which produces it and the function it fulfills must be investigated separately" (E. Durkheim, 1982). In the previous explanation of the division of labor, Durkheim discusses how it resulted from the necessity for man to sustain himself and thus the function (sustaining man) is the cause that led to the division of labor. Coser, too, fails to fully follow this rule as his explanation of the function of conflict is tautological and

[24] As an aside, one of the issues facing sociology is that there are multiple, conflicting groups within the discipline that no longer have the shared connection. Coser's theory, turned on the current discipline of sociology shows significant splits within the solidarity that make it an unsustainable structure rife with internal conflict and vulnerable to outside invaders.

appears to be both the cause and effect of the structure it takes place within (Coser, 1964). Comparative sociology, to a degree, helps mitigate this problem but Coser used comparative methods to explore conflict and rather than exposing the cause, it seems he merely exposed different effects—something Durkheim discusses as the trouble with the apparent 'plurality of effects' until nuanced classifications can be exposed (E. Durkheim, 1982). Despite these failings, such theories do still serve as a jumping off point for further development and refinement as sociologists try to better isolate variables and investigate the causes.

To me, the only way to truly solve this problem of avoiding collusion between the cause and effect is to run experiments with isolated conditions. While such methods would have previously been impossible in sociology for anything larger than small groups, new technologies are quickly allowing us to realize methods of testing social theories. Through the power of virtual worlds, where all elements of social constraint can be manipulated, it is becoming possible to run experiments with large groups of individuals within simulated societies (Bainbridge, 1987; Mennecke, Triplett, Hassall, & Conde, 2010). Like the early psychology experiments, there will likely be flaws in studies that use virtual worlds as a means to test theories but as the virtual worlds become finer tuned and sociologists learn better ways of exploiting the use of virtual world, and other technologies, it may finally become possible for sociologists to perform comparative sociology through true experimental methods. Additionally, the increased use of ubiquitous technologies allows for mountains of possible data on the movements of people and allows for participants to input information and thoughts on interactions at any point in time and in any location. Data collected in such a manner, if done ethically, would allow for new insights into behaviors and interactions that were previously impossible to collect and quantify *en masse*. In *Rules*, Durkheim stated that

only through conducting an experiment in isolation, a task he though both impossible and impractical, could one truly determine the cause of an effect in a set of given circumstances (E. Durkheim, 1982). While that isolation still will not be completely possible, it should provide a reduction in the number of variables and provide a more practical framework in which experimental methods can be employed.

Whereas Durkheim focused almost exclusively on the causes that led to the creation of functional system pieces (stating that the function is the effect), Weber does not argue that the function is the effect of various causes but does argue that we must start from the function to "determine which social action it is important to interpret and understand if we are to explain a particular system" (Weber, 1994). Similarly, Weber does not stop at the functioning system as the focus of his analysis and calls for an attempt to understand *more* than what the natural sciences are able to learn about their objects of inquiry:

> "[W]e are in a position, not only to formulate functional interrelations and regularities (or 'laws'), but also to achieve something which must lie for ever beyond the reach of all forms of 'natural science' (in the sense of the formulation of causal laws governing events and systems and the explanation of individual events in terms of them). What we can do is to 'understand' the behaviour of the individuals involved, whereas we do not 'understand' the behaviour of, say, cells." (Weber, 1994).

In some ways, I disagree with Weber on this matter, as the field of individual understanding seems better suited to psychology (and other disciplines) and less within sociology; however, in the case of how the individual fits into the group that seems to be within the domain of a study of societies/groups (it is only when you begin looking soley at the domain of the individuals interpretation that you enter a grey zone). In fact, later, Weber does make a statement that places the study of the individual clearly within the context of the group/society: "For the question which must always be asked first before the real empirical

work of sociology can begin is: which motives led and continue to lead individual functionaries and members of this 'community' to believe in such a way that it came into being and continues to exist?" (Weber, 1994).[25] The question is not 'how does an individual actor understand the world' but 'how does an individual actor accept and find himself/herself belonging to the system in which they exist'--or, in Weber's terms, "The formation of function concepts, in terms of relationship to the 'whole', is simply part of the preliminary work" (Weber, 1994).

In order to account for individual differences while still squarely focusing on the shared understanding of the group, Weber developed his ideal type method of examination to look at groups and group structures. At its most basic, an ideal type is simply those defining characteristics (or 'factors') "all of which must be just as they are and not otherwise" that define a phenomena or social organization (Weber, 1994). However, that is not to make the mistake of defining the 'ideal type' as one form that all other forms should seek to attain. Rather, it is a matter of finding those causes that have a "'general significance' and on that account of historical interest […] not with the total individual course of events, but with those elements which are essential if the events are to subsumed under norms [… and] not interested in the infinity of 'absolutely' trivial details" (Weber, 1994). In short, this means that the ideal type should not try to represent one single, specific case, but it should be a measuring stick by which phenomena and organizations can be compared. As an example, an ideal type created for engineering should not seek to classify one specific engineering

[25] Note, too, that Weber does not talk about multiple realities—his focus is squarely on the reality that has been socially constructed, not on all possible realities/interpretations of that reality.

discipline (e.g. mechanical engineering), but it should provide a basic frame by which engineering and non-engineering disciplines can be examined in order to determine:

1. if it fits within the metric of the ideal type and
2. what are the unique characteristics (the details ignored in the creation of an ideal type) that makes it distinct from other instances fulfilling the criteria of the ideal type.

As Weber puts it "an individual circumstance is insignificant" regardless of whether or not those circumstances played a direct part in causation or not, this is because the individual circumstances do not allow for a phenomena or organization to be generalized in a way that can be easily compared to other, similar, phenomena and organizations since the comparison is only made possible through first creating an ideal type that produces a metric of comparison (Weber, 1994). Weber goes on to discuss the importance of this abstraction as critical in the process of judging possibilities (e.g. serving as a metric):

> The very first step towards an historical judgment is thus […] a process of abstraction, which proceeds by means of analysis and isolation in thought of the constituents of what is immediately given, seen as a complex of possible causal relationships, and which should result in a synthesis of the 'real' causal connections (Weber, 1994).

Thus, by stripping away the specifics and thoughtfully abstracting to the primary causal components, we are able to judge why something is the way it is and not another by comparing it to the generalized, abstracted view that is the base case (n of 1) intended for comparison (Weber, 1994).

While ideal types are still used by contemporary sociologists, particularly theorists trying to understand phenomena (Krier, 2005), the process of creating metrics of a phenomenon through a series of factors has been refined to a point where it can be done quantitatively through structural equation modeling techniques (Bollen, 1989). Techniques

such as principal component analysis, an exploratory form of structural equation modeling, have been used to refine surveys and create indices to measure abstract social phenmona, such as team climate (Kivimäki et al., 1997). More advanced uses of structural equation modeling, use it not only as a metric but to refine causal theoretical models such as Munro's use of path analysis to explore higher education drop out rates (Munro, 1981). Since these examples rely on researchers to break a social phenomenon into components and examine the causal processes that take place, it should be clear that they are the spiritual successor to Weber's ideal types with additional scientific rigor that, until computer tools were invented, was difficult or impossible before.

4. Resurrecting And Restructuring Sociology

I began this essay by stating that sociology, as a discipline, has died (or is at least on life support); however, sociology still has much to offer the world and the time has come to evaluate how we can resurrect the discipline. As I have worked through the foundations of the discipline and the defining methodological approaches, it should be clear that in order to reconnect with the roots some branches of the discipline must be sacrificed. While, I am sure, other solutions exist and there may even be those who do not believe sociology is a dead (or dying) discipline, the solution proposed here is intended to be a proactive form of restoring the discipline to its previous level of academic prestige and establish a future-centric agenda for sociological research.

Pruning and Salvaging

Before delving into the future of the discipline, we must first try to rectify the fissure that has separated *some* contemporary sociological work from the core and then a discussion of a selection of theoretical works that have extended the core.

Classic Critique of Contemporary Approaches

To return to Durkheim, the critique of modern social constructionism is seen in his critique of Spencer, who Durkheim accuses of substituting a "certain conception of social reality" for that reality (E. Durkheim, 1982). Through this, Durkheim is not denying that the world is socially constructed, indeed, he criticizes those studying ethics at the time for not understanding and accounting for the social fact that there is no innate ethical or moral consideration, rather it is socially imposed based on the interactions and observations of social actors within a given social sphere (E. Durkheim, 1982).[26] Most critically to the argument, Durkheim very explicitly excludes the internal construction of knowledge: "states of consciousness can and must be studied externally and not from the perspective of the individual consciousness which experiences them" (E. Durkheim, 1982). This is precisely the point that social constructionists and deconstructionists, while not necessarily wrong in their theories, are asking entirely the wrong questions for a study of societies and what composes the social world. He goes on to explain how "[b]y their very nature social facts tend to form outside the consciousness of individuals, since they dominate them" (E. Durkheim, 1982).

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[26] Incidentally, this is why the argument that classic theorists should not be ignored simply because they do not value females or minorities: the societal values and norms were different at the time and they were socialized into certain ideals the same way each of us are socialized into the beliefs and values we hold (no matter how "anti-establishment" we claim

The idea that the social dominates the individual consciousness has taken heavy criticism over the years by social scientists, particularly those within the anti-essentialism (anti-identity) "theoretical camp"[27]. Before I get into a critique based on Durkheim's notion of social facts, I should point out that not all anti-essentialism theorists fall outside the realm of the originally established base of sociology. One particular theorist, Cecilia Ridgeway, I found particularly admirable for her efforts in theorizing and modeling the social forces that act upon individuals through expectation states theory and determining mechanisms that could create a counteracting social force to change the interactions of social actors toward one another (Ridgeway, 1993). Patricia Hill Collins, on the other hand, establishes standpoint theory for the black feminist epistemological foundations, where knowledge is only accepted when it has been established through lived experience rather than taking an objective view of the world (P. H. Collins, 2000). Here, I think Durkheim would both agree and disagree with Collins, as he would agree insofar as he would find it correct that different groups have different conceptions of ideas including morality and possibly knowledge (although he does not discuss knowledge as being different between groups); however, I think he would object to the idea of looking at a social fact from the individual experience rather than what has been established as an observable, social reality (E. Durkheim, 1982). As such, standpoint theory would fall outside of the foundations of sociology due to its focus on individual

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to be, we have likely adopted our values through interactions with others and their reinforcement of our values).

[27] One thing that strikes me about some people who support these theories is that they are quick to label things as American idealism/imperialism/etc. yet they do not stop to think (or at least don't seem to want to admit) that an egocentric view of the world of individualized identity is about as American as one can get. No nation has a more individualized population than the United States, which is probably why these theories find their greatest popularity with American theorists (Hofstede, 1993).

meaning making; however, the ideas and theory itself might serve as an object/subject of social fact that could be examined within the base of foundational sociology. Similarly, Butler's gender theory falls into a gray zone of being neither completely outside of the foundational underpinnings of sociology nor within it as it does see social forces at work in creating identities but then the theory seeks to explain the fallacy of those socially constructed identities—it seeks to reject what is mutually intelligible to society, the social fact itself (Butler, 2004).[28] Durkheim not only allows for individual deviation from a 'norm', but in fact states that: "The state known as health, in so far it is capable of definition, cannot apply exactly to any individual, since it can only be established by the most common circumstances, from which everyone deviates to some extent" (E. Durkheim, 1982). Thus, Durkheim does not contend that there is some uniform identity that all social actors conform to, rather that there is a vague generality that people deviate from, but through social interactions have formed a common grounding that can be used for practical reasoning about social interaction within a society.

The last school of thought we will look at through Durkheim's critique is that of the dialectic, rhetoric, and language theorists. Durkheim's discussion of the topic of language and rhetoric can be equated with his discussion of how a normal type can be defined when what is normal varies based on a society's conception (just as what is understood varies

[28] I should note here that it is not my intention to say that social facts should be established as facts forever. But until the mutual intelligibility of a fact is no longer the case, it remains a fact. Simply providing examples that show social actors can be made to believe that a man is a woman and vice versa through drag does not delegitimize the fact that social actors still believe there is a difference between what is male and what is female. However, it would be right, if empirical facts back it up, if social interactions do not proscribe an identity as a finite object, just as Durkheim contends that crime is normal since it is impossible for a society to exist without it (Durkheim 1982:98-103).

based on the language one uses and the language of the audience one speaks to): "[i]t is always by a great display of dialectic that [questions of normal or abnormal character of social facts] are resolved" (E. Durkheim, 1982). Durkheim discusses this problem of disagreement about what is and is not a social fact: "if the most general facts can be pathological, it may well be that the normal type has never really existed. Hence what use is it to study facts? They can only confirm our prejudices and root us more deeply in our errors, since they spring from them" (E. Durkheim, 1982). Thus, we see that Durkheim does not deny that there is an aspect of rhetoric and language in defining the social world. Language theorists, such as Derrida believe that language should be circumvented to uncover the plurality of meanings through the production of new traces and freeing oneself from the bounds of a single language (Derrida, 1976). Durkheim, however, views the constraints on language and the production of norms as exactly the social point: "[i]f normality does not inhere in the things themselves, if on the contrary it is a characteristic which we impose upon them externally or, for whatever reason, refuse to do so, this salutary state of dependence on things is lost" (E. Durkheim, 1982). In other words, if we choose to endlessly debate what is meaningful or what is a "norm" or what is a "social fact" we will find that our science does not progress.[29] Just as a group interacting must form a sense of mutual intelligibility in order to cooperate to accomplish a goal, we must do as every other science has done and accept that there are alternative explanations but for the sake of moving forward in our science we

[29] In fact, that is precisely what we have found in the forty years we have failed to readopt the previous core or find a new cornerstone in the discipline. It is precisely these debates that have led to the downfall and fracturing of the discipline—it is time for a split to occur and for one side to inherit the discipline and the others (because there is more than one major split) to move elsewhere.

must mutually accept assumptions that allow us to get 'close enough' to an explanation about a phenomena that might be further refined through future research.

The ideal goal of science may be to understand all phenomena with high precision, but the practical goal of science is simply to have as good of an understanding as we can given the current assumptions and current limitations of data collection and analysis, realizing that our understanding may be refined or replaced in the future as new phenomena and facts are uncovered.[30] If we do not do this, then we get to a state where mutual intelligibility becomes impossible and all claims of knowledge are accepted as fact. In such an inclusive of all knowledge world, our discipline will never move forward and will be restricted to simply detailing multiple views of the same phenomena and failing to make any substantial intellectual or practical advancements as can be seen in Honan et al's study of "Hannah" (Honan, Knobel, Baker, & Davies, 2000). With that said, some discussion of language is necessary for the advancement of sociology as much of the current language still paints societal activity in broad brushstrokes rather than attempting to refine the social facts or phenomena in a clearly distinguishable way and for this, we may find help in Whorf's exploration in language and logic (Whorf, 1956). It seems that the best way to describe social phenomena and facts is not in creating clearly distinct words through Indo European language structure, but rather to use a language with relational structures to create a building block description that will cover the main 'category' of social phenomena or fact and provide some indication of some of the deviant properties it exhibits (in a way that may mirror

[30] Our understandings may also be replaced as society changes since society is far from static.

Weber's ideal types). Thus, we could then more readily and succinctly describe and compare two similar but dissimilar societies.[31]

Extensions of the Trunk

Not all contemporary sociologists have diverged from the core foundations of the discipline, several, while rejecting some of the original concepts of the classic theorists, have found new ways of exploring the discipline or created new extensions of our understanding that strengthen the discipline. Several of these theorists have adopted concepts from the divergent branches in order to improve our account of individuals that the classic theorists lack (despite acknowledging the existence of differences), while others maintain a higher-level view of social phenomena. I should note here, again, that this is not intended to be a fully exhaustive list of theorists who have remained connected to the core and serves more as a selection of examples.

Restricted relativists are one group that tries to bridge the gap that exists between the functionalist foundational theories and the individualistic constructionist theories. Out of these, Foucault seems to add the most to the current discussion with his theory on the determination of what constitutes knowledge as a result of the compromise that is reached with the spark of two swords (Foucault, 2000). In fact, an examination of the history of scientific inquiry reveals that our current scientific process was the result of such a clash (Shapin & Schaffer, 1989). Since research time and money are limited, it is only natural that

[31] This idea is still, admittedly, not complete. But it strikes me that most sciences have clear distinctions between different types whereas sociology seems to not only paint in broad brushstrokes but different theorists do not agree on definitions. It seems that for sociology to be properly established as a science, a common language of classifications should be created.

conflict should ensue in order to establish a dominant paradigm of practice, yet sociology has failed for forty years for either side to either compromise or deal a final blow.[32] On a similar note, Žižek's concept of the Master Signifier accounts for mutual intelligibility as a critical component to social systems and knowledge (Žižek, 1998). In sociology, our Master Signifier needs to be the foundational definition of the discipline and we must use that in order to communicate with one another as we expand our disciplinary knowledge.

The rational choice and symbolic interaction theorists fall at the edge of sociology, still attached to the trunk and serving a critical role of acting as a bridge to other social science disciplines. However, they also walk a delicate balance and must be careful to stay within the realm of social fact and leave the role of the individual mind to the work done in conjunction with their partner disciplines. Goffman, in particular, has helped guide sociologists in new directions of research by looking at interaction as a form of ritualistic performance that both gives individuals their identities and ties them to the larger society (Erving Goffman, 1959). Collins expands upon Goffman's work in his examination of modern day interaction rituals as the bonds that hold us together, replacing the religious bonds that Durkheim attributed to the solidarity of traditional societies (R. Collins, 2004). Additionally, Tilly in his study of the process and mechanisms of democratization, adds to sociology an understanding of the processes that block and promote changes to the social structures that govern people as those in power try to maximize their power and keep those

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Of course, under the current division of the discipline such agreement would be extremely unlikely and the very notion that it can and/or should be done is likely to be highly contested.

[32] Part of this problem maybe that there are more than two swords in the fight and finding a compromise may not seem practical while no single side is strong enough to defeat all other sides.

beneath them in a state of conflict through exploitation of categorical inequalities (Tilly, 2002).

Functionalists, post-functionalists, and conflict theorists all claim direct inheritance from the classic theories that serve as the foundational framework. As stated previously, our understanding of the world may shift to replace these foundational theories, but the definition and framework we work under must remain true to the foundations of the discipline. However, as we have yet to find a replacement, these theories still serve as a critical component to our understanding of the way society is bonded together. On the micro level, Homans sees small group structure being sustained through a process of exchange equalization where individuals trade favors in an informal contractual style that mirrors Durkheim's explanation of the bonds that hold industrialized societies together (Homans, 1958). On the macro-level, Parsons view of societal bonds being maintained through cultural pressures and socialization of members considerably expanded upon Durkheim's foundational concepts (Parsons, 1954).

As an additional extension, a series of new theorists have begun looking not just at human structures and interactions but also at the artifacts that humans create. Bruno Latour stands out as one of the core representatives of this group with his actor-network theory seeking to not only include human-crafted artifacts within our study of social bonds but also embedding those artifacts as equal to humans within social networks (Bruno Latour, 1996). While this approach is admittedly on the extreme end, in "Where are the Missing Masses," Latour makes the argument that human actors bestow their values and social powers on to the objects they create in order to enforce social norms (B Latour, 1992). While not a social scientist, technologist Lanier sees this occurring with emerging technologies in his manifesto

calling for people to become more aware of the lock-in caused by the technologies they create and use—having himself played a role in creating several technological products that have created lock-in (Lanier, 2010). While Lanier views this as a modern problem, Latour's analysis shows that humans have long purposely or accidentally created technologies that change the way societies are structured and the way humans interact with one another by looking at technologies as simple as the hinge (B Latour, 1992).

5. Moving Forward

While some of the conceptualizations of Latour's actor-network theory (particularly the equality of humans and artifacts) may present issues, the general concept of artifacts playing a human-delegated role that helps bond individuals together socially should be an area of more active consideration than the currently marginalized role they play. Considering the rate at which new technologies are currently being adopted and the impact they are having in forming the thinking and social bonds of new generations (Tapscott, 2008), sociologists need to look at technology in a central role in the same way our founders looked at capitalism and industrialization as key aspects of their societies. In our failure to find a coherent framework, the discipline of sociology has fallen short on its ability to understanding the societal shifts currently enveloping society through the "digital revolution" that is seeing conversational interaction rituals replaced with technology-centric interaction rituals. The way people interact with each other and the expectations they have for one another, including the way people interact, is rapidly changing with fairly young technology (e-mail) now being seen by those under twenty as a tool for "old people" (Carnevale, 2006). These shifts would have at one point been central to the discipline, yet outside of a handful of

works (most not written by sociologists), they have all but been ignored and at best marginalized within a discipline so caught up with its own internal conflict that it is no longer able to study the core issues it was created to predict and understand.

Thus, we must shift our attention away from the various branches of the discipline, cut off the branches that seek to focus on descriptive details that fit better in the humanities than the sciences, and seek out new predictive and prescriptive theories that will help the new generations better understand the world they live. While, currently, these theories will apply primarily to developed nations, the theories can also be applied to developing nations in helping them adopt new technologies in a way that allows them to keep some of their traditions, or develop technologies more appropriate for their social structure than the technologies these countries import. Furthermore, through our understanding of other social phenomena, sociologists should be able to apply their knowledge in order to help develop better technologies to support society or promote positive social change.[33] That is not to say that all contemporary sociological work should center on technology—we still need to examine all aspects of societal bonds. However, all work in sociology should take a scientific approach of trying to discern the components that make up a social phenomenon in order to classify and understand the cause and effects of its elements.

Essentially, I am proposing three things to serve as a launching point for the "new" sociology: that sociology look for theories to explain social changes enabled by technology, that new empirically grounded methods be developed that leverage virtual worlds and other

[33] Positive social change depends upon who you ask and the current values of the society from which a person comes from, and we should not forget this as we seek to make change. Exclusion happens from the very nature of society since there is no "one size fits all"

social technologies as research environments and tools, and sociologists examine the critical role they may play in aiding the development of new technologies for the improvement of society (this last one to be achieved by the new discipline of social engineering). Further, I contend that modern technologies and their influence affect all areas of sociological research from understanding the effects of putting laptops and cell phones into underdeveloped societies and teaching small farmers how to leverage technological human-centered design approaches. Criminologists can look at deviance in online virtual worlds and better understand how a lack of structure enforcing conformity to norms within a virtual world affects behavior within the physical world. Organization specialists can explore how social networking tools that may help build social capital within a distributed team affect productivity but also distracts from work. The list of possible intersections is near endless; although that is not to say that any one socio-techno theory will ever be able to explain it all, only that the absence of technology in many modern social theories, despite its role in effecting human interactions and organizational structures, needs to be addressed.

In order to improve the public image of sociology and promote societal changes, *parts* of sociology that do not seek to classify and examine the cause and effects of society but instead focus their attention on promoting social change should be split off into a new discipline of social engineering[34] following the foundations set up by Lester F. Ward (Ward,

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solution, somebody will always be excluded in some way or form—technology also takes on this problem since it places, often unintentional, restrictions on use.

[34] The term "social engineering" carries some negative connotations, so the name is still up for debate; however, the principle that we need a highly applied discipline in order to find ways of making societal changes is the critical component. This will help with the public perception of sociology, obtaining funding, and help give basic sociological research both the good will and resources necessary to understand the world. Incidentally, by having

1906). Descriptive theories and methods, such as ethnomethodology, do little to extend our knowledge of the society; however, these techniques can be extremely useful when turned to solving specific societal problems or in designing technology (L. Suchman, 1995, 1999). One of the issues sociology as a discipline faces is that the general public does not understand the usefulness of the discipline; by creating an applied discipline that is very publicly trying to improve the quality of life of people, we can make the case for our continued existence. Furthermore, while I see the public policy studies being incorporated within the discipline of social engineering, I feel the true strength of the discipline will come not from policies dependent on politicians with many conflicting priorities, but instead on the application of sociological insight into the design and development of products, signs, city plans, etc. As Woodman in his study of road signs showed, the inclusion of sociologists within such projects can have very powerful results and are less prone to the political derailment that Ward's earlier social engineering suffered from (Brewer, Avant, & Woodman, 1985; H. Commanger, 1959). Other sociologists, primarily in the United Kingdom, have also sought to apply sociological methods and insights into the design and development of technological solutions with their work highly respected in other fields, such as the interdisciplinary field of human-computer interaction, but generally ignored or marginalized in sociology (Heath, Knoblauch, & Luff, 2000; L. A. Suchman, 2007).

We are living in a time where the government illegally violates individual privacy yet youth willingly and knowingly give up their privacy through sites like Facebook, MySpace, and their personal blogs. Individuals are able to filter news based on their own personal

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individuals focused on applying social theories to real-world problems, we also obtain a natural test bed for social theories.

political bias in ways unheard of before and find support groups that encourage disorders such as anorexia. Studying the impact of these technologies on society is important, but I would argue it is equally important to form theories that can be used to leverage these technologies to encourage positive social change and action, much as President-Elect Barack Obama leveraged them to help mobilize his teams of volunteers. In his book, *Tribes*, Seth Godin explains how some social networking technologies can be used to create global movements in ways heretofore unknown and with considerably less effort than ever before (Godin, 2008). However, Tribes simply looks at the leadership necessary in these small autonomous units, it does not try to explain the organic social phenomena that are at the heart of many of these socio-techno systems. These technologies influence the way humans interact from the micro-level of leaving messages on the 'wall' of a friend that in previous generations individuals may have lost touch with to the macro-level social organization where the structure of global corporations reliant on computer technology for organization and communication purposes can be analyzed along with the overall social systems that develop within virtual worlds (Bainbridge, 2010; Boellstorf, 2008).

It is my earnest belief that through the marriage between sociology and the new technologies, theorists will find an easier task in creating operationalized theories because the use of simulations that allow researchers to manipulate variables and thus have a better understanding of the effects of individual variables on the applicability of a theory. Furthermore, by being able to evaluate the individual variables in this manner, social theories will be able to achieve a greater level of elegance than they have ever been able to achieve in the past simply because in real social systems there is no way to manipulate or eliminate variables since all societies operate within pre-defined frameworks that the researcher has no

control over. Perhaps the best part about such a marriage of disciplines, however, would be the power of holism that social science theories would gain as technologies are increasingly making it easier and easier to document and track individual activity, store said data, and make it possible to use powerful data mining techniques to analyze the data. Thus, instead of looking at, say, fifteen members of a group in a small subset of situations, social scientists will be able to look at thousands or millions of individuals in a large cross section of activity using ubiquitous computing technology that allows participants to record their daily activity in the real world or using large, diverse virtual worlds where all participant activity can be logged, tracked, and analyzed while rigidly controlling the social rules of the system.

It is through returning sociology to its scientific roots that will allow us to explore, among other things, the changes occurring within our society through technology, removing the purely descriptive and social constructivism work, and creating a new discipline of social engineering that we will be able to resurrect the discipline and advance our state of knowledge about society.

6. Conclusion

While I started this paper with the damning remark that sociology as a discipline is dead and then retraced sociology to its roots, I earnestly believe that sociology still has much to offer the world through the tools and theories already created in addition to the potential for future contributions. However, the sociological tree must be pruned of the disparate branches that have grown in the wake of the ceaseless epistemological war and lack of agreement on a centralized epistemological standpoint resulting in debates over ideologies instead of debates over social facts that restrict both our ability to move the science forward

as well as our ability to improve the inhabitants of the social worlds that we seek to understand. In addition, it is time for sociologists to join the ranks of the other sciences in forming a separate and heavily applied discipline to improve public acceptance of sociology and make an impact by changing society in ways that working with politicians on policy would never practically allow. At present, our discipline has grown in such a way that we have formed narrow specializations and have taken different epistemological stances, making it difficult for us to communicate with one another despite all calling ourselves "sociologists." It is time to accept the fact that we have diluted the term to a point of meaninglessness, that we no longer have mutual intelligibility among ourselves let alone the general public, and that we need to refocus our discipline in order to see it survive for another two hundred years. The discipline as a whole is large enough to survive a splintering off into different segments, several disciplines have emerged from sociology in the past, but in this case it is the core of sociology itself that must free itself from the entanglement of branches that have grown in twisted sinews the obscure the original purpose of the discipline.

Our connection with the trunk has not been completely severed yet, as I have shown that several contemporary sociologists have continued to explore the core questions of the discipline and have continued operating under the original definition established by the classic theorists. We may not always study the works of Marx, Durkheim, and Weber—I have no doubt that as society continues to change and we find more objective means of measuring social phenomena that their theories will eventually pass out of the canon just as Freud's theories have been expunged from psychology. However, while their theories may be revised or replaced, their foundational ideas on the object of study of the discipline and the scientific basis should always remain central since those are the foundational concepts that

established and defined the discipline—to abandon them is to abandon sociology and form a wholly new discipline that lacks the right of inheritance to the discipline's name.

We are at the cusp of a choice, either to do nothing and watch the field perish at the hands of our own follies or return to the roots of our discipline and seek ways of reinvigorating a once thriving scientific discipline. Some may argue that the circumstances are not as dire as I paint, others may argue that we should abandon the scientific roots and return to a more humanistic and philosophical approach. To the first group, my reply is that time will determine who is correct and ask whether or not the risk is worth it. To the second group, I wish them luck in their pursuit of a new discipline that they define—as I have shown in this paper, the heritage of sociology is in the sciences, to abandon it is to abandon the discipline. As to the rest, I hope that it is not too late and that we can restore sociology and return to doing a service to our fellow human beings in helping explain society and helping direct it toward a state where individuals do not suffer the weights of alienation and totalitarian rule.

We have inherited a great intellectual foundation, to abandon it or to standby and do nothing while it dies would be an intellectual crime akin to the burning of the libraries of Alexandria, the destruction of the texts of the indigenous South American societies, and the execution of Socrates. There have been enough intellectual tragedies in history; we should not allow the death of sociology to be counted among them.

CHAPTER 3. CONVOCONS: ENCOURAGING AFFINITY ON MULTITOUCH INTERFACES

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Abstract

This paper describes the design of ConvoCons, a system to promote affinity of group members working in a co-located multitouch environment. The research includes an exploratory study that led to the development of ConvoCons as well as the iterative evolution of the ConvoCon system, design trade-offs made, and empirical observations of users that led to design changes. This research adds to the literature on social interaction design and offers interface designers guidance on promoting affinity and increased collaboration via the user interface.

1. Introduction

When individuals work together for the first time they lack knowledge of one another's reputations and other elements typically useful for successful cooperation (Bolton, Katok, & Ockenfeis, 2005). Strangers cooperating for the first time without a shared connection to facilitate introductions and establishing common ground may at first struggle to establish a level of affinity needed for productive cooperation (G. Convertino et al., 2008; Nardi, 2005). Individuals seek affinity as a means to fill a need for interpersonal relationships and established affinity is necessary for sustained cooperative relationships (Honeycutt & Patterson, 1997; Whittaker, 2003). We created a system, ConvoCons, as a means of helping strangers begin the process of building affinity and using cooperative strategies.

Our research intends to answer the question of whether or not a software interface can be built that can promote affinity between group members in a co-located collaborative environment. This paper presents an exploratory study that led to the ConvoCons framework and discusses the design trade-offs and iterative evaluation process that led to our current system. At this point, our research focuses on affinity creation and does not look at the length of affinity bonds created nor does it explore whether or not affinity creation through our system promotes cooperation in a competitive environment; it simply seeks to explore a low-cost method of promoting affinity within a co-located dyad where neither partner has previous knowledge of the other.

The system we created, ConvoCons, is an applied reification of Nardi's observations suggesting that incidental communication, even if unrelated to the task at hand, is critical to supporting productive collaborative strategies (Nardi, 2005). ConvoCons, defined as conversation starting icons or other visual features, are designed to serve as icebreakers and casual distractions to encourage informal discourse between new partners. This informal discourse leads to connections that aid in collaboration critical to productive collaborative strategies (Nardi, 2005). We believe that these affinity bonds, formed through the affinity of discussing the ConvoCons, lead to the critically important state of social cohesion (King & Star, 1990).

To measure whether the ConvoCons approach increases affinity, a measurable definition is required. Nardi (Nardi, 2005) defines affinity as a 'feeling of connection between people'. We have narrowed this definition to the "convergence of thoughts, actions, or ideas" and made the following assumptions for measurement purposes within a multitouch collaborative context. First, a group that lacks affinity will have group members that are more

likely to work *independently* from one another and more likely to *enforcepersonal space*. Signs of increasing affinity include actions such as *reaching into a partner' s personal space*. Personal space on a multitouch device is defined as the area immediately in front of an individual (Scott, Grant, & Mandryk, 2003; Tuddenham, 2007). Second, *joint work* is also a sign of affinity as coordination is required. A *leader-follower* approach, with one person directing the other, may be a sign of affinity if the partners deem the work afterward as equally representing each other's ideas; the leader-follower dynamic can demonstrate that the partners understand each other's roles and skills. Third, communications indicating *agreement and affirmation* of actions are also indicators of a group that has acquired a degree of affinity. Fourth, high affinity groups will indicate *no hesitation in close proximity* working areas. Fifth, *planning* communications, e.g., discussion about what to make and how to make it are indicators of a group that has acquired affinity. Sixth, *communication unrelated to the task* is an indicator of affinity, including reading ConvoCons to one another. Similarly, *shared laughter* is also an indicator of increased affinity.

Given the desire to create an interface component designed to promote affinity, three main challenges arise: the types of content to use, when to display it, and how to integrate it visually with the interface at hand. The research described below describes four phases of efforts to refine the ConvoCon design based varied approaches to addressing these challenges. Phase I is based on a study of Baseplate, a virtual block assembly application, where we discovered that dyads used the abstraction present in the interface as a means of jumpstarting collaboration on a multitouch table using the SparshUI architecture (Ramanahally, Gilbert, Niedzielski, Velázquez, & Anagnost, 2009; "Sparsh UI," 2009); the interface itself served as ConvoCon. Phase 2 describes a separate ConvoCon interface layer

that could be attached to applications as a means of promoting affinity. Phase 2 used news headlines that appeared as rotating circles within the middle of the multitouch device that appeared in the same color each time, had some transparency, and rotated in a circle so both participants could view it (see figures 1-4 below). Phase 3 displayed riddles and jokes (first the question, then the next ConvoCon would display the joke or punch line) and the text would flash on and off as they rotated in the center of the screen. Phase 4 ConvoCons displayed a question (either a joke or riddle) on one end of the device while displaying an answer on the other end of the device to face the participant at each end. The background color of the ConvoCon was different each time.

We conducted this study using a multitouch device as it allowed co-located collaboration where both pairs in a dyad could have equal control over the results, but unlike collaboration with paper on a physical table we could dynamically display ConvoCon items (Buxton, Hill, & Rowley, 1985). These initial phases of ConvoCon research takes place in a co- located environment to optimize conditions for partners to understand one another's intended actions ("social translucence") (Kellogg & Erickson, 2002). To enable two participants to collaborate, Phases 1 and 2 employed an FTIR-based 60" multitouch table (Dohse, Dohse, Still, & Parkhurst, 2008) with participants standing. Phases 3 and 4 used a Stantum 15.4" multitouch display with participants seated.

2. Phase 1 ConvoCons

Phase 1 was originally designed as an exploratory study to evaluate the use of Baseplate, a collaborative block-assembly application, in a co-located and remote environment to explore the collaboration strategies used by participants. However, after

running this study, the main findings led to our development of ConvoCons. We analyzed the conversations that created bonds within dyad groups that led to their collaboration on the tasks. (G Fischer et al., 2004) and (Hollan, Hutchins, & Kirsh, 2000) describe the need for collaborators to have a shared vocabulary of the task in terms of distributed cognition. When using Baseplate, participants needed to have a shared understanding/vocabulary of the interface to complete the tasks.

From results that showed that elements of the interface led to collaborative strategies, we were able to develop the initial framework for ConvoCons, which we hoped to use for the purpose of creating a theoretical framework to guide the future designs of co-located and remote collaboration virtual assembly environments.

Phase 1 Methods

Our first experimental groups consisted of five co-located dyads that used the table, having a shared physical space (the input device of the tabletop) and a shared virtual space (the Baseplate workspace) where work was performed on a 60" FTIR table (Ramanahally et al., 2009). The second experimental group consisted of three dyads where one participant using Baseplate on the table and the other participant using Baseplate on the Stantum—in this condition participants were located in the same room and allowed to talk with each other, but they were not allowed to look at one another's devices.

All participants were asked to reproduce a series of simple, 2D patterns using Baseplate for three tasks, with ten minutes per task, and then were given up to ten minutes to create a new pattern collaboratively for a total of four tasks. Beyond instructions on how to place, rotate, and move blocks, participants were not given any information about the

interface and what each block represented. Baseplate and the patterns used for Tasks 1- 3 can be seen in Figure 1.

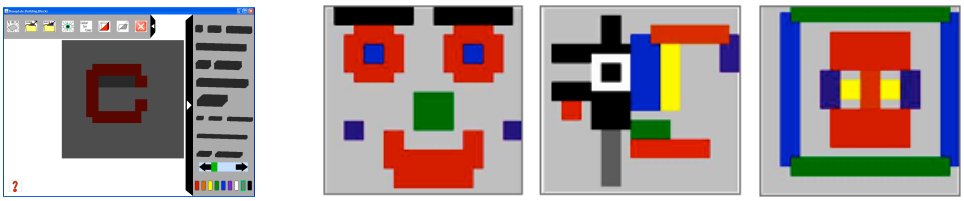

Figure 5 Baseplate (left) and the three task patterns used in the study

Participants' hands and conversations were video recorded during task completion. Video and audio feeds were analyzed qualitatively for strategies of collaboration, while survey data were analyzed quantitatively.

Phase 1 Results & Discussion

We observed a discussion that often jumpstarted the collaborative process for dyads in both focused on which block in the interface represented which block in the pattern. This discussion resulted from the ambiguity of the blocks within the interface (appearing from a 3D perspective view, whereas blocks in the pattern were in a 2D top-down view). The interface's ambiguity was thus a source of increased affinity. The idea that a challenging interface can lead to positive collaborative strategies may seem counterintuitive to a HCII audience, but it aligns with the MIT constructionism philosophy that participants learn precisely through such meaning making during constructive design (Kafai & Resnick, 1996). Developing challenging interfaces intentionally, of course, would incur significant usability costs. Seeking a solution that would provide similar affinity benefits without the cognitive or usability costs, we began ConvoCons research.

Given Nardi's observations noted above on the importance to casual conversation for affinity building, the question remained of whether the key to increased affinity and effective collaboration was task-related conversation (about the interface, leading to a shared representation of the application) or whether any conversation would have helped (per Nardi).

3. Phase 2 ConvoCons

For Phase 2, we designed a structured ConvoCons system to promote affinity that could be used with any and all of our multitouch applications with equal effectiveness in promoting affinity. Since our original design was focused on promoting affinity for groups standing around a 60” FTIR table, we chose to make the ConvoCons round to indicate that they are intended for all individuals and to rotate them so no single user had a privileged view that would provide them ownership of the ConvoCon content. ConvoCons were circular, placed in the center of the display with a width of approximately 30% of the total table width and a 50% transparent background so users would both be forced to pay attention to it and able to continue working while displayed. Since ConvoCons were intended to serve as icebreakers, the first touch to occur on the multitouch device triggered the display of the first ConvoCon. This first iteration used the day's news headlines as an informal icebreaker to promote affinity. ConvoCons appeared during the first 15 minutes of interaction at 1.5-minute intervals. The 15-minute time limit was set to allow their use as icebreakers but prevent participants from being distracted during the entire course of the task. The 1.5-minute interval was set as a sufficient amount of time for the previous ConvoCon to make a full rotation while also providing one minute of uninterrupted work time for participants.

In creating this initial design for ConvoCons, certain compromises were made based on choices in design tradeoffs. The most significant of these compromises was the fact that the design risked annoying and alienating users by appearing in the center of their work area; however, we chose to do this because it provided equal access to all collaborators and because we wanted to force users to attend to the ConvoCons so we could observe the effects of ConvoCons on affinity building. This was particularly an issue of possible user frustration since ConvoCons could not be moved out of the way or made to disappear before they had completed a full rotation—this was intended to prevent one user from taking control and dominating the ConvoCons, which would prevent them from serving as a means of promoting affinity at a level of equality within the group. In addition, headlines required minimal for reading, though they required users to attend more fully to reading them than to and image or color. Headlines also had the issue that three to ten words often provide very little information to begin a discussion about a topic if no participants are familiar with the story.

In order to evaluate the efficacy of this design, an initial pilot test of the ConvoCons system was conducted. This pilot took place on a 60" FTIR table using our Tangrams application as seen in Figure 2. Tangrams offers puzzles that require users to combine smaller geometric shapes into a larger geometric shape. This application was chosen as the initial test bed for the ConvoCons system due to the graphical simplicity and clarity of the application, which would ensure minimal confusion from abstractions of interfaces that could serve as an additional means of affinity building. Participants were given instructions on how to rotate, drag, and flip the seven shapes that make up tangram puzzles. Participants were then asked to complete three tangram puzzles with the solutions seen in Figure 2 and told

they had up to ten minutes per puzzle. After participants completed all three puzzles they were given up to ten minutes to create anything they wanted.

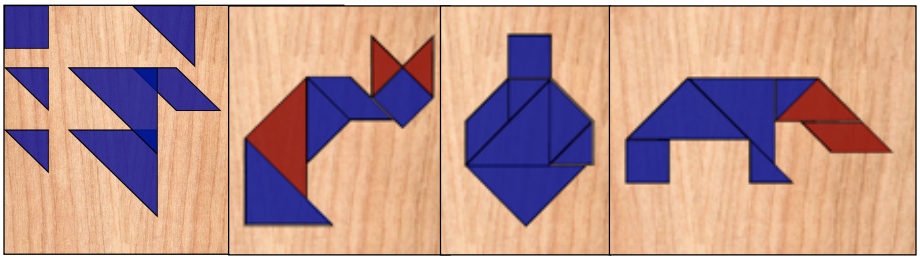

Figure 6 The virtual tangram application and the three patterns.

Phase 2 Results

Phase 2 ConvoCons were evaluated with three dyads with each dyad containing one male and one female participant and a mean age of 27. All participants in this phase had previous experience with multitouch and four of the six individuals reported their sociability as *not very social,* defined in our Likert scale as preferring tight groups while two reported it as *highly social,* defined in our Likert scale as being comfortable with talking to strangers. The two highly social participants were part of the same dyad, this dyad rated each other as acquaintances. The other two dyads rated familiarity with their partner as "seen around" and "never met," respectively.

This initial iteration of ConvoCons failed almost entirely to promote affinity in a manner that would not be invasive to users. Users sometimes read the first headline and then quickly came to ignore all subsequent content of ConvoCons. Users still attended to the ConvoCons on occasion after the initial headline, but conversations about the ConvoCons were focused on how to get rid of them and about how annoying they were while trying to complete the puzzles. In unstructured interviews after the tasks were completed, participants were unable to remember any headline in its entirety and only had a vague notion of one

headline at most. All participants stated that they found the ConvoCons to be annoying and distracting and described them with such terms as "irrelevant" and "uninteresting." Two participants, each in different dyads, noted that they felt a sense of bonding over the ConvoCons in the annoyance they shared with their partner as they tried to get the ConvoCons to go away. The last of these three groups tried a modified version where the ConvoCon text flashed; however, they found it difficult to read and annoying and ignored the ConvoCons just as much as the previous groups.

4. Phase 3 ConvoCons

With the failure of Phase 2 ConvoCons came the need to tweak the ConvoCon system in hopes we could still promote affinity through their use. Phase 3 ConvoCons incorporated the same design elements as Phase 2 ConvoCons but were made harder to become habituated to by having each ConvoCon appear with a random colored background. In this iteration, the headline text was replaced with riddles or jokes with the question displayed and then the next ConvoCon displaying the answer or punch line. This created the tradeoff that this iteration was very culturally grounded so its global use would be highly limited. In addition, riddles and jokes tended to be significantly longer than headlines, so users had to devote more time to read and process the text to converse about it. However, unlike headlines participants these required no additional information in order to fully understand the information. Since the first riddle and joke portion of the ConvoCon was posed as a question, it provided a potential point for users to discuss it to try to figure out the answer or punch line before receiving it from the system.

The procedures for evaluating Phase 3 ConvoCons were similar to that of Phase 2 in that participants received training of the basic functionality of the system and were then asked to complete three patterns, the same three that were used for Phase 2, and were then given up to ten minutes to create any pattern they chose using the tangram pieces. However, unlike Phase 2, participants in this phase were not told of a time limit to complete the puzzles as some results in Phase 2 raised concern that placing a time on puzzle completion may bias participants to be focused on reducing the time spent on non-task oriented items like reading ConvoCons text and talking to one another. This concern arose from the unstructured interviews of Phase 2 where one participant noted that her reason for ignoring the ConvoCons was a feeling that she needed to complete the task as quickly as possible given the time constraint.

Phase 3 Results

Phase 3 involved six dyads recruited from the undergraduate psychology department. Our observations indicated significant confusion of participants when the first ConvoCon appeared with one participant remarking "I didn't know there'd be a quiz." It was also observed that due to participants' focus on the task that by the time the answer arrived they often had forgotten the question. Generally, conversations between these dyads were muted, both in terms of conversations around ConvoCons and conversations about the task, with conversations focusing mostly on issues where the solution they were independently working on was found not to work. In unstructured interviews after the tasks, two of the six groups paid significant attention to the ConvoCons with a member from group 2 stating they originally paid more attention to the ConvoCon text than they did the task. One of the two groups that attended to the ConvoCons had a modified version where two ConvoCons were

displayed simultaneously without rotation with one partner receiving the question and the other the answer. The group with this slight modification recalled the greatest number of ConvoCons (3 of 10). This group was also the only of the six groups to read aloud a ConvoCon beyond the first one. The group with the modified Phase 3 ConvoCons was composed of a mixed sex dyad who had never met and both self- reporting a preference for "tight groups."

5. Phase 4 ConvoCons

With the promising results from the slightly modified Phase 3 ConvoCons, we formalized the design modifications for two ConvoCons on opposite sides of the multitouch display with fixed orientation toward one user, similar to the placement of numbers or letters on playing cards. This approach provided the tradeoff that this version of ConvoCons biases interaction and affinity promotion toward two individuals rather than a group. No other visual changes were made to the ConvoCons.

The procedure used was changed slightly for Phase 4 ConvoCons evaluation in order to further reduce user focus on the tasks to promote user attendance to the ConvoCons. This change was to remove the training on the Tangram application and instead provide five minutes for participants to play with the system, during which ConvoCons appeared from first touch and at minute and a half intervals. This playtime had the additional advantage in that it allowed us to evaluate the intuitiveness of the gestures employed in the application. The decision to make this change came from an observation of a tour group to which we demoed the ConvoCons-enabled Tangram application. We observed a user on the answer side covering it up while another user read the question, which suggested to us that

participants may need a similarly relaxed setting in order to make use of the ConvoCons as an affinity building mechanism. Given the power of authority and the tendency to conform to assigned roles demonstrated by Milgram and Zimbardo (Milgram, 1974; Zimbardo, Maslach, & Haney, 2000), participants may have been strongly focused on the puzzle tasks by 1) hearing our experimenter conduct training on the tasks and 2) knowing that they would receive a departmental research credit for participating in the study. The playtime was designed to lessen these influences.

We also ran participants that used Tangrams without ConvoCons but with the playtime in order to ensure that observations of affinity were a product of ConvoCons and not the playtime.

Phase 4 Results

Phase 4 was evaluated using ten dyads using a ConvoCons enabled version of Tangrams and nine dyads with ConvoCons turned off. Observations of users suggested that playtime does have a role in users attending to ConvoCons as all groups attended to at least one ConvoCon during this playtime and all but one ConvoCon group chose to use the entire five minutes of the playtime although all but two groups had learned all gestures within the first two minutes of training. In contrast, only three of the nine dyads working without ConvoCons used the entire five minutes of playtime, most stopping after roughly three minutes, one stopping after just over one minute, and others asking the researcher to advance to the task or sitting in awkward silence staring at the researcher or at their own hands until being asked if they wanted to start the puzzles.

In unstructured interviews after the tasks were completed, dyads were able to remember at least three ConvoCons, both the general content and specifics, the dyads also

stated that during the playtime the ConvoCons were not distracting or annoying although they were at first confused what they were and why they were there. Reaction to the ConvoCons during task time were similar to those in previous iterations where they were often ignored, although some groups continued to pause work to read over and have a shared laugh over a joke or try to solve a puzzle—this most often occurred when a ConvoCon appeared while a dyad was having difficulty solving a puzzle. One group, in commenting on the ConvoCons, responded, "[ther were] maybe not so much for getting to know each other, but for creating conversation." Another group stated that the ConvoCons probably made them talk more than they would have without them; however, they also felt the ConvoCons were irrelevant and distracting.

6. Conclusions

Phase 4 ConvoCons indicate that it is possible to create a layer on top of the interface that enables users unfamiliar with one another to build affinity. Efforts to code and quantitatively compare the levels of affinity for each of the groups in Phase 4 are underway to determine the magnitude of the effects of ConvoCons. Future work looks to expand ConvoCons beyond dyads to small groups in addition to looking at the effects of ConvoCon-encouraged affinity when a reward structure is present that would result in a level of competition between participants. We also hope to explore the use of ConvoCons as a way of building affinity among remote collaborators.

7. Acknowledgements

We thank Cole Anagnost, Thomas Niedzielski, and Desirée Velázquez for developing the initial Baseplate application. We also thank Jay Roltgen, Prasad Ramanhally, Ashley Polkinghorn, and Ankit Patel for their development efforts of the ConvoCon code base and the Tangram application. This research was performed as part of a Research Experience for Undergraduates sponsored by NSF (IIS-0552522). Additional funding was provided by the Air Force Research Lab and the Grow Iowa Values Fund.

CHAPTER 4. BUILDING BETTER DESIGN TEAMS: ENHANCING GROUP AFFINITY TO AID COLLABORATIVE DESIGN

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Abstract

This paper discusses ConvoCons, a novel system of conversational icons intended to encourage affinity between collaborators unobtrusively. Using a reification of Bonnie Nardi's framework for social connection and affinity, ConvoCons overlay an existing application and display a varying media that can encourage collaborating partners to begin developing affinity through informal conversations. This research explores whether dyads working on a collaborative multitouch application with ConvoCons develop more affinity than dyads that do not while solving simple design problems and a freeform design task. Results indicate that after an average of 23.25 minutes, affinity, defined as a function of conversational and behavioral cues, was 40% higher ($p < 0.001$) in the ConvoCons group than in the control group. This research offers a framework for evaluating affinity within groups and a foundation for exploring software-based methods of improving the effectiveness of collaboration within design teams.

1. Introduction

Imagine a new employee joins a team of designers to create an interface for an application. The design team typically works in pairs, and her partner for this project is somebody she has never met. The designers share a multitouch device to place the GUI

components and create the interface of their product. There is some awkwardness and formality as they work. Having never worked together, they are strangers trying to create a shared vision of a design. Suddenly, a message pops up on the screen; the new employee reads it—some sort of a question. She looks across the screen and her partner has one as well, so she reads hers aloud. The other employee reads hers, and they realize it is a riddle. They begin talking about the riddle and about their past work experience. They continue to work, and when a work-related question arises about a design idea, the partners now have no problem asking each other questions; the awkwardness has been removed.

The story above illustrates the social awkwardness that can occur when working with a new partner for the first time. Typically one has little idea of what to expect from a partner and unless there has been an introduction before, a person may find him- or herself hesitant to start a conversation as no affinity has been developed. When individuals work together for the first time they lack knowledge of one another's reputations and other relational elements typically useful for successful cooperation (Bolton et al., 2005). Strangers cooperating for the first time without a shared connection to facilitate introductions and establish common ground may at first struggle to establish a level of affinity needed for productive cooperation (G. Convertino et al., 2008; Nardi, 2005). Individuals seek affinity as a means to fill a need for interpersonal relationships and established affinity is necessary for sustained cooperative relationships (Honeycutt & Patterson, 1997; Whittaker, 2003).

This research describes the evaluation of a user interface technique developed to more quickly build affinity and effective collaboration strategies among strangers by promoting incidental conversations. This system of conversation-starting icons, called ConvoCons, offers conversation starters to encourage an informal discourse between new partners that

Nardi identified as a central component of group affinity (Nardi, 2005). An example screenshot of an application with overlaid ConvoCons can be seen in Figure 1; in this case, the ConvoCons are text within circles that are oriented towards two partners facing each other and collaborating on a tangram puzzle.

ConvoCons are part of an ongoing research effort to explore means of using interfaces to promote constructive collaborative strategies among groups of individuals using computers to facilitate their work, with a particular emphasis on collaboration involving creativity and design (Oren & Gilbert, 2009).

In this paper, we provide an analysis of ConvoCons used in a multitouch tangram application and their effectiveness in encouraging affinity between dyads, a pair of individuals treated as one unit. Tangrams is a Chinese puzzle game consisting of seven geometric shapes (five triangles, a square, and a parallelogram) that is used to create a variety of shapes both freeform (creative) as well as filling in a pattern (problem solving). It is important to note that ConvoCons appear concurrently with the tangram puzzles, but are semi-transparent and serve as passive interface elements (they do not recognize user input), thus users are free to attend to or ignore the ConvoCons without adversely effecting their ability to get work done.

The first research question (Q1) is "Does the presence of ConvoCons lead to increased incidental conversations?" In order to answer this question, we defined incidental conversation to be dialogue unrelated to the tangram task at hand and looked at the amount of such dialogue between dyad members that worked on tangrams with ConvoCons vs. without Convocons. Our secondary research question, (Q2) is, "Do ConvoCons lead to increased affinity between participants?" For this research question, we operationalized a definition of

affinity based on two components: conversational affinity and behavioral affinity. Total affinity is based on a percentage of the interactions that demonstrated affinity vs. those that did not.

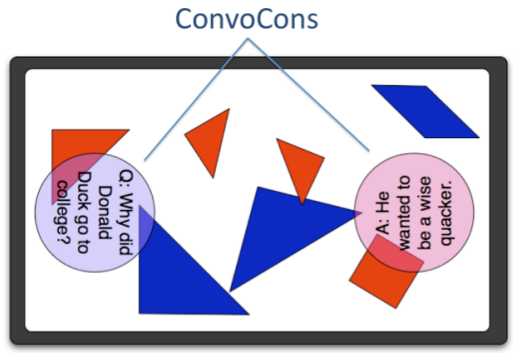


Figure 7 A sample joke ConvoCon, the participant on the left would have a privileged view of the question while the one on the right would have a privileged view of the answer.

2. Background & Context

The system and research model for ConvoCons are an applied reification of Nardi's observations suggesting that affinity plays a central role in the process of creating and sustaining connections necessary for productive collaboration. While the majority of the dimensions of affinity that Nardi observed were physical in nature, we chose to focus on the aspect of incidental communication, i.e., conversations outside of productive work such as commenting on the weather. Nardi suggests that this informal discourse leads to connections that aid in collaboration critical to productive collaborative strategies (Nardi, 2005). We hypothesize that these affinity bonds, promoted through discussing ConvoCons, lead to the critically important state of social cohesion (King & Star, 1990). By conducting this experiment with two people sharing a small (15.4") multitouch device, two of the other activities that promote affinity are added to the work context: human touch (the occasional

brush of the hand) and a shared experience in a common space (where the common space is both physical and virtual) (Nardi, 2005).

The importance of affinity for effective collaboration can also be seen in Schmid's discussion of affinity as the cornerstone to the development and use of social capital (Schmid, 2000). Specifically, ConvoCons seek to improve what Schmid refers to as positive affinity, which connects individuals to one another through a build up of social capital and, as a result, reduces the free rider problem. While this study does not examine the effect of affinity overtime, assuming the validity of Schmid's theory, the ConvoCon system is designed to accelerate this accumulation of affinity and decrease the time needed to build social capital. Kellogg and Erickson (Kellogg & Erickson, 2002) suggest that social translucence, the idea that user activity needs to be apparent to other users, is a key to effective collaboration. ConvoCons are designed to increase social translucence in that by building affinity between partners, group members will be able to understand their partners' cues better in order to collaborate through turn taking and directing work with their partners. In addition, (G. Convertino et al., 2008) suggest that in order for group members to successfully collaborate, they must develop converging measures, which is the idea that they have a common ground or shared representation of the task. Both of these concepts are components of the third dimension of affinity identified by Nardi, that of a shared experience within a shared space (Nardi, 2005).

However, the creation of common ground has been shown to cause problems within groups when individuals focus on the elements they share and never move beyond that to share expert knowledge needed to solve a problem. Larson described this tendency in his study of doctors working on collaborative diagnosis where each doctor had been shown a

different piece of the medical problem and a successful diagnosis could only occur when information was shared (Larson, Christensen, Franz, & Abbott, 1998). Analogously, earlier ConvoCons prototypes explored the use of a centralized, shared conversation starter, but designs that provided each participant with separate, privileged information (Figure 7) were more likely to prompt participant conversation. Participants asked about one another's pieces of the question and answer (Ramanahally et al., 2009).

3. The ConvoCons Approach

ConvoCons were developed based on an initial collaboration study that suggested that the ambiguity in a somewhat confusing user interface served as a means of creating converging measures through users' discussion of the interface. However, given the cost of encouraging poor interface design to promote collaboration, the ConvoCon system was developed to serve the same role without the cost to general usability of the system (Oren & Gilbert, 2009). Related research by Clear and Daniels has explored the use of icebreakers to encourage better collaboration techniques between distant learners (Clear & Daniels, 2001). In addition, Fisher and Tucker have used online games as a means of providing an out-of-classroom means for online students to gain affinity with one another (Fisher & Tucker, 2003). However, unlike these previous approaches, ConvoCons are built into the tasks and collaborators are free to attend to them or not; there is no structured ice-breaking mechanism or time required outside of the task.

Also, while ConvoCons are designed to encourage incidental conversations and affinity, the goal is not simply to connect people, but rather to encourage stronger collaborative working behavior. In our research we have often observed members of dyads

who, although working on the same problem within the same virtual and physical space (on the same device), failed to acknowledge or utilize their partners, instead tackling the problems separately, avoiding interaction with their partners when possible. Previous research by Rogers looked into the use of shared displays to serve as an icebreaker to promote and track conversations within a social setting; in this research we use the shared display as a work tool (rather than an icebreaker) although Rogers' and our own work share the goal of using technology to bring people closer together (Rogers & Brignull, 2002). Finally, while the underlying goal of Karahalios' social catalysts is similar (Karahalios, 2004), in calling for designers to consider interfaces as a means of promoting social connections, her work focuses primarily on aiding individuals in finding collaborators. In contrast, our work assumes that group members are already paired by a work assignment. ConvoCons are intended to ease new partners' transition into working with higher affinity on a shared goal.

4. ConvoCons System Architecture

The ConvoCons system is designed to be overlaid on any Java application and can be used with several simultaneous client applications, e.g. two people using ConvoCon-enabled applications at different sites. By allowing this level of adaptability of ConvoCons, we are able to test a variety of configurations to test their effectiveness in encouraging collaboration within a wide range of applications and environments. The touch interface is not required for ConvoCons; it is helpful in this context for affording an easy approach to simultaneous use of an application by two co-located users. The touch-based gesture recognition system is built using Sparsh-UI, an open-source API for platform independent touch-based applications

(Ramanahally et al., 2009; "Sparsh UI," 2009). While this study used visual ConvoCons containing text, the ConvoCon architecture supports media including auditory signals, videos, and images.

5. Methods

Thirty-six participants were recruited from the Iowa State University psychology department participant pool and paired into 18 dyads (the dyad will be the unit of analysis). Each dyad was then randomly assigned to be in either the experimental group (ConvoCon enabled tangrams; n=9) or control group (plain tangrams, n=9). Participants in all dyads had no previous relationship beyond “seeing each other around” (n=1 dyad) although the majority (n=17) had never met before. Participants were instructed to arrive and wait at different entrances to the research lab to prevent interaction before the start of the study.

Dyads were instructed to sit across the table from one another to allow co-located collaboration with the multitouch device, a Stantum SMK 15.4, placed length-wise between them (see Figure 8) (Buxton et al., 1985; Russell & Sue, 2006; Scott et al., 2003). All dyads then followed the procedure below (see Figure 9). Dyads were first given a brief description of the technology and told they would have five minutes to play with the interface and teach themselves how to use it. After dyads completed the five minutes of playtime, dyads were then given the first pattern to create with the tangram pieces. Dyads worked on the pattern until completion, before being given the next pattern for a total of three patterns. Upon completion of the patterns, the dyads were then given up to five minutes to create any new pattern of their choice. All interactions were video recorded, and the software logged user inputs.

The dyads assigned to the ConvoCon group were exposed to ConvoCon riddles and jokes upon the first touch of the multitouch interface. One participant was given a privileged view of the riddle while the other was given a privileged view of the answer (see Fig. 2). Each ConvoCon remained visible for thirty seconds, followed one minute later by another ConvoCon. ConvoCons did not affect the interaction with the tangrams application; they did not block access to the application, nor could users control them. There were a total of ten ConvoCons displayed to dyads over a fifteen minute time period (see Fig. 3). The ConvoCon group had a mean completion time of 14.75 minutes (SD=5.75); this resulted in most participants completing part of Task 2 as well as all of Task 3 and the freeform task without ConvoCons. Turning ConvoCons off midway was intended to allow the researchers to observe whether or not the effects of ConvoCons would be sustained throughout the working session.

Figure 8 The multitouch device between two participants.

Finally, we administered an exit survey to all participants based on a modified version of the survey Convertino developed to assess the similar concept of common ground development (G. Convertino, et al., 2005). Using this survey, consisting primarily of five-point Likert scale questions, we compared the control and experimental groups to determine how well they felt their group worked together and the agreement that was reached within the

group. Dyads in the ConvoCon group also participated in a brief, unstructured interview in order to obtain their input on ConvoCons to obtain qualitative feedback and aid future design of the system.

Our choice of using visual versions of ConvoCons was taken due to research indicating that visual background noise has less of an adverse effect on performance compared to auditory background noise (Ephrem, Brungart, & Parisi, 2006). Since ConvoCons are not directly related to the task at hand in this experiment they may, at times of particularly difficult work, be viewed as background noise. The choice of using text-based ConvoCons for the initial study was due to the two-part reasoning that they were the simplest to implement and that it was easier to detect whether participants were attending to the ConvoCons since reading text requires some cognitive load and, with a partner present, is often spoken.

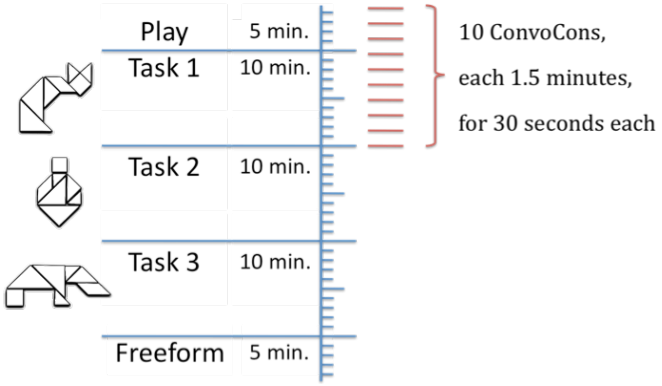


Figure 9 Sample timeline of the procedure (task times varied based on completion time), the 10 minutes per puzzle is just an example, some took less time and some took more.

Through an iterative process we discussed in an earlier paper, we settled on riddles and jokes over news headlines and trivia or facts about tangram puzzles. Participants lacked the contextual information to discuss news headlines and trivia, while facts about tangram puzzles afforded little discussion (Oren & Gilbert, 2009). The jokes (obtained from children's

collections) were chosen as a way of lightening the mood, which Goffman's study of role distances has shown to be an effective means of initiating new members into a group and allowing senior members a break from the stress of the roles they play (E. Goffman, 1975). Riddles alternated with jokes in the same order for all ConvoCon dyads. There was no observable difference between dyads' attentiveness to riddle or joke-based ConvoCons, although in informal observation, the joke-based ConvoCons did appear to be more effective in creating affinity bonds within a dyad, particularly in stimulating discussion after the fact. The riddle-based ConvoCons often had more discussion while they were still present, however, as participants sometimes tried to solve them before reading the answer or would comment on how the answer "made sense."

Framework for Measuring Affinity

To measure whether the ConvoCons system increases affinity, a measurable definition is required. (Nardi, 2005) defines affinity as a "feeling of connection between people." The issue of empirically measuring affinity is similar to the problem Goudy observed with "rapport" where there are multiple, sometimes conflicting, definitions and limited clearly defined metrics for measurement (Goudy & Potter, 1976). With this problem in mind, we adapted Nardi's definition and framework and narrowed it in the context of our multitouch environment to the "convergence of thoughts, actions, or ideas" and made the following operationalized assumptions for measurement purposes within a multitouch collaborative context.

Seven tag categories were established partially based on observations of over forty dyads performing collaborative work on multitouch devices, and partially based on common

notions of affinity, such as socially appropriate conversational distance (Hall, 1966; Richmond & McCroskey, 1995).

Peshkin has suggested that qualitative methods are the most useful means of observing social interactions (Peshkin, 1993). To quantify the affinity that we observed within dyads, we used an approach based on Anfara et al. in their discussion of making qualitative data gathering techniques transparent (Anfara et al., 2002). Videos of dyads were tagged with codes according to the behavior observed. The coding tags were derived from the below seven categories of affinity (see Table 1).

Coding for Affinity

Using the video recordings of the hand movements and voices of dyads, we divided the videos up between each task (Play/Training, Task 1, Task 2, Task 3, and Freeform/Creative). The researchers then classified each five-second block of the video based on two overall constructs: the type of **behavior** (9 codes) and type of **conversation** (16 different codes). See Table 1. For conversations, the codes were then grouped into four larger categories: ConvoCon-related (e.g. reading ConvoCon text to each other, discussing ConvoCons, trying to solve ConvoCon riddles, etc.), *ConvoCon-indirect* (laughter within 1 minute of ConvoCon appearance and non-work talk within 1 minute of ConvoCon appearance), *non-ConvoCon affinity* (talking about year in school, major, directing partner, etc.), and *low/no affinity conversations about task* (e.g. getting unstuck, teaching their partner how to perform a system action, etc.) These four conversation categories were further grouped into affinity-related and low/no affinity. Participants' behaviors were coded as *affinity-related* (e.g. close proximity of hands, turn taking where one places and the other adjusts, etc.) or *low/no affinity* (e.g. hand avoidance, independent work where one partner is

working on one section of the pattern while the other is working on another without any shared vision).

Table 1: The tags used to code the videos

Types of Conversation

- Affinity – Directly Tied to ConvoCons
- Riddle Solving
- Both Reading
- Laughing (ConvoCon)
- Talking (ConvoCon)
- Affinity – Indirectly Tied to ConvoCons
- Talking (within 1 min. of ConvoCon)
- Laughing (within 1min. of ConvoCon)
- Affinity – non-ConvoCon (not tied to ConvoCons)
- Playful Conversation
- Conversation About Partner
- Planning Solution (not fixing)
- Discussing Freeform
- Directing Partner
- Affirmation, gratitude, etc.
- Low/no Affinity
- Getting 'unstuck'
- Teaching
- Other Talking
- Work related (w/i 1 min. of ConvoCon)

Types of Behavior

- Low/no Affinity
- Independent
- Turn Taking (independent)
- Avoidance (hands)
- Grabbing (taking pieces from other's 'personal space')
- Affinity Related
- Turn Taking (one places, other adjusts)
- Directing-Following
- Close Proximity (hands)
- Shared Plan
- Building--adding on to other's (Creative/freeform only)

No Talking or Action

Each five-second block of video received one tag related to dyad behavior and one related to dyad conversation. The total number of affinity related blocks were then calculated and divided by the total number of blocks for each task. The overall affinity score is based on two parts: the proportion of affinity conversation and the proportion of affinity work (all affinity blocks / all blocks that exhibited some conversation or behavior). The proportion of affinity was then compared for each task between the experimental and control group through a Student's T-Test (see Table 2 for an illustration of the proportion calculation).

A total of 5,149 blocks were given conversational and behavioral codes by a single coder, one of the researchers. In order to ensure the coding method was valid, two videos (674 blocks) were randomly selected and the category codes for behavior and conversation were compared between the researcher and a second coder using percent agreement and Cohen's Kappa (calculated in SPSS version 18). The second coder was an undergraduate who was not informed about the purpose of the experiment. She was trained for approximately an hour. The second coder was also provided with a 1-3 sentence description of each code but was not provided a specific video example of the code. She then completed one practice video getting feedback from the researcher after each task had been coded, which were only checked to ensure that she understood the process—particularly that each block should have only one conversation and one behavioral code. After completing the practice video she then tagged the two videos used for the calculation of interrater reliability. For the behavior category codes across both videos, there was a 90% agreement between coders with a Cohen's Kappa of 0.612. For the conversational category codes across both videos there was a 90.7% agreement with a Cohen's Kappa of *k*-0.708. Both of these Kappa

scores fall into the range of scores that Landis and Koch referred to as "substantial agreement" (Landis & Koch, 1977).

Table 2. For a 4-block task (20 seconds), conversational affinity is 25% (1=affinity, 0=low/no affinity, blank=no talking). Behavioral affinity is 75%. The overall affinity is 67% (all affinity blocks / all blocks that exhibited some conversation or behavior).[35]

Conversation	1			0
Behavior	0	1	1	1
	5 sec	10 sec	15 sec	20 sec

6. Results

As this was an initial study intended to verify the feasibility of ConvoCons as an interface technique to encourage increased affinity in collaborative work, we have only analyzed the data using basic statistical methods and have not identified any other variables of interest at this time. In reading these graphs it should be noted that ConvoCons typically stopped appearing between the end of task 1 and the middle of task 2. In addition, the puzzles used for each task, presented in a consistent order, were intended to go from simplest to solve to hardest to solve. All Student T-Tests were conducted with an α=0.05.

Exit Survey

[35] While conversational affinity includes no talking, the overall affinity ignores those blocks since there were behaviors occurring during those blocks. Some readers may object to this approach. However, combining the two rows into one would produce an inaccurate picture of 100% affinity. Alternatively, counting all cells without talking would produce a 50% affinity in this simple example; however, in real world scenarios where people are constantly performing work but only occasionally talking, this method produces artificially low affinity percentages. In comparing all three methods for calculating overall affinity, we saw no noteworthy difference between counting and not counting the instances of no talking where action was still taking place. Ultimately, we chose to ignore the blocks without talking in the final method as it gave a more accurate depiction of what we saw qualitatively and any bias in not counting these favored the control group.

The control group (n=18; 9 dyads) had a mean age of 20 (SD=2.09) with 12 males and 6 females. All but one participant in the control group indicated that they had used a multitouch device (such as an iPhone) at least once with a mean response on a 5-point Likert scale of 3.0 ("A Few Hours") and a median response of 2 ("Tried it Once"). One participated self-reported as "Life of a Party" on a 5-point Likert scale of sociability, with a mean rating of 2.89 and a median score of 2 ("Prefer tight groups").

The experimental group (n=18; 9 dyads) had a mean age of 21 (SD=3.21) with 9 males and 9 females. Five participants in the experimental group indicated they had never used any form of multitouch device, with a mean score of 2.53 and a median score of 1 ("None") and 3 ("A Few Hours"). One participated self-reported as "Life of a Party" on a 5-point Likert scale of sociability, with a mean rating of 3.00 and a median score of 2 ("Prefer tight groups").

Analysis of survey results was conducted both through an analysis of individuals within each group as well as by grouping data into dyads where agreement at an appropriate level was scored a "1" and disagreement with one partner providing a score of "neutral" or lower scored as "0". There were no statistically significant differences between groups on the questions intended to assess participant's feelings of affinity toward their partners.

Completion Time – Log Data

Including the play time and the freeform task, there was no significant difference between the experimental group (mean=23.25 minutes, SD=7) and the control group (mean=23.25 minutes, SD=6.5). While groups were told they had five minutes to "play" with the system and learn the controls, the ConvoCon group was more likely to utilize the full play time while the control group often reached a point where both partners would

awkwardly stare at their feet, the screen and away from each other before asking to move on to the puzzle, resulting in a statistically significant difference between the groups (p=0.008). Since one concern we had was that ConvoCons and the incidental conversations might distract groups from the work at hand, we calculated the mean completion time just for the three puzzles to look at just the effects of ConvoCons on work efficiency. There was no significant difference in time spent on the three puzzle tasks between the experimental group (mean=14.75 minutes; SD=4.75) and the control group (mean=16.25 minutes, SD=6.5).

Quantitative Evaluation of Video Data

Q1 of this study, whether ConvoCons produce more incidental conversations was part of our score for conversational affinity with the means and standard deviations seen in Table 3. It should be noted that for frequency of incidental conversations, we did not count all conversational labels that we classified as signs of affinity—only the tags that were not related to work were counted (e.g. "playful conversations" and "talking about partner"). There was a significant difference between the frequency of incidental conversations between groups for the playtime, task 1, task 2, and task 3 (p=0.001, p=0.002, p=0.01, and p=0.021 respectively). However, there was not a significant difference between groups in the frequency of incidental conversations during the freeform task (p=0.11). Overall, there was a significant difference between groups (p<0.001) thus supporting the idea that ConvoCons increase the frequency of incidental conversations.

Table 3 Means and standard deviations of incidental conversations over all tasks indicate a higher frequency in the experimental (ConvoCons) group.

	Play	**Task 1**	**Task 2**	**Task 3**	**Freeform**	**Overall**
ConvoCons	15.78	8.22	5.44	7.67	2.67	7.96
SD	7.68	6.96	4.33	9.82	3.00	2.64
Control	3.11	0.44	1.22	0.33	1.22	1.27
SD	7.20	0.88	2.39	0.71	1.72	2.35

Table 4 ConvoCons serve as an early conversation starter for groups and the conversational affinity increases steadily.

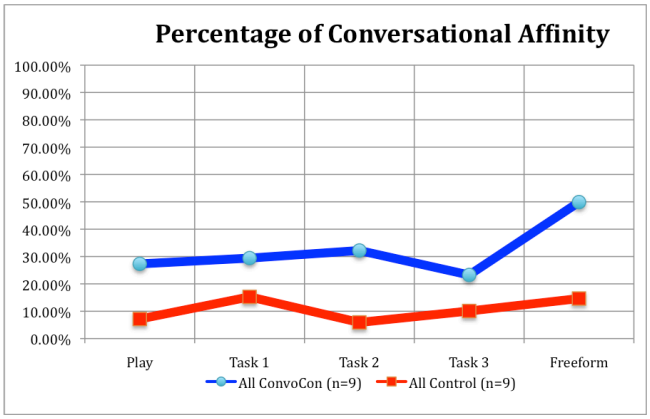


Table 4 corresponds directly with a portion of Q2 of this study: whether or not the use of ConvoCons leads to increased affinity. As expected from the literature on ice breakers that providing a shared framework for conversation allowed participants to begin incidental conversations at an early stage, resulting in a 20% increase in conversational affinity which was statistically significant at p=0.006. Furthermore, a statistically significant difference between the experimental and control groups were maintained throughout the duration of the study (task 1, p=0.025; task 2, p<0.001; task 3, p=0.004; and freeform, p<0.001). While the researchers expected a significant increase in conversational affinity for the freeform task in both groups, the control group only saw a 4% increase compared to the experimental groups 26% increase in conversational affinity. This difference came from the control group discussing the freeform task less, with conversation centering on the general shape that would be made and very little planning and coordination of the task compared with the experimental group. In fact, it was not uncommon to observe one individual in the control group take control of the pattern rather than sharing the work and design with his or her partner. Taking the mean across all tasks (not seen in the graph), there was a significant

difference (p<0.001) between the experimental group with a mean of 32.4% affinity (SD=10.2%) and the control group with a mean of 10.6% affinity (SD=9.3%).

Table 5 Behavioral affinity begins the same for both groups; however, when work on the puzzles begins there is sharp rise followed by a steady increase. Both groups see an expected jump in behavioral affinity in the freeform task; however, the experimental group ends nearly 40% higher.

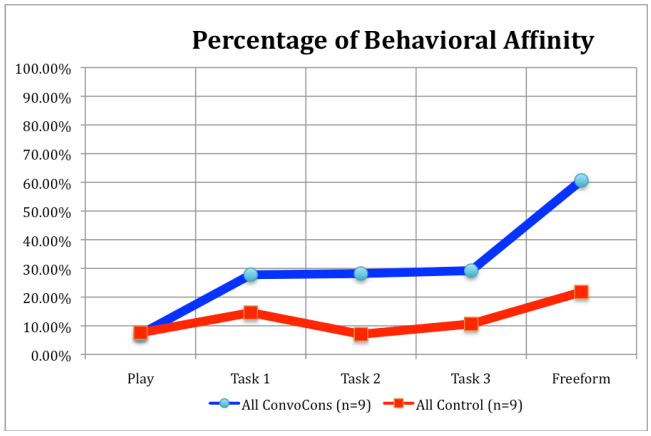
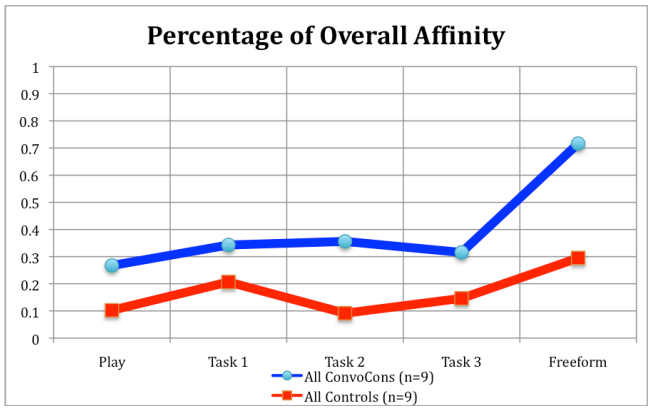


Table 5 also corresponds to Q2, whether or not the use of ConvoCons leads to increased affinity. To the researchers, this is the more important question since our ultimate goal for ConvoCons is to get individuals to work with one another in a collaborative manner. As expected with groups that are working together for the first time, the level of behavioral affinity for both the experimental and control groups starts out with a nonsignficant difference (p=0.456). Once the first pattern is given and the individuals start trying to complete a shared puzzle, the proportion of behavioral affinity goes up for both the control and experimental group, although the increase for the experimental group is larger with a marginally significant difference between groups (p=0.069). Task 2 and task 3 see a minor, but steady increase in the percentage of behavioral affinity for the experimental group with a statistically significant difference compared to the control group (p=0.024 and p=0.013, respectively). In the final, freeform task the researchers expected both control and

experimental groups to have a rapid increase in behavioral affinity as they work to realize a shared vision for a new pattern; however, while both groups did see a jump in behavioral affinity, the experimental group saw a much larger increase from 29.6% in task 3 to 60.6% compared with a 10.6% to 21.8% for the control group. This difference between the behavioral affinity and the control group for the freeform task was significant (p=0.002). Taking the mean score across all tasks results in a significant difference (p=0.004) between the experimental group with a mean of 30.6% affinity (SD=16.9%) and the control group with a mean of 12.3% affinity (SD=5.9%).

Table 6 displays the composite, overall affinity across all tasks. Playtime, task 2, task 3, and freeform all had statistically significant differences between the experimental and control groups (p=0.018, p=0.001, p=.002, and p<0.001 respectively). However, the difference between groups in task 1 was only marginally significant (p=0.068). The mean across all tasks was statistically significant (p<0.001) with the experimental group having a mean of 40.3% affinity (SD=10.9%) compared to a mean of 16.8% affinity (SD=7.8%) for the control group.

Table 6 The experimental group starts out with just under 20% higher affinity, due to the increased conversations occurring due to ConvoCons. Affinity continues to grow for the experimental group although there is a dip during task 3 when ConvoCons are no longer present. However, there is a sharp rise in affinity on the final (freeform) task and the experimental group ends with over 40% higher affinity.



Exit Interviews

During the interviews of the nine ConvoCon dyads, four dyads indicated no signs of affinity as they answered questions. Out of the four dyads that exhibited no signs of affinity, two of them exhibited a disconnect regarding their feelings toward ConvoCons where one person found them interesting/funny and the other had no opinion. Three of the nine dyads thought the ConvoCons were irritating or distracting and all three of these dyads expressed affinity or high affinity during the interviews. Only one of nine dyads had both members that enjoyed the ConvoCons and this dyad showed signs of high affinity.

Out of the eight dyads asked about the ConvoCons they remembered, six remembered three ConvoCons (a total of ten were displayed during their working time). One dyad remembered one ConvoCon and one remembered two ConvoCons. No relationship exists between the number of ConvoCons remembered and a group's feelings toward ConvoCons or their apparent affinity during the interview.

All dyads, regardless of their feelings toward ConvoCons, indicated that after some time they began ignoring the ConvoCons and focusing more on the tasks. This was expected and part of our reasoning behind stopping ConvoCons after a period of time had elapsed. Further studies may indicate what the "sweet spot" is for displaying ConvoCons long enough to get a dyad conversing but stopping them before the dyads decide to ignore the ConvoCons.

Four of the nine dyads indicated that they felt the ConvoCons were somehow related to the task. Of these four dyads, two showed no signs of affinity within the interview and two of them showed some signs of mild affinity. In addition, five dyads expressed feelings of pressure to complete the puzzles as part of the reason they began ignoring the ConvoCons—this was despite the fact that the groups were told that completion time was unimportant and that they would be given as much time as they needed or desired to complete the puzzles.

Finally, three of the nine dyads specifically mentioned that they felt the ConvoCons had an influence in getting them to begin conversations. However, one of these three dyads indicated no affinity during the interview.

7. Discussion

The 9% drop in conversational affinity for the experimental group from task 2 and 3 (mirrored in the overall affinity) is likely due to ConvoCons no longer appearing after task 2. Despite this drop, the freeform task saw the experimental group increasing conversational affinity to 45% higher than that of the control group.

One thing we noted, was the apparent unreliability of the survey data—while multiple observers saw groups where a single individual performed almost all work, however, the survey data reported that both participants felt they worked equally and the final product

equally represented one another's goals. This surprised us because previous studies that have examined similar concepts of rapport and development of common ground have relied almost exclusively on survey data (Carey, Hamilton, & Shanklin, 1986; G. Convertino et al., 2008). To us, this disparity between the survey data and the empirical observations suggests a need to explore new methods for assessing group work that has been echoed by other researchers who study improving group work (Bolia et al., 2006).

Given the power of authority and the tendency to conform to assigned roles demonstrated by Milgram and Zimbardo (Milgram, 1974; Zimbardo et al., 2000), participants may have been strongly focused on the puzzle tasks by 1) hearing our experimenter conduct training on the tasks and 2) knowing that they would receive a departmental research credit for participating in the study. The playtime (task 1) was designed to lessen these influences.

One of the key findings from the interviews is that groups that showed affinity during the interviews were likely to agree on their feelings about ConvoCons with three of nine dyads agreeing that they had negative opinions toward ConvoCons. These findings may suggest that the key to ConvoCons building affinity may not be the content but rather the creation of a shared experience outside of the work although further research would need to confirm this. Such a finding would be consistent with earlier work where we discovered that an ambiguous interface could lead to increased affinity within groups (Oren & Gilbert, 2009).

The lack of difference in completion time between groups provides support that ConvoCons do not increase the time groups take to complete work even though they produce more incidental conversations. These results are encouraging to us because they indicate that

it is possible to use the interface to increase conversational and behavioral affinity without adversely affecting the efficiency of work.

8. Conclusion

To return to our initial research question of "Does the presence of ConvoCons lead to increased incidental conversations," the data presented in this study suggests that they do, in fact, promote incidental conversations. Furthermore, the increase in incidental conversations does not appear to come at the cost of efficiency as measured by completion time.

At this point, our research focuses on affinity creation and does not look at the length of affinity bonds created nor does it explore whether or not affinity creation through our system promotes cooperation in a competitive environment; it simply seeks to explore a low-cost method of promoting affinity within a co-located dyad where neither partner has previous knowledge of the other. Some limitations of the current results include the possibility that the system will not work in a competitive team climate, it may not scale to larger teams without modification, and part of the benefit may be task specific. Future research will seek to answer these larger problems, but in this research we are seeking to establish a foundational framework for the design of interfaces to encourage specific collaborative behavior within working groups.

Regarding the secondary research question, "Do ConvoCons lead to increased affinity between participants," based on this study it appears that the incidental conversations promoted by ConvoCons are effective in producing a greater level of behavioral affinity, reifying Nardi and Whittaker's framework for affinity as a central element to collaboration. These results may also suggest that Schmid's theory of the role of affinity within the buildup

of social capital for the reduction of free riders and increased motivation may be realized through ConvoCons, although further studies would be needed to explore free riders within larger groups rather than simple dyads. This effect may be enhanced through the use of privileged, as opposed to shared, information within the ConvoCon display.

9. Acknowledgements

We thank Prasad Ramanahally and Jay Roltgen for their assistance in creating the drivers and software used for this study. In addition, we thank Joanne Marshall for her advice and help in exploring qualitative data. This research was performed with support from the Air Force Research Lab.

CHAPTER 5. DISTRIBUTED CREATIVE TEAMS: A TOOL FOR BUILDING AFFINITY AMONG DISTRIBUTED DESIGNERS

Modified from an article to be submitted to *Computer Supported Collaborative Work '12*
Michael A. Oren and Stephen B. Gilbert

Abstract

In this paper, we present the result of an iterative design for a user interface elements to increase awareness of privileged information that we use in a tool intended to increase incidental conversations and social affinity between remote collaborators working on design tasks. The results suggest that the tool is successful in increasing incidental conversations between strangers and overall affinity that is 14.6% higher than the control group, without a significant difference in task completion time.

1. Introduction

With increasing globalization, the need for remote collaboration with a distributed workforce where team members may have little information about the individuals with whom they work and no opportunities to learn about their colleagues' expertise through informal face-to-face communication (Warkentin, Sayeed, & Hightower, 1997). While instant messaging (IM) and other computer mediated communication tools may allow for some opportunities for colleagues to learn about one another's background and expertise, the barriers of time zones and limited opportunities for conversation with remote colleagues often prevent these informal dialogues. This situation results in the hidden cost that team members may not be aware of expert knowledge another team member may have. There is

also the more salient cost that remote collaborators have an impaired ability to form social affinity bonds that are critical to the creation of social capital and the type of social creativity required by modern product design teams (G Fischer, Czerwinski, Resnick, & Myers, 2006; Schmid, 2000).

Much of the work of computer supported cooperative work has examined making the experience more comparable to natural interactions (Robertson, 1997; Scott et al., 2003), increasing the efficiency of work (Cutkosky, Tenenbaum, & Glicksman, 1996), or improving the flow of project-specific information (Neff, Fiore-Silfvast, & Dossick, 2010). Similarly, the design of groupware systems has so far focused primarily on either all participants sharing the same workspace (Esenther & Ryall, 2006; Maher & Rutherford, 1997) or participants having a shared workspace with personal workspaces that serve to test ideas individually and these personal spaces are often visible to collaborators (Scott, 2003; Scott & Carpendale, 2006; Philip Tuddenham & Peter Robinson, 2007).

For our particular project, we were interested in privileged information as a means of encouraging incidental conversation and affinity building among remotely located strangers working on design tasks, extending our work on the co-located version of this problems (Oren & Gilbert, 2009, 2010). Theory suggests that by encouraging individual awareness of partner-privileged information, it will increase the sharing of additional information outside of the elements the design solution presents to collaborators (E. Goffman, 1975; Nardi, 2005; Vetere, Howard, & Gibbs, 2005). As this last aspect was outside of the scope of our current research agenda, we currently do not have results verifying that the design solution improved the sharing of additional privileged information. In this way the contributions of this paper

include designing interfaces for promoting awareness of privileged information and a tool for promoting social affinity among remote collaborators.

In this research, we had three research questions: (Q1) How can we promote awareness of privileged information in the interface during remote collaboration? (Q2) Are ConvoCons effective at promoting incidental conversations between collaborators? (Q3) Does our design solution result in increased observable signs of affinity as measured through behavioral and conversational cues?

2. Q1 Promoting Awareness of Privileged Information

In our research context, we adopt the following framework based on previous research: incidental conversation increases affinity among partners (Nardi, 2005; Oren & Gilbert, 2010), which increases sharing of priviledged conversation (E. Goffman, 1975; Nardi, 2005; Schmid, 2000; Vetere et al., 2005). While we had previously succeeded in increasing the social affinity of co-located groups, we found that the approach used in the co-located condition was ineffective when working with remote dyads (Oren & Gilbert, 2010). We attempted to resolve this by utilizing research that explains how technology can define individual's social expectations as well as work that explored establishing coordination policies outside of traditional social protocols (B Latour, 1992; Morris, Ryall, Shen, Forlines, & Vernier, 2004). In addition, we were able to utilize previous research into design and placement of web advertisements in order to try to alleviate problems potentially stemming from banner blindness by varying the color of the ConvoCons so they would be salient while at the same time matching the style of the content, the tangrams, the users were working with

(Langheinrich, Nakamura, Abe, Kamba, & Koseki, 1999; Lohtia, Donthu, & Hershberger, 2003).

In examining this problem, we defined the audience as strangers collaborating remotely for the first time with no knowledge of physical appearance, skill set, or knowledge. We chose to have participants collaborate via voice communication but not video since previous research has shown that video communication produces a negative impact on the effectiveness of collaborative work (Bradner & Mark, 2001).

We evaluated the design within a multitouch interface that made collaborators aware of where their partners were touching in accordance with the recommendation by Kellogg and Erickson (Kellogg & Erickson, 2002) for transparency of actions within collaborative applications. The context was a tangram puzzle chosen because the puzzles require a high cognitive load while the application, itself, requires no interface beyond direct manipulation and thus minimizes the possibility of poorly designed interface elements being the cause of conversation (Oren & Gilbert, 2009).

In order to evaluate the effectiveness of our design in promoting awareness of privileged information, we used a multiple phase iterative design process to explore and evaluate different design options given our design context. These phases included brainstorming sessions with the research team, informal feedback from colleagues, and examining the effectiveness of the design with participants through pilot studies with each pilot phase consisting of 2-3 dyads. Through this iterative design process we examined layout on the screen to promote awareness, different ways to promote knowledge of privileged information, and different ways of making users aware that they do no have all available

information. In this context, the privileged information consisted of the question or answer to children's jokes or riddles, e.g.:

> Q. Why did Donald Duck go to college?
> A. He wanted to be a wise quacker.

Because participants are generally aware of the paired question-answer joke paradigm, we anticipated that seeing just the question or just the answer singly might suggest that their collaborator had the missing information. Even without the participants being aware of the privileged information, we hoped the initial reading of one part might stimulate conversation due to a natural desire to avoid social awkwardness when one person talks and the other does not respond within a culturally dependent timeframe (R. Collins, 1992). While jokes may seem overly casual or unrelated to a task, they offer a simple paradigm with which to analyze a privileged information interface that could be generalized to task-related information (E. Goffman, 1975).

For all iterations, the ten ConvoCons appeared at the first touch for a duration of thirty seconds each and a minute in between the disappearance of one ConvoCon and the appearance of the next one with a total duration of thirteen minutes.

First Iteration

In the first iteration, the system gave one person the question half of a riddle or joke (unrelated to the tangram puzzles) while the collaborator received the answer half. Participants were not told that the messages would be popping up nor were they told the significance of the messages. The messages did not allow interaction and did not interfere with the tangram interface below. This model was based off of the presentation utilized in the co-located tasks, but in the co-located tasks the users were aware of the other information as

they were able to view it upside down, with their partner having a privileged view (Oren & Gilbert, 2009).

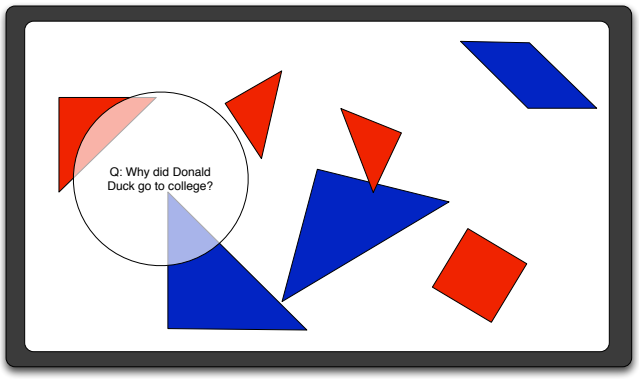


Figure 10 Iteration 1 with the message left-aligned and no indication of a second half.

Dyads used the tangram interface for approximately 25 minutes and experienced these messages for the first 10 minutes of that time; we experimented with the placement of the information—left, center, and right side to see if that would affect the likelihood of collaborators discussing the information. We also manipulated the presence of a half circle at the top center of the screen with the content of the other participant's message displayed upside down to further mimic the presentation used in the successful co-located environment (see Figure 10).

From this iteration, we learned that participants were most likely to discuss the information when the text was placed on the left. We thought that placing it in the center, on top of the work, might increase their awareness and thus the number of conversations associated with the jokes and riddles. However, center alignment tended to result in banner blindness and informal interviews after the study indicated that participants chose to ignore the center-aligned text in favor of focusing on the work at hand. Since participants were from

Western cultures, the failure of the right aligned configuration was unsurprising although in cultures where text is right aligned, the optimal placement may be different.

Exit interviews also uncovered that regardless of layout, individuals in both groups believed they had the same information on their screen as their collaborator. Those with the half-circle indicating part of the content of their collaborator had noticed the half-circle but assumed they could pull down the answer/question from the half-circle and wrongly assumed the inability to do so was due to a software bug.

Second Iteration

The decision was made to run a new round of pilot studies with just the subtle change of making the half circle containing the text of the other participant as a dashed circle instead of a solid circle in an attempt to indicate lack of ownership of the ConvoCon content (see Figure 11).

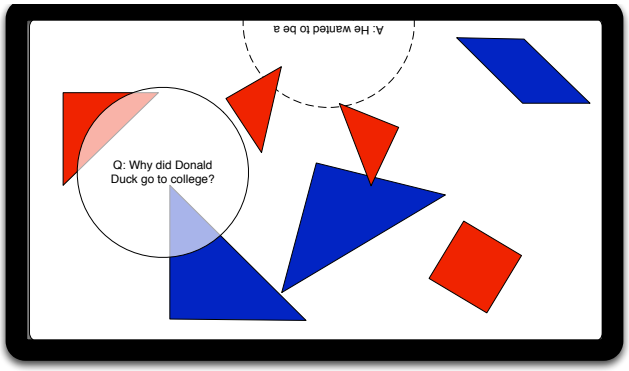


Figure 11 The layout for the second iteration, with second half indicated as "other" by dotted line.

While this minor tweak tested slightly better than the solid half-circle, participants were still unlikely to begin discussing the content in the same manner as the co-located groups had in our previous experiment (Oren & Gilbert, 2010). Furthermore, exit interviews

still indicated that participants believed their collaborator shared the same content they did and that there was no difference in terms of the text shown.

Final Iteration

The failure of the second design led us to begin rethinking our approach to making participants aware of their collaborator's privileged information. Instead of displaying the content as solid text, we began to explore the use of varying the opacity of the content as a means of indicating privileged information. With this in mind, we developed three primary designs to test in the pilot phase. Before moving to the pilot phase we ran the mockups of the previous designs and the new mockups by colleagues and several strangers in an attempt to get more feedback on what worked and what did not for each design. This informal polling indicated that the design of the second iteration should perform better, so we decided to include the second iteration design within our pilot trials in case its failure in the previous round was due to the network bug. We also decided to eliminate the design where the primary content fades (see Figure 12).

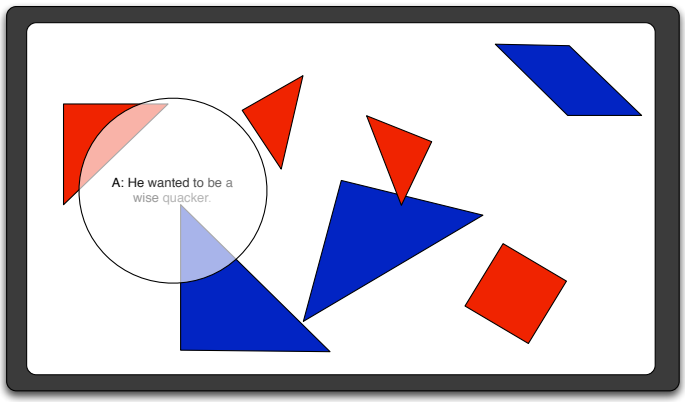


Figure 12 Stage three design eliminated via informal polling.

Figure 13 indicates the two new designs that were evaluated in this round. Both of these new designs provide participants with both halves of the information but fade out the information that belongs to their partner. In addition, we explored swapping which piece of information a participant owned—before one person always owned the question half and the other always owned the answer half. In this round, the design where both the question and answer were in the same bubble with the other half faded tested the best and resulted in discussions being prompted in a manner similar to the co-located condition. Exit interviews also indicated that this last design was successful in making participants aware of privileged information.

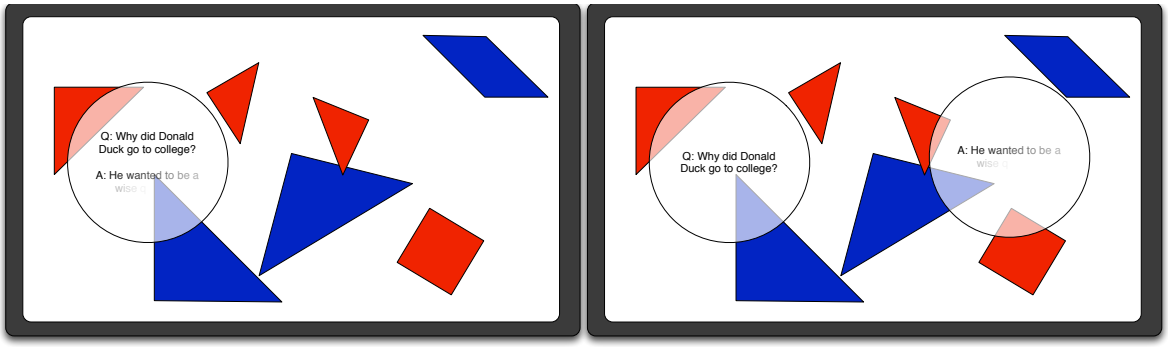


Figure 13 The new designs evaluated in the pilot studies.

Additional Observations

In some cases, it was apparent that one participant noticed the information while the other participant either failed to notice the text or chose to ignore their partner. Assuming one participant failed to notice the information, this might be explained by previous research into road signs that some individuals do not attend to textual information while working on another task (Brewer et al., 1985).

During some pilot testing, a bug cropped up in the networking code where the tangram pieces were no longer synchronized causing participants to have different views of

the state of the puzzle completion. This lack of a synchronized view did lead to some additional conversations and a lot of information sharing that may be an area for future exploration of methods to stimulate conversation; however, it has the drawback of creating misunderstanding and may lead to increased task difficulty.

While an additional study still needs to be conducted to ensure that this approach will lead to people sharing more privileged information, the results of the iterative design process has at least shown the potential for indicating privileged interface information in a subtle way to collaborators. A qualitative assessment also suggested that this design approach will lead to participant conversations about the privileged information, which our previous research has shown leads to participants having more conversations in general (both work and non-work related) without a negative affect on performance as measured by completion time. We believe that this approach of presenting both halves of privileged information but fading it out can be generalized to other projects needing to promote awareness of privileged information—whether that information is text (such as previous work experience), images (such as a design), or some other form of visual content.

3. Q2 & Q3 Improving Social Affinity

In reading these graphs it should be noted that ConvoCons typically stopped appearing between the end of task 1 and the middle of task 2. In addition, the puzzles used for each task, presented in a consistent order, were intended to go from simplest to solve to hardest to solve. All Student T-Tests were conducted with an α=0.05.

In order to evaluate the effectiveness of our system in improving social affinity between remote collaborators, we first pre-tested 50 participants using the form board test

and a subset of Goldberg *et al*'s AB5C personality test (Bäckström, Björklund, & Larsson, 2009; Ekstrom, French, Harman, & Dermen, 1976; Goldberg et al., 2006; Hofstee, de Read, & Goldberg, 1992). Since the reliability of AB5C is evaluated on each subsection, in addition to the big 5 factors, we chose to only use the aspects of personality relevant to our study, specifically: sociability (mean=2.79; SD=0.69), creativity (mean=3.46; SD=0.51), friendliness (mean=3.59; SD=0.63), leadership (mean=3.40; SD=0.57), gregariousness (mean=3.21; SD=0.63), assertiveness (mean=3.68; SD=0.41), cooperation (mean=3.33; SD=0.48), and ingenuity (mean=3.80; SD=0.43). Individuals with high spatial ability and high sociability scores were paired with individuals who scored low in order to ensure dyads all dyads were balanced on both of these scales. Dyads were then randomly assigned to either the control group or the experimental group and Student T-Tests were run to ensure that no significant difference existed on any personality aspect or on spatial abilities between groups. Participants also indicated their previous experience with multitouch systems (such as the iPhone) with a mean score of 3 (SD=1.05) on a 5-point Likert scale and computers and no significant differences appeared between groups on these measures. All participants came from the psychology department's participant pool and had a mean age of 19.67 (SD=3.09).

Procedures

Having minimized the impact of individual variance affecting the results, we then attempted to schedule participants for the follow-up study to complete the tasks. Here, we ran into problems of participants failing to respond for the follow-up study or failing to show up. However, we were still able to successfully run nine control dyads and ten experimental dyads (for a total of 40 participants, a 20% attrition rate). In order to ensure participants did not meet before the start of the experiment, we had one participant go to a lab on the second

floor of the building and the other to the lab on the first floor of the building. Each participant interacted with the application using a 20” 3M multitouch monitor. Upon arrival, participants were asked to read through and sign the informed consent and then put on the headset to await further instructions. Instructions were delivered via Skype and followed the same script, which ended when participants were asked to touch and hold their screen until both participants were simultaneously touching the screen. The process of starting requiring mutual touch was done to ensure accuracy of task timing and to make sure both participants were ready to begin the task. Aside from piece movements, participants’ touch points were transmitted and displayed as circles on the interface in order to allow for translucence of action (Erickson & Kellogg, 2003).

Participants then spent up to five minutes learning the system on their own with actions limited to dragging pieces, rotating pieces using two fingers, and flipping pieces along a fixed axis using a double tap. For most pieces, flipping simply acted as a 180-degree rotation but the parallelogram has a different orientation when flipped and flipping it is necessary for the third puzzle. After five minutes had elapsed or participants had indicated they were comfortable using the system, they were given the first of three puzzles. No time limit was given on the completion of the puzzle and participants were not allowed to move on until the puzzle had been completed (see Figure 9 for a sample timeline). After all three puzzles had been completed, the participants were given up to five minutes to create anything they wanted with the pieces or could stop when they were satisfied with their creation.

Upon completing all tasks, participants then completed a short exit survey based on Convertino’s survey to assess common ground (G. Convertino, et al., 2005). The exit survey

also asked them to rate their prior familiarity with their partner and all participants indicated that their partner had previously been a stranger.

4. Results

A significant limitation of this study was the need to keep participants from seeing one another before the study forcing us to place the computers in different locations and thus putting the study at the mercy of the campus network instead of keeping both computers on the same switch. Due to these network issues along with some problems in the commercial screen recording software we began the study with, which worked during the pilot tests, we ultimately wound up with only four control dyads and four experimental dyads (16 participants total) for the detailed video analysis. However, we report the results of all dyads for the exit survey and log analysis, although we break out the results of the groups that were analyzed for affinity over time since many of the groups that were thrown out had other factors, such as bonding due to network bugs that forced communication to solve the puzzle, that could have impacted the results. Despite this loss of data, we believe that the findings of the detailed video analysis present an accurate view of the overall trend. The dyad compositions were two male-male dyads and two male-female dyads in the control group; with three male-male dyads and one female-female dyad in the experimental group. Participants would have been able to identify one another's gender via the voice communication but were unaware of any other traits of their collaborator. No significant differences existed among the demographics or spatial ability between the dyads in the control group and the dyads in the experimental group—this was examined using the Student T-Test both at the dyad unit of analysis and at the individual participant level of analysis.

Additionally, no significant difference existed between the dyads where usable data was obtained and the larger sample population.

Completion Time – Log Data

Some dyads from the full sample are not included in this analysis, due to network latency resulting in the time scheduled for participants running out or lost data due to crashes; we only report the full results here. Including the playtime and the freeform task, there was a marginally significant difference (p=0.08) between the experimental group (n=7 dyads; mean=27.85 minutes, SD=4.43) and the control group (n=7 dyads; mean=22.51 minutes, SD=8.54) when examining the entire sample. Within the final sample, there was no significant difference in completion time between the experimental group (n=4 dyads; mean=26.72; SD=4.44) and the control group (n=4 dyads; mean=21.69; SD=9.84). Since one concern we had was that ConvoCons and the incidental conversations might distract groups from the work at hand, we calculated the mean completion time just for the three puzzles to look at just the effects of ConvoCons on work efficiency. Looking at the entire sample, there was a marginally significant difference (p=0.057) puzzle completion time between the experimental group (n=7; mean=21.62 minutes; SD=3.14) and the control group (n=7; mean=17.45; SD=7.35). There was no significant difference for the final sample in time spent on the three puzzle tasks between the experimental group (n=4; mean=20.88 minutes; SD=3.62) and the control group (n=4; mean=16.60 minutes, SD=8.48). In the entire sample, no single task indicated a significant difference in completion time between the experimental and control group. However, playtime was marginally significantly longer (p=.066) when looking at the final sample between the experimental group (n=4; mean=3.11 minutes; SD=0.91) and the control group (n=4; mean=2.16; SD=0.59).

Exit Survey

The control group (n=18; 9 dyads) had a mean age of 19 (SD=1) with the final sample (n=8; 4 dyads) having the same mean age and standard deviation. The experimental group (n=20; 10 dyads) had a mean age of 21 (SD=4.6) with the final sample (n=8; 4 dyads) having the same mean age with a standard deviation of 2.7; the original sample was skewed due to one participant being age 38 and this participant was not part of the final sample.

In the full sample, the experimental group reported significantly higher (experimental mean=4.05; SD=.39; control mean=3.72; SD=.75; p=0.048) feelings of "shared task understanding" as well as a marginally significant higher feeling of "role understanding" (experimental mean=3.75; SD=0.55; control mean=3.39; SD=0.55; p=.063) with both metrics coming from Convertino's survey on assessing common ground, which utilizes a 5-point Likert scale (G. Convertino, et al., 2005). None of the other survey metrics indicated significant differences when using the entire sample.

In the final sample, we analyzed the data on both the individual level as well as comparing on paired dyads. Comparison by dyadic units follows the recommendation of (Mizruchi & Marquis, 2006). In the comparison based on individual units, we found marginally significant differences between the experimental and control group on ratings of time efficiency, amount of work, the quality of work, the satisfaction with their work on task 1, and self-reported use of the turn-taking strategy (significant) with higher scores in the control group. All questions other than the use of turn-taking, which was a binary checkbox among a list of possible strategies they may have utilized, were 5-point Likert scales. When compared on the dyadic level of analysis, each of these same categories was found to be

statistically significant or marginally significant. The means, standard deviations, and p-values for the individual and dyadic comparisons can be found in Table 7.

Table 7 Exit Survey results indicating the control group self-reported higher on their assessment of time-efficiency, amount of work, quality of work, task 1 satisfaction, and use of turn-taking strategy.

Individual		**Time-Efficient**	**Amount of Work**	**Work Quality**	**Task 1 Satisfaction**	**Turn Taking**
n=8	**Experimental**	3.25 (.71)	3.75 (.47)	3.63 (.92)	3.375 (1.06)	0.25 (0.46)
n=8	**Control**	3.75 (.71)	4.00 (0)	4.25 (.46)	4.13 (.64)	0.75 (0.46)
		p=0.09	*p*=0.074	*p*=0.054	*p*=0.054	*p*=0.024
Dyadic						
n=4	**Experimental**	3.25 (.29)	3.75 (.29)	3.63 (.25)	3.375 (.85)	0.25 (0.29)
n=4	**Control**	3.75 (.29)	4.00 (0)	4.25 (.29)	4.13 (.48)	0.75 (0.29)
		p=0.025	*p*=0.067	*p*=0.008	*p*=0.088	*p*=0.024

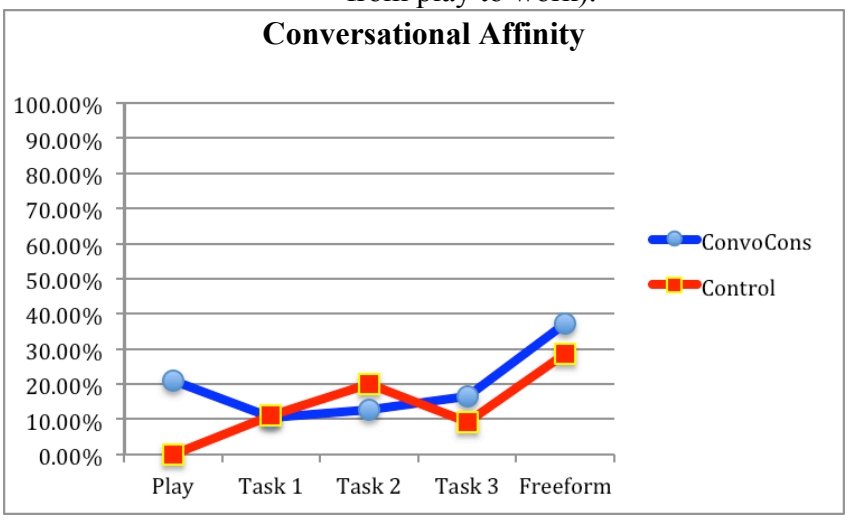
Q2. Incidental Conversation

In calculating the frequency of incidental conversations, we did not count all conversational labels that we classified as signs of affinity—only the tags that were not related to work were counted (e.g. “playful conversations” and “talking about partner”). There was a significant difference between the frequency of incidental conversations between groups across all tasks, with a higher frequency count seen in the experimental group. Overall, there was a significant difference between groups thus supporting the idea that ConvoCons increase the frequency of incidental conversations for remote collaborators (see Table 8 for the full results).

Table 8 Means and standard deviations of incidental conversations over all tasks indicate a higher frequency in the experimental (ConvoCons) group.

	Play	Task 1	Task 2	Task 3	Freeform	Overall
ConvoCons (n=4)	8.25	8.00	5.25	4.50	7.25	6.65
SD	6.40	4.24	4.27	0.58	2.99	1.53
Control (n=4)	0	0	0.75	1.50	1.75	0.80
SD	0	0	0.96	2.38	1.26	0.67
***p*-Values**	0.021	0.005	0.043	0.025	0.007	<0.001

Table 9 ConvoCons serve as an early conversation starter for groups and the conversational affinity increases steadily (after an initial drop when switching from play to work).



Q3. Affinity Metrics

Table 9 presents the percentage of conversational affinity across all tasks. As expected from the literature on ice breakers that providing a shared framework for conversation allowed participants to begin incidental conversations at an early stage, resulting in a 21% increase in conversational affinity which was statistically significant at p=0.031. However, outside of task 3 (p=0.021), no statistically significant difference was seen in conversational affinity between the experimental and control groups. Taking the mean across all tasks (not seen in the graph), there was a marginally significant difference

(p=0.097) between the experimental group with a mean of 17.68% affinity (SD=6.14%) and the control group with a mean of 13.90% affinity (SD=5.10%).

Table 10 shows the measured behavioral affinity across all tasks. To the researchers, this is the more important question since our ultimate goal for ConvoCons is to get individuals to work with one another in a collaborative manner. One of the more interesting findings in this study is that the experimental group actual began with significantly higher behavioral affinity (p=0.033), which stands in contrast to our findings from our co-located study (Oren & Gilbert, 2010). However, this initially high behavioral affinity, which was primarily from participants building on to each other's creative designs during play, falls drastically when the work begins. A statistically significant difference in behavioral affinity is seen again in task 3 (p=0.021). Taking the mean score across all tasks results in a significant difference (p=0.013) between the experimental group with a mean of 22.57% affinity (SD=7.35%) and the control group with a mean of 11.52% affinity (SD=1.76%).

Table 10 Behavioral affinity begins almost 30% higher for the experimental group and remains slightly higher during the work tasks (after an initial drop) and ends about 10% higher than the control group.

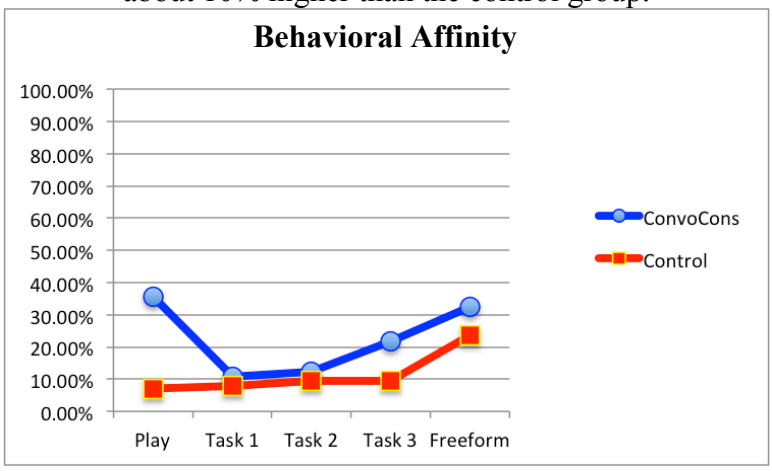
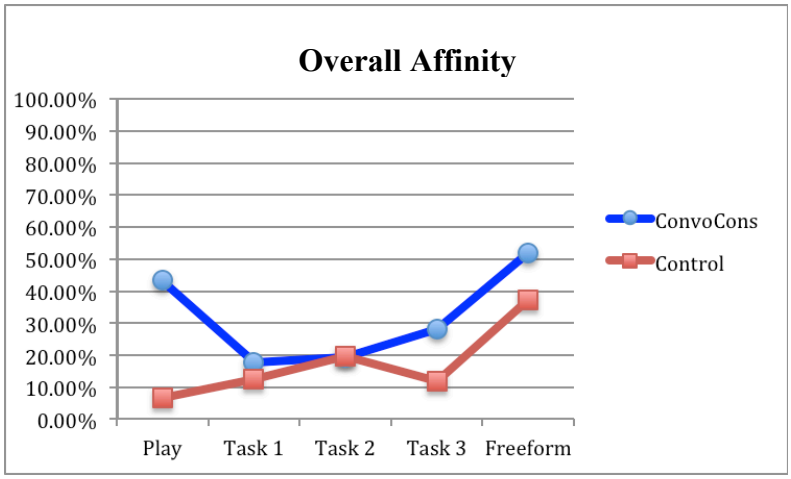


Table 11 displays the composite, overall affinity across all tasks. Playtime and task 3, both had statistically significant differences between the experimental and control groups

(p=0.003 and p=0.002); additionally, the freeform task had a marginally significant difference between groups (p=0.099). The mean across all tasks was statistically significant (p<0.001) with the experimental group having a mean of 32.06% affinity (SD=3.90%) compared to a mean of 17.46% affinity (SD=2.33%) for the control group.

Table 11 The experimental group starts out with just over 35% higher affinity, due to the increased conversational and behavioral affinity occurring due to ConvoCons. There is a drastic decrease in affinity when the puzzle tasks begin, but the affinity of the experimental group grows during each task and ends nearly 25% higher than the control group in the freeform task.



5. Discussion

The large drop in affinity conversation and behavior may be due simply to participants switching modes from play to work; it may be due to the play phase, combined with the ConvoCons, served as an icebreaker period and the drop in affinity is similar to the drop seen when moving from icebreakers to actual work; or it might be due to some combination of these two factors. There is some evidence pointing toward it being related to a change from play to work; however, as the majority of behavioral affinity in the play task came from participants building off of one another's designs rather than working in close

proximity or in cooperative turn taking. Similarly, there is only a very small drop in frequency of incidental conversation from play to the first task and this suggests that the drop in conversational affinity is due to increased work-related conversations.

While the exit survey for the entire sample must be taken with a grain of salt, they do suggest that the ConvoCon group was able to establish stronger bonds of affinity and form a greater understanding of working with their partner. In looking just at the final sample, the results suggest that the control group felt that they were generally more efficient at accomplishing good quality work; however, there is no evidence that this is true when examining the completion times of just the final sample, although we do see evidence of this in faster completion times as seen in the full sample. However, the finding of groups with higher affinity performing less efficient work is unsurprising as previous research on remote collaboration showed a similar result when comparing videoconferencing to teleconferencing, with videoconferencing still being recommended as a tool to help bond individuals at the first team meeting (Dubé & Paré, 2001; Egido, 1988). While the experimental group is potentially less efficient, there are other potential benefits to increased affinity such as recognizing the strength of collaborators and the build up of social capital that can produce more efficient work over a longer period of time (Schmid, 2000).

6. Conclusion

We have presented the design of user interface elements to encourage awareness of privileged information and in future work, we plan to test whether or not increased awareness of privileged information within the user interface will increase sharing of privileged information given to participants prior to the start of the study. One element of the design

that needs to be improved in the future is the inclusion of both graphical and textual information in order to increase the salience of indicators and reduce the possibility of one individual ignoring the information while the other attends to it.

Due to the network latency and other problems encountered during this study, there is currently the limitation both of the small sample size and the results of the full sample needing to be taken with a grain of salt since other factors may have impacted both the log results (latency increases the amount of time it takes to complete puzzles) and the affinity bonds formed (latency and bugs associated to it increased bonding over shared frustrations with the system). However, the qualitative results from the full sample do provide further support to the idea that shared frustration from either bad design or system glitches can increase the bonds between collaborators (Oren & Gilbert, 2009; Riche et al., 2010).

Despite the aforementioned limitation, the results of this study do suggest that ConvoCons can be used to increase incidental conversation. Additionally, there is evidence to support the idea that ConvoCons has an initial impact on conversational and behavioral affinity as well as a significant affect on overall affinity. We believe that the aforementioned change to the system, which may result in increased awareness of the ConvoCons, will see an increase to the effectiveness of ConvoCons in terms of increasing conversations and all affinity metrics.

Finally, as the results of this study also indicated that the affinity bonds associated with ConvoCons may also decrease work efficiency, we also plan to conduct future work into ConvoCons that attempts to decrease affinity bonds in order to improve efficiency of work. We believe that the amount of affinity needed in order to work productively and

efficiently will vary widely based on the type of task being worked upon and hope that over time we can categorize the optimal range of affinity for various types of work.

7. Acknowledgements

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CHAPTER 6. SOCIETY-COMPUTER INTERACTION: TOWARD A NEW DIRECTION IN HUMAN-COMPUTER INTERACTION AND SOCIAL COMPUTING

Modified from an article to be submitted to *Human-Computer Interaction*
Michael A. Oren

"Do you want to sell sugar water for the rest of your life, or do you want to come with me and change the world?" – Steve Jobs

Abstract

In this paper, I explore the social impacts of technology an their potential to alter human behavior, thought, social norms, etc. as a potential force of good when yielded responsibly by human-computer interaction researchers and practitioners. In this paper, I make the case that we must consider these impacts and consciously design to promote changes in norms, when those norms are no longer functionally beneficial to society, or reinforce them in order to better benefit society as a whole. Additionally, I explore expanding the predominantly cognitively oriented theoretical canon of human-computer interaction through the inclusion of classic sociological theory. Several other topics are touched on briefly and are intended to serve as focal points for further discussion within the field.

1. Introduction

In the early days of personal computing, human-computer interaction served as a key force in promoting the needs of the individual user over the blind advance of technology. As a new social age of computing continues to grow, it becomes increasingly apparent that the changes are motivated by an uncritical drive toward technology and business evolution,

leaving society and humans outside to conform to the technological paradigms. With technology now an ubiquitous element in individual lives we must turn our gaze toward human-human interactions as they are shaped by technology to address design solutions which minimize the alienation, anomie, and loss of individuality—the results of mass produced individuality and the amorphous hive mind, free of the rebellion and creativity needed to drive innovation forward.

The personal computer is dead--that is, assuming it ever truly existed. There has always been a social aspect to computers as a means of accomplishing and sharing work, connecting with remotely distributed collaborators, and linking people with shared interests and passions (Dourish, 2004; Rheingold, 1993). With computing technologies' continued ubiquity and the prevalence of the Internet, computational technologies are now as much a part of social lives as the local café (Wellman & Haythornthwaite, 2002).

Computer technology, despite the frequent comparisons with the adoption of radio, television and the telephone, has permeated more deeply into our social interactions than have any previous technologies (Brynjolfsson & Hitt, 2000; C. S. Fischer, 1994). Additionally, while other technologies such as medicine that impacted on part of our life or telegraph and telephone technologies that were merely interacted with on occasion, computational technology has become a constant fixture in both our work and social lives, to the point where entire books are dedicated to the concept of "disconnecting" (Powers, 2010). Despite this deep integration into our daily lives, we still have little understanding of the causal mechanisms behind the way technology can affect interactions, even less in examining technology for potential impacts before release.

Just as a previous generation of human-computer interaction researchers sought to understand how technology could be used to augment and alter cognition, it becomes the civic and scientific duty of the new generation to create theories that help us understand the impact of technology on society and human-human interactions as well as ways of designing technologies to put society and humans *before* the technology. The current focus on technology has led to what Jaron Lanier has described as "cybernetic totalism," where we glorify the accomplishments of technology and the faceless crowd (a pre-modern form of society) over the role of the individual (Lanier, 2010). To make this last idea more explicit, we can turn to a traditional sociological view of religion, where group interaction rituals are used to make individuals feel as if they are part of a larger "divine" plan and project their own image onto the group "god" (É. Durkheim & Pickering, 1994). In essence, this exact same process happens when we give up recognition of individual contribution and creativity and bestow credit on to the faceless crowd of Wikipedia editors and "the cloud" in general. Similarly, just as religion involves a series of interaction rituals that bond individuals, we find that our use of technology involves a series of interaction rituals that produce similar bonds to a point where some researchers, such as Bainbridge, believe that we are seeing religious institutions replaced by virtual communities (Bainbridge, 2010; R. Collins, 2004).While a full discussion of the interaction rituals from computers is beyond the scope of this paper, one familiar example is the morning ritual by most individuals who work on computers to power up their computer in the morning and spend the first five minutes or more going through e-mail and checking the online news or the college student who updates their Facebook status every hour.

Regardless of whether or not one believes that a "digital revolution" is quietly occurring in much the same way as the industrial revolution did just a few hundred years ago, it is clear that, from instant messaging to Facebook, the way social groups communicate and organize is changing (Tapscott, 2008). In addition, technology allows for semi-controlled social environments that can be leveraged for both inductive and deductive research. While current virtual worlds such as *Second Life* and *World of Warcraft* lack the institutional control and consequences of the real world, researchers can create new worlds that include these enforcers of social norms so human social behavior can be studied in a more realistic environment than the currently available online worlds. Simulation has been used in both HCI and sociology in the past, but in our modern world we now have the capability of using humans, rather than artificial intelligent (AI) based agents since virtual worlds are now populated by thousands of players and ubiquitous technology allows for real-time tracking of human behaviors (Bainbridge, 1987, 2010; Bellotti et al., 2008; Froehlich, Chen, Consolvo, Harrison, & Landay, 2007). Thus, it becomes critical for us to use our knowledge to both understand how technology affects society through use of simulation and ubiquitous research tools as well as design technology to support changes that benefit society as a whole.

An Uncertain Future

We stand at the edge of a precipice as computation permeates every aspect of the lives of Western citizens and rapidly encroaches upon citizens of all nations regardless of their cultural or political affiliations. Technology and the way we interact with it on both the individual and the social level has come a long way since the special interest group on computer-human interaction (SIGCHI) was first established in 1982 at the Human Factors in

Computer Science Conference (CHI). Arguably, the first CHI conference served as the establishment of computer-human interaction as its own discipline—bringing together computer scientists and psychologists from around the world. In 1982, the everyday use of computers by all citizens everywhere was still just a pipe dream, as the computer was just a tool primarily used for business purposes. The CHI conference has undergone significant transformation over the past several years, but beneath it all is a crisis of identity. As a discipline, human-computer interaction (HCI) has grown very large in a relatively short period of time and with the changes in computation and use, the former canon of the field is no longer sufficient in establishing an intellectual basis to work (Rogers, 2004). While HCI has benefited from a broad range of disciplines and approaches, without establishing a strong theoretical core to the discipline, we risk reducing the likelihood of our forming a high-consensus, high-impact discipline.

One has simply to read one of the books or articles declaring sociology a dead discipline for an example of another all-encompassing discipline which has suffered from an inability to work within a shared understanding of what constitutes knowledge in the field (R. Collins, 1994; Gouldner, 1970; Porter, 2008). Prior to the epistemological wars of the 1960's, sociology was a respected science and contributed significantly to our understanding of the world and examined ways society can be improved; it was not uncommon for it to be considered the most important of all sciences (E. Durkheim, 1982; Mills, 1959 (2000); Ward, 1897). Now, sociologists debate among themselves whether sociology is a science and spend their time debating the future of the discipline, while major transformations to society brought on by technology have been marginalized and largely ignored by the discipline (Berdayes & Murphy, 2000; Button & Sharrock, 1993; Cole, 1994; R. Collins, 1989).

However, although sociology has failed itself, a case could be made that its theories and methods could play a powerful role in the intellectual core of an emerging generation of human-computer interaction researchers, in much the same way cognitive psychology has served as primary theoretical core of human-computer interaction up to this point.

Computation has become an increasingly social and ubiquitous construction, with impacts on all levels of human interaction from pairs of individuals to traditional societal institutions of families, governments, etc.; as well as networks and cultural phenomenal such as the Internet and financial systems that are global in nature. The social nature of these human and social/cultural systems suggests that sociological theory could readily serve as the logical base for the new generation of human-computer interaction, as sociology has a rich tradition of a scientific study of interaction from as early as 1893 in Émile Durkheim's seminal work on the division of labor in creating social systems (E. Durkheim, 1997). While human-computer interaction has always considered interaction, the unit of analysis has traditionally been primarily that of the individual through a study of the cognitive principles that inform the design and allow evaluation of interfaces and the computational, with a focus on building systems. Given the large scale impacts of the Internet, cloud computing, social media and global instantaneous financial systems, it is surely past time that we shift our focus to interactions between and among other units of analysis, including individuals, groups, and other kinds of aggregations, organizations, societies, and cultures.

Selectively importing sociological theory into the core of HCI will begin the process of addressing the problems with the social theories currently available to HCI practitioners, as identified by Yvonne Rogers (Rogers, 2004). Specifically, many of the classic sociological theories are predictive and prescriptive while the social theories currently available in HCI

tend to be neither. Furthermore, where descriptive theories and practices in HCI such as activity theory, situated action, and ethnographies have contributed to our understanding, the use of these theories is impractical in most industry settings and often require considerable training (Kuutti, 1996; Nardi, 1996; Rogers, 2004).

The call for social science theories and methods to be employed within computing technologies has been recognized by leaders in HCI in the concluding chapter of *The Human-Computer Interaction Handbook*, which denotes one of the grand challenges of the field being a need for a better understanding of computer-supported collaboration in terms of understanding how to best utilize the technologies to organize corporation's distributed efforts (Sears & Jacko, 2008). Clearly this is an area where the social sciences could provide unique insights into the field by asking questions not currently on the table. Some sociologists, such as Lucy Suchman with her *Human-Machine Reconfigurations*, have witnessed some areas where social theories can help inform design, as in situated action (L. A. Suchman, 2007). At present however, social scientists constitute a minority within the field of HCI despite technological advancements in pervasive and multi-touch devices, which further supports the call for socio-techno research (Sears & Jacko, 2008).

In stark contrast to such descriptive theories is Max Weber's use of "ideal types," a concept similar to personas, which makes it easier for HCI practitioners and researchers to adopt (Weber, 1904). An ideal type is a model or construct useful in the classification and comparison of groups and other aggregates, complex and social organizations, and even social systems and cultures. The ideal type does this by determining the common elements across a range of similar instances and then generates an explanation for how those similarities both comprise the ideal type and how it makes the type predictive of outcomes

(Weber, 1904). By utilizing ideal types to determine the critical elements of contextual interaction or an organization, we can find ways of applying research findings across different situations and more readily compare the results of our studies of social computing applications. Eventually the use and testing of ideal types would mean that empirically validated types would become standard tools of analysis and less empirically valid ideal types would fall out of usage. This reflects, of course, the standard deductive-model of science: theory-proposition-hypothesis-theory-testing-theory revision model of science outlines by Thomas Kuhn in *The Structure of Scientific Revolutions* (Kuhn, 1996).

Sample Ideal Type: Engineers

The most basic, defining characteristic of an engineer that truly separates engineers from all other academic disciplines can be defined in two words: "problem solving." Scientists seek to categorize and understand the causes of the existing world; mathematicians seek to prove the existence of solutions and provide formulaic methods of arriving at quantitatively grounded solutions; artists seek to aesthetically interpret the world; and philosophers to understand all possibilities of the world whether it is as it exists or as it could exist.[36] While one may think that because engineering is grounded in problem solving that it should follow that engineering is grounded within problems identified as being in need of a solution, the reality is that engineering seeks out problems, often before a problem exists. This is in stark contrasts to the physical and biological sciences, which only identify problems, as they exist within the system. Within the non-engineering culture, there is a misconception that engineers lack creativity and simply calculate and build a solution to a

given problem absent any need for creativity. However, engineering involves an aspect of creativity through the design of solutions and in the process of solving problems as more than one solution to a problem exists and the problem space may not be known, so creativity, in the case of engineering, can be seen through designing the most elegant solution. This is in contrast to creativity in the arts where rather than seeking elegance of a solution; creativity is defined as a wholly original production—creating something out of nothing, so to speak.

However, one popular cultural conception of engineers that tends hold true, and has become a problem within recent changes in engineering needs within industry, is the engineers' tendency to prefer individuality and solitary work (Leonardi, 2003). In contrast, until very recently even the individual scientist working solo on a problem did not see the task as solo work but identified with the "scientific community." Similarly, artists may produce a work as an individual but the work only receives the necessary recognition and value that makes it 'art' through acceptance by other members of the community of artists, either during their lifetime or post-mortem. Engineering solutions do not require outside recognition, the only criteria is whether or not they solve the problem, and as such the field is able to take a more individualistic view. Another defining characteristic of engineers is that they often take action solely to solve a problem and do not attempt to calculate the optimal solution or seek methodical precision—the solution only needs to be "good enough" or satisfice as sociologist/economist Herbert Simon would put it (Simon, 1996). Ignoring what is often actually the case in science (Bruno Latour, 1979), the sciences seek methodical precision in measurement and work to seek the optimal way to measure a phenomena—this

[36] These are, admittedly, gross generalizations but serve to give a salient example of an ideal type.

is why psychological studies measuring reaction time for keyboard presses require special equipment that will measure the precise reaction time to the millisecond as regular computer input has a delay imperceptible to end users (and engineered "good enough" solution that is not "good enough" for psychologists). Similarly, mathematics exists almost solely in order to study the ways of calculating precise solutions to problems and satisficing is nearly unheard of in mathematics. Thus, engineering seeks action to achieve a solution to a problem without necessarily seeking methodical precision.

To sum up, the primary characteristics that make up an engineering ideal type are "problem solving", "problem creation", creativity through solution elegance, individualistic, and action-oriented (reaching a solution without necessarily seeking methodical precision). The extent and exact importance of each of these factors varies based on the precise type of engineering one is talking about or the problem the engineer is trying to solve. For example, an engineer working on a space shuttle will seek methodical precision to ensure conditions are as safe as possible for the astronauts, but an engineer working on a low-cost micro satellite will not worry as much since solutions are designed with an expected failure rate, which is why multiples are often launched as only one needs to work properly. An engineer from any engineering discipline should exhibit these traits to varying degrees but an individual outside of engineering may not possess all of these traits.

Utilizing Ideal Types

From the above example, the similarity to the broad generalizations found in personas should be clear. In addition, my inclusion of contrasts to other disciplinary mindsets that make up HCI should help illustrate how ideal types can be utilized as a discussion tool in

research and practice. When using an ideal type, it is important to keep two ideas in mind, that are related to its use as a taxonomic method:

1. if it fits within the metric of the ideal type and
2. what are the unique characteristics (the details ignored in the creation of an ideal type) that makes it distinct from other instances fulfilling the criteria of the ideal type.

While we are unlikely to care about the ideal types of disciplines for most of our work, we may find that ideal types for different social groups, organizations, or technological compositions can be powerful tools within our work.

2. Understanding Power

As some individuals will be reluctant to recognize the authority of computer professionals, particularly designers and builders of computational systems, there is a need to first discuss relevant sociological theories related to power. Power, as a concept, is fundamental to sociological thought (Tucker, 1978) and a discussion of integration of social theory with human-computer interaction would not be complete without a brief discussion of computation as a tool for power. Classically, power is defined as a means for an individual to get other individuals to do something that the individuals would not willingly do without an external influence or motivator. There are three primary theories of power within sociology: functional, conflict, and interactional. Of these three theories, the one that is most useful in this discussion is functional power as envisioned by Durkheim, a state where crime is necessary in a healthy society in order to allow society to continue to evolve and change its values for continued growth and stability (E. Durkheim, 1997). The functional perspective tells us that the role of power should be to allow for transitions in thinking, as discussed further in the section on innovation, as well as ensure stability. In conflict theory, individuals

in power are placed at odds with those who lack power in a social system and the social structure is used to keep those in power from obtaining power (Tucker, 1978). The conflict provides a path that should be avoided, as individuals who wield power through technological knowledge and expertise, we should make it our goal not to force solutions down to a technologically illiterate mass population but to lower the barrier to participation. The last mode of power, interactional, stems from functional or status inequalities that allow one individual to wield power over another individual, such as an expert withholding information (R. Collins, 2004). Interactional power is often necessary for social groups to accomplish goals, but in the case of status inequalities that do not have functional purposes (such as gender or racial inequalities) interventions or structural changes need to be designed to reduce and eliminate the affects of interactional power (Ridgeway, 1993)

While a full discussion of this topic is outside the scope of this paper, a new "power elite" has emerged in the last few decades consisting of individuals possessing the technical knowledge (a form of interactional power) necessary to design, build, and utilize complex computational systems (Bard & Söderqvist, 2002). At the same time a new middle class, as defined by sociologist C. Wright Mills typology of the middle class, has emerged consisting of the individuals who create the information technology policies and maintain the networks that the current "salary slaves" of office workers are chained to ((Bard & Söderqvist, 2002; Mills, 1951 (2002)). The creation of new social classes outside of the traditional economic and political classes, places a social responsibility on those who design, build, and manage the technology that lock billions of individuals into interaction paradigms (Lanier, 2010). Researchers and practitioners in HCI stand at a critical nexus, as it is our work which connects the human actors to the computer systems, Vulcan-like systems that lock human

users into defined sets of actions they are both required to, in the context of work, and choose to, in the context of social interactions, utilize on a daily basis. Some of us even go beyond simply addressing the interactions of the individual with the system, but further, address the interactions of systems to other systems and thus the interactions of individuals to other individuals (either in an ubiquitous way or by directly seeking to connect people to one another). However, in our networked world, almost all computation can now be viewed as a social interaction at some level. HCI is still waking up to this reality and we are thus failing in our roles as members of a power elite that whether accidentally or purposefully, enslave individuals to machines to an extent that even transcends Foucault's description of the panopticon that makes up the current model of power in society (Foucault, 2000; Lanier, 2010).

In Foucault's exploration of knowledge and power throughout human history, he notes that the current model of power is based on surveillance made possible by attaching human work to machines that can easily be monitored (Foucault, 2000). In his essay, Foucault was speaking primarily about industrial technologies and had not yet imagined the level of attachment people would have to their computational devices. Furthermore, this level of control has moved beyond simply a control over work, with socialization moving increasingly online, one does not have to look far to find warnings about how individuals need to censor their online presence in order to not jeopardize future employment , although a recent court case appears to protect their free speech in relation to their current employment ((Eaton, 2009; Hananel, 2011). Understandably, some might protest that we, as designers of technology, cannot control how our creations, designed with the best intentions, are usurped not only by users but also by the political and economic power elite. While admittedly,

hindsight is 20/20, I contend that had we been more familiar with sociological theory and examined our designs not just on their efficiency, or the rising trend in their experience, but also the impacts they might have on the way people interact, perhaps we could have designed our technologies differently.

Here I must pause and take a second to make one thing clear: I am not contending that we stop designing new computational systems or throw out our current systems for a radical new system. Neither of those solutions is practical and both of those solutions stand in the way of progress and thus, to me, fail to be solutions at all since we should always consider progress a goal at some level. Instead, I am contending that we must recognize the power vested in us by the technical knowledge and skills we have obtained along with our role as the gatekeepers between the bits and brains in order to help engineer progressive changes in society.

Out of the currently available theories that discuss the role of technology in society the one that appears to most successfully explain our interactions is Bruno Latour's Actor-Network Theory (ANT) that views technology as an equal social actor that people imbue with their values and beliefs and when other actors choose to interact with the technology, they must conform to the values and beliefs that are built into the technology (B Latour, 1992; Bruno Latour, 1996). While ANT has its flaws, particularly the ethical implications of objects as equals to human, the premise of technological objects serving as agents of human creators. While many of the premises of ANT have yet to be experimentally evaluated, if the basic premise is to be accepted then this places a significant onus on the designers and researchers of technological interactions, namely human-computer interaction researchers and practitioners.

Returning to Foucault, it should be noted that part of his argument regarding power comes from what constitutes knowledge at a given time period (Foucault, 2000). While one argument is that due to the sheer volume of knowledge being ascertained and made available, the understanding of information is only possible via computational tools (2009), the more significant argument is that computers play a role in the creation of knowledge and not simply in the parsing of data. From the very early days of sociology, through Durkheim's *Division of Labor,* and as articulated by Dewey's assertion of the central role of communication, sociology has always contended, regardless of epistemological underpinnings, human knowledge is formed through interactions—with the world, through communication, and through the actions individuals take (Dewey, 1939; E. Durkheim, 1997; Parsons, 1937). As people interact with computers on a daily basis, some form of knowledge is then transmitted to them, for example; the rigid logic to which the computer adheres, this direct interaction and acquisition of knowledge is compounded, however, by the fact that computers often mediate our communication and actions with one another. Due to various monetary, technical, and infrastructure restrictions, there are limitations placed on our communication and interactions with one another as we utilize computational technologies, which result in a restriction of our interactions and thus a subtle shaping both of our knowledge and our ability to create and interpret technology (Bijker, Hughes, & Pinch, 1987). Thus, the computational world becomes embedded within our social fabric and part of what constitutes knowledge to the point where the phrase, "it isn't real unless it's on Facebook" becomes a reality. As Bainbridge asserts; virtual worlds and social networks are serving to replace religion as the modern world becomes increasingly secularized (Bainbridge, 2010).

Human-computer interaction is traditionally about making computers easier to use and lowering the information literacy bar. However, information only has value insofar as people and organizations have privileged information that they can choose to share, keep secret, retain, or destroy. While Facebook and other social networks have made this fact salient in terms of individual privacy, little research has been done to explore the way computational interfaces can be designed and ways of evaluating interfaces *and* policies to ensure increased sharing of mission critical information within and, when relevant, between organizations to enhance their ability to compete while also retaining the value of the information by not freely sharing information equally.

To reframe this idea: modern technology allows societal structures and organizations to *push down* rules to constrain and control those previously uncontrollable situational interactions (Conley, 2009; B Latour, 1992; Bruno Latour, 1996). Technology creates a fixed situation for interaction with fixed rules while still giving the illusion of individual control over interactions. This is an extension of Latour's ideas, the full discussion of which is beyond the scope of this paper; however, understanding this basic idea we can delve further into a possible future in HCI as a form of applied sociology.

Avoiding a Technological Quick Fix to Social Problems

There have been several attempts in the last century to fix social problems via quick technological solutions; however, these are often done simply by introducing technology that may fix, or cover up the symptoms, but not address the cause itself (Volti, 2010). I am not proposing the blind introduction of technology, nor am I proposing technology as a direct means of promoting social change. People and society are too complex and too resistant to

direct manipulation to make a direct approach workable. A cure for merely the symptoms of techno-socio problems fails to utilize the power of technology in modifying social interactions. Whereas other technologies have helped people complete tasks, prolonged life, etc., computational and communication technologies are the first that fundamentally change the way people interact both with one another, with organizations, and the way organizations act with one another. By addressing the way people interact, we directly address social behaviors and motivators by fundamentally changing the social structures that are supported through the interaction mechanisms and, in theory at least, should find greater success than previous attempts at technocratic rule (Poster, 1990; Volti, 2010).

It would be worse for us to ignore the power forced upon us by our vocation as doing nothing will lead to the continued immersion of individuals into a cocoon of anti-social "social" technologies (such as Facebook, Twitter, etc.) and finish the descent of humanity into Mills' vision of the "Cheerful Robot," blindly following a pre-programmed routine (Mills, 1963). It is through a façade of individualism that we cheerfully make our descent into our self-centered universes where Facebook makes us the center of attention and we tune the world out as we listen to iTunes with our noise-isolating earphones.

3. Applied Sociology and Social Responsibility in HCI

Lester Frank Ward was the first president of the American Sociological Association (ASA) and his pragmatic approach to sociology is credited as serving as the foundations of Roosevelt's New Deal (H. S. Commanger, 1967). Ward believed that by studying society and identifying the mechanisms that reproduce inequality and other social ills, we could introduce social programs and utilize the education system in order to engineer a better

society (Ward, 1906). While Ward has fallen out of popularity in the discipline of sociology, with the ASA Career Award recently being renamed in favor of W.E.B. DuBois further diluting Ward's place in the American sociological canon (Deflem, 2008). Despite his marginalization in sociology, I believe Ward's concepts detailed in *Applied Sociology* can play a critical role in determining the future direction of HCI as a discipline not only designing and researching technology but also as social engineers constructing a better society (Ward, 1906). However, unlike Ward's earlier vision that involved bureaucratic efforts and construction of social programs, we can more directly engineer social change by utilizing the power of technology (as explained by ANT) to influence and direct people into conforming to social norms encouraged by the computational devices and applications people use (B Latour, 1992; Bruno Latour, 1996). In fact, this idea is not entirely unknown to the HCI community as recent years have seen a steadily rising interest in design for social change (Harboe et al., 2008; Lindley, Couteur, & Berthouze, 2008; Maynes-Aminzade, Pausch, Seitz, & MIT, 2002). However, rather than confining this to a sub-interest, I contend that all HCI researchers and practitioners need to consider how the interfaces that are being created influence interactions at both the individual and societal levels since they are occurring whether we are conscious of them or not.

Tackling Societal Problems Through Computer Interfaces

Emilé Durkheim, founder of sociology, explored the functional and structural mechanisms that allowed human society to evolve and reach modernity through ever increasing division of labor allowing individuals to specialize and become experts in a discipline or trade (E. Durkheim, 1997). In his final chapter, Durkheim went on to describe

how industrial society was seeing the overspecialization of individuals to a degree where communication between specialists in different disciplines was no longer possible due to a condition he referred to as anomic division of labor, where individuals are isolated from one another and no longer able to communicate effectively (E. Durkheim, 1997). While this problem was first identified in the 19th century, it has only grown in magnitude first with industrialization and then the knowledge economy leading to increased specialization and increased difficulty in communication between specialists.

Although increased specialization and greater division of labor has allowed society to advance at unprecedented speed over the past century, an increasingly competitive environment has shown the limitations of design by narrow specialists. While specialization is still required, modern product design often requires interdisciplinary teams to collaboratively design solutions to the difficult problems faced within engineering and a globally competitive market (Perrson & Warell, 2003). However, given the anomic division of labor these interdisciplinary design teams often struggle to collaborate at first since words often have different meanings between disciplines and the goals of disciplines often conflict. In order for these problems to be resolved, researchers must find ways of helping diverse teams form the affinity bonds between individuals that will help them build social capital and work more effectively toward their common design goals (G. Fischer, Scharff, & Ye, 2004).

When individuals work together for the first time they lack knowledge of one another's reputations and other relational elements typically useful for successful cooperation (Bolton et al., 2005). Strangers cooperating for the first time without a shared connection to facilitate introductions and establish common ground may at first struggle to reach the level of affinity needed for productive cooperation (G. Convertino et al., 2008; Nardi, 2005).

Individuals seek affinity as a means to fill a need for interpersonal relationships and established affinity is necessary for sustained cooperative relationships (Honeycutt & Patterson, 1997; Whittaker, 2003).

In my own research, I have designed and run initial evaluation of a user interface technique developed to build affinity and effective collaboration strategies among strangers more quickly by promoting incidental conversations. This system of conversation-starting icons, called ConvoCons, offers conversation starters to encourage an informal discourse between new partners that Nardi identified as a central component of group affinity (Nardi, 2005).

ConvoCons are part of an ongoing research effort to explore means of using interfaces to promote constructive collaborative strategies among groups of individuals using computers to facilitate their work, with a particular emphasis on collaboration involving creativity and design (Oren & Gilbert, 2009). Currently, we have shown their potential for use in a co-located working environment through a controlled laboratory study where a 40% difference in affinity was found at p=.001 (Oren & Gilbert, 2010). Results from a study of distributed teams also suggested that ConvoCons help build affinity within a controlled experiment (Chapter 5).

Role of Social Theory in Collaborative Tools

While the problem that has created the anomic division of labor that impedes the effectiveness of interdisciplinary design teams occurs at the macro level of social structures and organizations, we viewed the solution as an organizationally enforced prescription at the micro-level of small group interactions through interface elements, such as ConvoCons,

intended to intervene and mediate communication. Such interface elements, while visually and computationally simple, require designers to take into account a variety of theories from sociology and psychology to efficiently mediate group behavior in a subtle manner that minimizes distraction from the task-at-hand.

In designing ConvoCons for example, one of the key elements we needed to understand were the small group interaction techniques could be used within conversation—informed by Erving Goffman's dramaturgical work in which he examined medical teams use of humor to maintain bonds and reduce stress (E. Goffman, 1975). Additionally, the social mechanisms that allow ConvoCons to work effectively are based on the work of conversation analysts who have observed that, in Western societies, the gap between one person speaking and the other responding is barely perceptible, anywhere from a half second between the end of one person speaking and the next beginning, and is viewed as awkward silence (R. Collins, 1992). By giving individuals privileged information, the ConvoCon system allows one person to initiate the conversation and the other person to feel socially obligated to continue the conversation by reading their piece aloud. Since only a very small conversation can be had from directly reading the ConvoCons, the resulting space after the ConvoCons have disappeared (or have been discussed) make participants feel obligated to continue the discourse. However, if the initial conversation ended in awkward silence a new ConvoCon will likely appear in an attempt to reignite conversation between participants and give them another chance to increase their comfort and affinity with their collaborator.

Alternatively, taking a phenomenological viewpoint, we can see that task-oriented groups are forced by structural constraints to construct a unique reality for their interactions (Dourish, 2004). Thus, ConvoCons can be used as a tool for individuals thrown together in a

group to find a common ground element, ambiguous enough to not force a shared definition, which allows them to form a shared view of the world and begin productive collaboration. If ConvoCons works in this way, a longitudinal study is necessary for confirming the likely mechanisms at play, then this means that while the individuals may seem to be a primary group in observations at the end of a single session, they will not maintain contact afterward and will need to rebuild affinity bonds in future working sessions. This same phenomena can be observed in groups of individuals brought together for a single task, such as a disaster response team, or a group of people who share a particularly strong experience, such as being trapped in an elevator, where at the end of the event all individuals appear to have formed a primary group but contact is rarely maintained.

Discussion of Example

The above example illustrates one way social theory combined with the current cognitive theories used in HCI, can be utilized in both the identification of a problem (Durkheim's *Division of Labor*) and integrating ideas from social theory (Goffman's role distance) into a fairly simplistic interface design with a powerful impact. Critical to the idea behind addressing societal issues through computational systems is that the change should not be drastic or forced modifications of the way people interact. Such large scale changes that ignore existing social structures would be doomed to fail—exemplified by Ward's popularity decline after social changes were implemented through the New Deal (H. S. Commanger, 1967). Facebook has not been modifying our social interactions by introducing a wholly new concept but rather because it takes what we already know and tweaks it slightly, never forcing us to adopt anti-social behaviors, simply making us aware of the

possibilities and reducing the amount of work we need in order to interact with our peers.

Our predecessors designed earlier interfaces they found success through improving ease of use and reduction of steps and time to complete tasks within computer systems. Ease of use and improved efficiency continues to be important in creating social systems with the intention of changing social behaviors. Novelty and "experiences" can change behaviors temporarily, as seen in Volkswagon's popular "fun theory" project, but to create a change that permeates into the way individuals act, think, and interact we must make our interfaces in such a way that they will always see a personal benefit (G. H. Daniels, 1970; Volkswagon, 2010).

4. Sociological Insight, HCI, and the Innovation Paradox

While I expect this paper will result in some level of discussion and be met with some controversy, I expect no section of this paper to engender as much discussion as will this one. Computational technology has created a paradox where at once the knowledge of and to use, and design of technologies requisite for innovation also stand in the way of innovation. For at least a decade, scholars and writers in the United States have been discussing what they see as a reduction in American innovation blamed on everything from failures in the education system to the role of economic (Andersen, 2006; Nelson & Wright, 1992). During this same period, computation has been promoted to such an extensive degree that there is now a push for students to learn "computational thinking," or thinking in strict logical procedural processes (Guzdial, 2008; Wing, 2006). While the full discussion of this argument is outside the limited scope of this paper, it should be clear from the social theories of innovation that

computation is at least one factor, if not a chief factor, in the reduction of innovation within the United States (one of the countries most dependent upon computational technologies).

There is little disputing the core ideas behind *The Fourth Paradigm* and *New Kind of Science* that scientific innovation in the modern world is dependent upon computation to organize, cross reference, and explore the vast amounts of information people have created (Hey et al., 2009; Wolfram, 2002). Part of the innovation problem may also be due to engineers not having enough official power in society, as Veblen observed half a century ago that engineers are the key to innovation in the United States but rarely have the power to be key decision makers, being subservient to financiers and business oriented management (Lerner, 1950). However, many of the top computing companies in the United States have CEOs with engineering backgrounds, thus Veblen's theory may not be enough to account for a perceived reduction of innovation. Rather, as Lanier posits, the reduction of innovation is due to the way computers lock us into a particular way of thinking and doing things; a very simple example of such is when we cannot submit a form unless all of the requisite data is entered within a specific format (Lanier, 2010).

While I do not expect much disagreement on the necessary role of computation in modern innovation, I do expect a decent amount of dissent and debate about how computation can serve as an impediment to innovation. I should note here that I do not contend that the use of computation makes innovation impossible, small-scale innovation through mash-ups are promoted and made considerably easier through the use of computational technology. Rather, the forced conformity build into computer systems and the enforcement of a binary logical model impedes the ability of individuals who are not technically proficient from creating innovation in the form of paradigm shifts, which require

outsider intervention (Kuhn, 1996). The most critical idea in understanding this concept is that innovation and creativity is essentially a form of social deviance, as Merton states: "[Innovation] refers to the rejection of institutional practices but the retention of cultural goals" (Cropley, Cropley, & Kaufman, 2010; Merton, 1968). However, as Suchman and Orr observed, computational technology forces individuals into *prescribed* paths based on policy in a way that cannot be surmounted due to the computational technology locking the policy in as the only accepted practice (Lanier, 2010; L. Suchman, 1995). Even in the case where we design interfaces for multiple paths, users are still constrained to the interactions that we have thought to design for, that is, unless they have the skill and knowledge to hack the system and open up a new interaction path. This becomes considerably troubling when we begin to look at what Steve Jobs refers to as post-PC products that place previously unprecedented controls into the system to lock users out and into a pre-ordained mode of interaction so that files become accessible only in the app they were created in, with little sharing of information.

From this stepping-stone, we can begin to see the inherent paradox that we must overcome in order to move computation forward and retain an innovative edge. This should also help illustrate the very troubling problem of the current push to promote computational thinking within education: rather than computers being made to provide users with control of their interactions, we are asking people to think like computers, further locking them into a rigid system of logic that prevents their ascension beyond institutionalized practices—at which point the practices *become* the institution.

Through these institutions we are led into compulsive conformity. While Merton discusses innovation as a form of deviance, he also discusses the more socially accepted form

of deviance such as if an individual compulsively follows prescribed practices they fail to define their own path and thus fall into an insurmountable rut (Merton, 1968). This compulsive conformity often comes in the form of rituals we fail to question. My contention is computing and the push for computational thinking not only forces interaction rituals on people by constraining our interactions but also culturally embeds them due to the mass acceptance and reproduction of the computational interactions. For HCI practitioners and researchers, a significant portion of this problem is due to our ambition to simplify computer interactions to the point where interactions no longer require much thought. When a person can take an action without thought, they often fail to think critically about the action (Newman, 2001; Žižek, 1998). This failing is then multiplied by the extremely rigid logic of computation which further discourages critical thinking; in a recent study of higher education, computer science students are among the lowest ranked in terms of critical thinking skills (Arum & Roksa, 2011).

Here we have the heart of the matter, we require computation in order to achieve continued innovation at the same historical pace, but as currently designed, computation impedes innovation. While there are many issues interaction design can address, it seems fitting that the core focus of the initial efforts to pair classic sociological theory with HCI should, at least at first, focus its efforts on redesigning computational interactions to overcome this paradox. Part of this effort would naturally include an increased focus on ease of end user programming, something that has traditionally been a focus in HCI with various ebbs and flows of popularity. As we cannot account for all possible actions that users may take, and a completely accessible path to end user programming may not exist, we must however, discover new ways of creating interfaces that allow for deviant interactions, not

simply by handling the errors but by giving the user control of the meaning making process through promoting human-human, human-organization, or organization-organization interactions. Such interfaces, such as the example of ConvoCons, would not necessarily require direct user action and might not have a clear interpretation, instead the users would be free to choose the way they interact and be forced to interact for the purpose of meaning making.

5. Examination of Socio-Technical Theory

In his book, *Tribes*, Seth Godin explains how some social networking technologies can be used to create global movements in ways heretofore unknown and with considerably less effort than ever before (Godin, 2008). However, *Tribes* simply looks at the leadership necessary in these small autonomous units, it does not try to explain the organic social phenomena that are at the heart of many of these socio-techno systems. These technologies influence the way humans interact from the micro-level, of leaving messages on the 'wall' of a friend that in previous generations individuals may have lost touch with, to the macro-level social organization where the structure of global corporations reliant on computer technology for organization and communication purposes can be analyzed along with the overall social systems that develop within virtual worlds (Bainbridge, 2010; Boellstorf, 2008).

Although examinations of the role of technology in social systems are scarce, some attempts have been made over the past several decades. While a full review of these theories is beyond the scope of this paper, we can briefly review of three popular approaches known to HCI. Bruno Latour (philosophy/sociology), Lucy Suchman (anthropology/sociology), and Kevin Crowston (management sciences) all come from different branches of the social

sciences and form different conceptions of human motivations and their interactions with nonhuman entities. All three theorists discuss and/or contain themes related to the role of human vs. nonhuman entities, the panopticon's influence on social actors, role of space, time and social context, conceptions and roles of power, mutual intelligibility, and (in)visible mechanisms of activity.

Latour

Critical to Latour's theoretical conception is his definition of an actor as a "semiotic definition" and simply anything that acts or is attributed by others as having acted (Bruno Latour, 1996). This is a much broader definition than Goffman, for instance, who seemingly limited the role of a perform (or actor) to human individuals, seemingly performing for the approval of others (Erving Goffman, 1959). Equally important is the conception of a "network" as a topology in which all interactions occur, with "as many dimensions as they have connections", and everything is based on conceptions of networks (Bruno Latour, 1996). Like actors, Latour's conception of a network is considerably broader than many other social theorists, such as Tilly's conception of a network, focused on the trust social actors have for one another in order to help mitigate disputes (Tilly, 2002). Translation is another central concept to Latour's theory where the role and conception of one actor can be shifted on to the conception of another actor within a network (B Latour, 1992). Modernity is defined as an asymmetrical conception that ignores both the "birth of 'nonhumanity'" as well as the "crossed-out God" and is characterized by doubles (Bruno Latour, 1993). Through the dualism of modernity, we get what Latour refers to as "hybrids" which are formed through the translation process of giving nonhuman objects human roles (B Latour, 1992; Bruno

Latour, 1993). Along with hybrids, the concept of a "quasi-object" also has a tie to the translation process in that it is an actant that moves because it translates the moving object; it is necessary in order for actors to move between networks and create the hybrids (Bruno Latour, 1993, 1996). Nature is everything that is not human or extrahuman, although it seems Latour attributes this conception of nature as a purely Western conception, but it is yet the conception which defines modernity (Bruno Latour, 1993). Society, on the other hand, contains the subject and the human aspects that are defined by relations, such as politics, and the Western society the framework of nature—within modern conceptions (Bruno Latour, 1993). While many other concepts exist within Latour, the last one defined here will be "nonmodern" as the patching of the divide between society and technology as well as the divide between society and nature, this is what Latour sees as reality once the focus shifts to networks (B Latour, 1992; Bruno Latour, 1993, 1996).

For Latour, theory should assume that actors do not have any motivation while acting, there should simply be a blank slate to be filled by the actions occurring (Bruno Latour, 1996). It should be noted that Latour does not see this as the condition for any real actor, simply the conception that should be taken up by any observer. However, in his earlier work, he does appear to provide a motivational mechanism for social actors in power as seeking to create dualistic conceptions, e.g. a moving vehicle must have a driver with a buckled seatbelt(B Latour, 1992). These actors in power do not take on this role of enforcement directly but find nonhuman delegates to enforce their prescription (B Latour, 1992). Other social actors simply follow their pre-inscribed positions as determined by the engineers and authors, although the actors may deviate, such deviation is either irrelevant (e.g. the actor was excluded in the prescription—such as a small child or elderly individual from opening a

hydraulic door) or a new way of prescribing behavior is created (B Latour, 1992). In fact, Latour seems to imply that (human) actors desire such delegates of the forces in power as the delegates create order and reduce the work required by (human) actors (B Latour, 1992).

Suchman

Suchman's theory relies heavily on her conception of "situated action", which places all actions within a framework of the local situation and contexts of interactions (L. Suchman, 1987). Planning occurs within situated action, but only within the context of situated activity that Suchman claims is the only type of activity for people and "planning and plan execution are still primary forms of activity" (L. Suchman, 1993). Suchman's conception of a plan seems to differ from Burke's conception, as Burke appears to view activity as a process of constantly shifting one's plans in order to achieve a goal (Burke, 2004). Suchman, however, appears to view plans as not necessarily related to a goal or intent, as the intent and plan are often formed after the actual action has occurred (L. Suchman, 1987). The "glue" of activity, relational connections, is conceptualized as invisible to the social actors until the contextual elements are brought to the attention of actors or the absence of important interactional elements leads to actors awareness of the role such elements play (L. Suchman, 1987, 1993, 1995, 1999). This "glue" can be compared with Habermas's conception of the marked space in language, where as long as interactions are occurring without problems then actors can stick within the frame of the marked language, but once a breakdown occurs "communicative action" must take place to move an unmarked understanding into the marked territory (Habermas, 1979). For Suchman, the communicative action takes place through the "indexicality of language" since communication breakdowns

can be repaired by referencing the contextual information within the given situation (L. Suchman, 1987).

For social actors in Suchman's theory, intent can serve a practical purpose insofar as they are general and do not try to address each step toward that intent (1987:38). In addition, for social actors it is typical that plans are an artifact of *reasoning about* action (that has occurred), and not a generative *mechanism* of action (L. Suchman, 1987). However, Suchman states that it is not her intention to deny the use of plans by social actors, as they are still in use but only within the frame of situated activity (L. Suchman, 1993). Plans do exist before action occurs, their role is not in determining action but in orienting people to the situation where action will occur in vague, flexible terms rather than strict step-by-step terms (L. Suchman, 1987). Actors do not have explicit rules and procedures, rather when situated action becomes problematic *then* rules and procedures are explicated through deliberation and action and only in the process of working out a solution does situated action ever become accountable to rules and procedures—which normally are not invoked when taking action (L. Suchman, 1987). Mutual intelligibility is formed by *common practices* that "produce typifications of which schemes and rules are made" rather than the rules and schemes themselves (L. Suchman, 1987). Thus, the primary motivator for social actors is interacting with the world in a way that s/he understands, so actors conform all actions to fit their conceptualization of the world (L. Suchman, 1987, 1995, 1999).

Crowston

Crowston's theory is best understood through an understanding of "coordination", which is defined, purposefully, broadly as "managing dependencies between activities"

(Kevin Crowston, 1997; K. Crowston, Rubleske, & Howison, 2006; T Malone & Crowston, 1990). Dependencies are simplified in Crowston's 1997 paper as dealing with tasks and resources and the permutations of conflicts between those two types, e.g. task-task, task-resource, and resource-resource (Kevin Crowston, 1997). The dependencies that are to be managed occur between actors; however, the definition of "actors" varies depending upon the coordination mechanism a researcher is interested in and can range from the biological (each muscle as an actor), customers and employees, and even to "collective actors" (treated as one actor) such as different organizations or different groups within an organization (Kevin Crowston, 1997; Thomas Malone & Crowston, 1994). Crowston sees the goal of coordination as overcoming the constraints on how tasks can be performed in order to increase efficiency and such "coordination problems" can be overcome through "coordination mechanisms" aimed at managing the problems and preventing dependency bottlenecks, which then reduces the amount of work necessary for actors to perform (Kevin Crowston, 1997; K. Crowston et al., 2006).

Crowston's motivational mechanism is that social actors wish to manage dependencies they face in order to increase efficiency and minimize costs, in terms of time and/or money (Kevin Crowston, 1997; Thomas Malone & Crowston, 1994). It is also claimed that coordination is a key motivator for actors not directly related to the management of resources as the failure of coordination results in actors being unsatisfied with their work (2006:124). Ultimately, actors seek coordination in order to achieve either individual or organizational goals where interdependence exists (Kevin Crowston, 1997; Thomas Malone & Crowston, 1994). In this way, Crowston is very interested in what Simon referred to as

"procedural rationality", trying to determine the best actions actors can take, given their knowledge, to achieve the best possible goal (Simon, 1996).

Closing Comments on Socio-Technical Theorists

Each of the theorists conceptualize the role of the nonhuman within the social world using different assumptions, but each of the theorists also suggest that while the nonhuman may not be a social actor (outside of Latour) it does play a critical role within contemporary social interaction. Whether you agree or disagree with Latour's conception of the social world given the assumptions he makes, the notion of the nonhuman as a prescriptive, invisible, and (often) ignored within social theory, actor has potentially wide ranging implications—both in terms of shifting greater power from the politicians to the engineers and in terms of better understanding how individuals conceive the world—should humans be rebelling against spoken norms or the invisible nonhuman forces that enforce norms? All three theorists empower the nonhuman with the ability to transform the human, just as (in Latour) humans translate the nonhuman into hybrid entities.

Ultimately Latour is a functionalist to whom the world remains in balance because individuals desire to interact within the world, and by acting, accept the functions assigned to them and to the other human and nonhuman actors within the world. Suchman, however, appears to be a combination: part functionalist, with her assumptions of mutual intelligibility, and part critical theorist, in her general rejection of rationality and universalism, in her favor of relativism positioned within situational context, in her favor of understanding within a situation why and how people do what they do and how best to match nonhuman assistance to that context rather than forcing a corporate-wide view based on increasing efficiency.

Opposed to Suchman is Crowston who sees everything within the rational choice paradigm of relentless pursuit of goals through rational evaluation of dependencies and forced coordination mechanisms that are seen as universal across all similar coordination problems. Similarities exist between each theorist, but the underlying assumptions between each one paints different conceptions of the social world.

Through this discussion, it should be clear that room exists for multiple perspectives on technology which can both help society understand the role of technologies as well as help engineers design technologies that better fit natural human interactions. In this, we also have further support of Ogburn's idea that although technology plays a role in creating and shaping society, separating the parts is a difficult task and understanding the base causality may be an impossible undertaking (Ogburn, 1964). Ultimately, this means in order to effectively study computational impacts on society and design effective user interfaces that take society into account, we must adopt Merton's concept of middle range theories that can be used as organizational tools in understanding working hypotheses within larger working schemas (Merton, 1968). These larger working schemas could then be created using Weber's method of ideal types in order to allow comparisons between societies and organizations, thus allowing a more effective means of designing interfaces (Weber, 1904).

One of the problems of all three of the theorists discussed in this section, and represented in most social theories utilized in HCI, is a lack of middle range theories or empirically testable hypotheses. Instead, the theories tend to either be focused on a small area of social phenomena, e.g. situated action, or attempt to explain the complexities of socio-technical systems in an overarching theory in the way both ANT and coordination theory attempt to do. Out of these three theories, only coordination theory makes a clear case for

how it can be used in an applied setting, but it over generalizes and fails to examine the complex elements that would affect its use and interpretation within different levels of analysis and organizational structure. In these ways, the current theories most commonly used in HCI can be bolstered by integrating additional theoretical perspectives, but most importantly we can see that no single theory will provide us with all of the solutions we need, rather we need a wide collection of theories in our toolbox to explore the complex socio-technical phenomena we encounter within our work.

On a final note, all of these theories place an emphasis on the importance of communication and transfer of information between entities in order to accomplish collaborative tasks. Within our cultural origins of computer science and information science, we have a fundamentally flawed conception of information with the epithet that "information wants to be free" as a rallying call for many of us. However, an understanding of Simmel's sociology of secrets might provide us with a pause as to the wisdom of a world where all information is freely and equally available to everybody (Simmel, 1950). The fact of the matter is that information only has value when there is a degree of secrecy and it is the secrets that individuals share with one another that define our social groups, organizations, nations, etc. If we are to believe that the current economy is based on information and knowledge rather than tangible goods than to free information would to decrease its value to a point of worthlessness. For an example of this, one need only look at the state of the news media where their products are consumed at higher than previous levels but their revenues are at historic lows due to their decision to place the information freely on the web.

6. Conclusion

Technology itself is neither inherently good nor bad, but without the input of those who understand the societal implications technology may have, the hard logic of computation will lead to an increasingly isolated and uncritical society. As technology continues to encroach into the sphere of interpersonal communication, we must turn to examining the causal processes within society and understanding the role it can play in shaping society through aiding the design and understanding of the structures and technologies that shape society.

As the gatekeepers between humans and computation, we are the best suited to explore these issues and to design new interactions that will modify societal structures toward positive ends. Chief among those is a need to fix the paradox created by computers where they are a requisite component of modern innovation but their inability to allow for deviance reduces innovation. To rephrase the quote from Steve Jobs I began this essay with, "do you want to [design] sugar[-coated experiences] for the rest of your life, or do you want to come with me and change the world?"

CHAPTER 7. SUMMARY AND FUTURE WORK

In this dissertation, I have explored a variety of seemingly disparate ideas from an overview of sociological theory, the design and evaluation of a system for promoting social affinity, and a discussion of the future of human-computer interaction. Yet, it is only in the synthesis of these ideas that the previous chapter was possible. Only by looking at a field with similar traits as human-computer interaction: covers a wide range of phenomena, utilizes a wide range of measurements and tools, explores questions with too many variables to entirely isolate, etc. can we understand a possible fate of HCI if we fail to form an agreed upon epistemological and theoretical core. Despite these traits, sociology was able to thrive for over a hundred years but the last several decades have seen the discipline fail to reach agreements necessary for its future. At the same time, it was in utilizing sociological theory that I was able to understand the phenomena in my study of improving social affinity in small groups. Similarly, it was only through exploring a simple interface for modifying small group behavior that I was able to fully appreciate Latour's Actor-Network Theory, along with the flaws it presented, and to form a clear idea of how those concepts need to be leveraged in order to ensure the future relevancy of HCI.

I fully expect some people to reject the idea of computation as a powerful social force and for many individuals in HCI to deny that their design has this kind of power, whether out of distaste at the idea or for more reasoned ideas. What I hope is that this will at least begin to open a dialogue so we can begin to empirically explore these questions and, if supported by strong empirical evidence, more consciously plan the design of systems in order to take on the requisite social responsibility. Regardless of the power component, I hope this work

makes HCI researchers more aware of sociological theories on interaction and begins the process of evaluating their usefulness within the discipline since they appear to get at the heart of the most critical component of the field: interactions—between people, between machines, and between organizations. These interactions at all levels are complex since they cannot be isolated, at least in the modern Western world, our interactions with one another are now intrinsically tied to our interactions with both technology and the organizations we are part of. Ultimately, it is my contention that it is not the *context* of interaction that HCI needs to understand better, which is what has allowed for the prevalence of ethnomethodology, rather it is the *interactions* themselves. These interactions are the *social facts* that constrain the way people act, even the way they view the world, and as such they can be understood, measured, and generalized just as sociologists have done for over a century.

Returning to the interplay between these chapters, the form of content analysis utilized to measure social affinity within my experimental work is essentially a form of Weber's ideal type methodology, where the core components of a group (in this case a high affinity dyad) are determined and all groups are then compared based on appearance, or not, of those characteristics. Furthermore, the problem being addressed in the experimental research is a direct consequence of the anomic division of labor that Durkheim uncovered almost two centuries ago that appears to be further exasperated by the modern use of computation.

Ultimately, what this work comes down to is an example of the power of classic sociological theory as a lens for understanding phenomena in human-computer interaction.

Future Work

This work presented a foundation for several future research projects, and as such a considerable amount of future work is left, particularly if left to a single individual. As part of laying the foundational work; however, I had always intended on the work splintering off to future generations of researchers to build off the initial keystone of classic sociological theory as a core component in HCI. Thus, chief among the future work is to continue my exploration of sociological theories of interaction and to write a book, similar to Norman's *Design of Everyday Things*, that examines the computational world through the lens of various theories of interaction.

Additionally, the method developed for measuring social affinity within my experiments needs further validation through testing and refining it through measuring affinity of dyads across a wide range of tasks and context of work. Part of improving this method will include further generalizing it and separating it from any task-specific context in order to, ultimately, allow it to be refined to a series of computationally understandable rules so the process of measuring affinity can be automated. Utilizing a system with automated affinity recognition, we can then begin to form a better understanding for what level of affinity is ideal for various tasks and type of work.

ConvoCons was originally conceived as a versatile research platform to study a variety of group work dynamics, not just social affinity. As I move this research forward, aside from looking at affinity bonds over time as well as its effectiveness across a variety of tasks and within a variety of settings, I also hope to perform an experiment to test Goffman's theory that jokes both reduce stress and bond individuals in a high stress environment (such as surgery). This experiment can be done by measuring psychophysical changes in

participants as they complete a series of tasks where stress is artificially introduced and joke-based ConvoCons are displayed for one group while the other receives no mediating artifacts. Assuming Goffman's theory is correct, then a higher level of social affinity and a lower level of stress response should be seen within the experimental group.

In further extending ConvoCons, I plan to explore how the agent can be scaled between different levels of social interaction and be used to both increase and decrease affinity, since groups that are too cohesive can have a negative impact on creativity and innovation. Currently, the agent has been built to enhance dyadic group work in both co-located and remote work environments. However, I hope to extend this to the organizational level through an industry partnership where employees have elected to share their expertise and projects they have worked on with a database. Part of this extension will include finding the right level of controls that will make individuals feel comfortable sharing information with the system as well as including controls that take into account the office politics. Individuals and project managers will be given control over who can contact them and what information is shared with whom within the organization. Aside from work related information, individuals will also be encouraged to share some level of personal information that would help increase their social affinity bonds with coworkers and potentially improve the trust within the workplace. While much research still needs to be done, the goal would be to increase the trust individuals have with the database and their willingness to share critical details to improve the institutional memory. The conversational agent would then leverage the institutional memory and personal details in order to promote conversation and collaboration opportunities between employees. These collaboration opportunities may not

have occurred normally, which in turn could lead to ideas outside of the norm and increase organizations' ability to innovate.

I plan to continue my theoretical exploration with my future research work and expand it by taking an approach similar to Garreth Morgan's *Images of Organizations* and explore the metaphors that best represent the emerging socio-technical systems enabled by the Internet and increasingly ubiquitous computation (separate from the aforementioned book expanding upon chapter 6). The goal of this book will be to provide practitioners and researchers with the necessary lens and measuring sticks to perform comparative studies of socio-technical systems. The metaphors and metrics will be created in the tradition of Weber's ideal types and cover a wide range of organizational types and task contexts.

REFERENCES

Andersen, P. H. (2006). Regional Clusters in a Global World: Production, Relocation, Innovation and Industrial Decline. *California Management Review, 49*(1), 101-122.

Anfara, V., Brown, K., & T., M. (2002). Qualitative Analysis on Stage: Making the Research Process More Public. *Educational Researcher, 31*(7), 28-38.

Arum, R., & Roksa, J. (2011). *Academically adrift : limited learning on college campuses*. Chicago: University of Chicago Press.

Bäckström, M., Björklund, F., & Larsson, M. R. (2009). Five-factor inventories have a major general factor related to social desirability which can be reduced by framing items neutrally. *Journal of Research in Personality, 43*(3), 335-344.

Bainbridge, W. S. (1987). *Sociology Laboratory*. Belmont, California: Wadsworth.

Bainbridge, W. S. (2010). *The Warcraft Civilization: Social Science in a Virtual World*. Cambridge, MA: MIT Press.

Bakhtin, M. (1981). Discourse in the Novel. *The Dialogic Imagination: Four Essays*. Austin, TX: University of Texas Press.

Bao, P., Gerber, E., Gergle, D., & Hoffman, D. (2010). Momentum: getting and staying on topic during a brainstorm. *Proceedings of the 28th international conference on Human factors in computing systems*, 1233-1236.

Bard, A., & Söderqvist, J. (2002). *Netocracy: the new power elite and life after capitalism*. London, UK: Pearson Education Limited.

Baudrillard, J. (1983). The Precession of Simulacra. *Simulations*. New York, NY: Semiotext(e).

Baumeister, R., Dale, K., & Sommer, K. (1998). Freudian Defense Mechanisms and Empirical Findings in Modern Psychology: Reaction Formation, Projection, Displacement, Undoing, Isolation, Sublimination, and Denial. *Journal of Personality, 66*(6), 1081-1124.

Bellotti, V., Begole, B., Chi, E. H., Ducheneaut, N., Fang, J., Isaacs, E., et al. (2008). *Activity-based serendipitous recommendations with the Magitti mobile leisure guide*. Paper presented at the Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems.

Berdayes, V., & Murphy, J. W. (Eds.). (2000). *Computers, human interaction, and organizations: critical issues*. Wesport, CT: Praeger Publishers.

Bijker, W. E., Hughes, T. P., & Pinch, T. (Eds.). (1987). *The Social Construction of Technology Systems*. Cambridge, MA: MIT Press.

Bobbio, B., & Gobetti, D. (1993). *Thomas Hobbes and the Natural Law Tradition*. Chicago, IL: University of Chicago Press.

Boellstorf, T. (2008). *Coming of Age in Second Life: An Anthropologist Explores the Virtually Human*. Princeton, NJ: Princeton University Press.

Bolia, R., Nelson, W., Summers, S., Arnold, R., Atkinson, J., Taylor, R., et al. (2006). *Collaborative Decision Making in Network-Centric Military Operations.* Paper presented at the Human Factors and Ergonomics Society.

Bollen, K. (1989). *Structural Equations with Latent Variables*. New York, NY: John Wiley & Sons.

Bolton, G., Katok, E., & Ockenfeis, A. (2005). Cooperation among strangers with limited information about reputation. *Journal of Public Encomics*(89), 1457-1468.

Bradner, E., & Mark, G. (2001). *Social presence with video and application sharing*. Paper presented at the Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work.

Brewer, K. A., Avant, L. L., & Woodman, W. F. (1985). *Addendum to Perception and Interpretation of Advance Warning Signs on County Roads*: Iowa Department of Transportation.

Brynjolfsson, E., & Hitt, L. M. (2000). Beyond Computation: Information Technology, Organizational Trasnformation, and Business Performance. *The Journal of Economic Perspectives, 14*(4), 23-48.

Burke, P. J. (2004). Identities and Social structure: The 2003 Cooley-Mead Award Address. *Social Psychology Quarterly, 67*, 5-15.

Butler, J. (2004). *Undoing Gender*. New York, NY: Routledge.

Button, G., & Sharrock, W. E. S. (1993). A Disagreement over Agreement and Consensus in Constructionist Sociology. *Journal for the Theory of Social Behaviour, 23*(1), 1-25.

Buxton, W., Hill, R., & Rowley, P. (1985, Sep 22). *Issues and techniques in touch-sensitive tablet input.* Paper presented at the Proceedings.

Carey, J., Hamilton, D., & Shanklin, G. (1986). Development of an Instrument to Measure Rapport Between College Roommates. *Journal of College Student Personnel, 27*(3), 269-273.

Carnevale, D. (2006). E-mail is for Old People. *The Chronicle of Higher Education, 53*(7), A27.

Clear, T., & Daniels, M. (2001). *A Cyber-Icebreaker for an Effective Virtual Group?* Paper presented at the Conference on Innovation and Technology in Computer Science Education.

Cole, S. (1994). Why Sociology Doesn't Make Progress like the Natural Sciences. *Sociological Forum, 9*(2).

Collins, P. H. (2000). Black Feminist Epistemology. *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*. New York, NY: Routledge.

Collins, R. (1989). Sociology: Proscience or Antiscience? *American Sociological Review, 54*(1), 124-139.

Collins, R. (1992). *Sociological Insight*. New York, NY: Oxford University Press.

Collins, R. (1994). Why the Social Sciences Won't Become High-Consensus, Rapid-Discovery Science. *Sociological Forum, 9*(2), 155-177.

Collins, R. (2004). *Interaction Ritual Chains*. Princeton, MA: Princeton University Press.

Commanger, H. (1959). *The American mind: an Interpretation of American though and character since the 1880's* (Vol. 7). New Haven, CT: Yale University Press.

Commanger, H. S. (Ed.). (1967). *Lester Ward and the Welfare State*. New York, NY: Bobbs-Merrill.

Conley, D. (2009). *Elsewhere, USA*. New York, NY: Random House.

Convertino, G., et al. (2005). *A multipleview approach to support common ground in distributed and sychronous geo-collaboration.* Paper presented at the CMV '05.

Convertino, G., Mentis, H., Rosson, M., Carroll, J., Slavkovic, A., & Ganoe, C. (2008). Articulating common ground in cooperative work: content and process. *CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*, 1637-1646.

Coser, L. A. (1964). *The Functions of Social Conflict*. New York, NY: Free Press.

Cosley, D., Lewenstein, J., Herman, A., Holloway, J., Baxter, J., Nomura, S., et al. (2008). ArtLinks: fostering social awareness and reflection in museums. *CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*.

Cropley, D. H., Cropley, A. J., & Kaufman, J. C. (Eds.). (2010). *The Darkside of Creativity*. New York, NY: Cambridge University Press.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. London, UK: SAGE Publications.

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

Crowston, K., Rubleske, J., & Howison, J. (2006). Coordination Theory: A Ten-Year Retrospective. In P. Zhang & D. Galletta (Eds.), *Human-Computer Interaction and Management Information Systems* (pp. 120-138). Armonk, NY: M.E. Sharp.

Cutkosky, M., Tenenbaum, J., & Glicksman, J. (1996). Madefast: collaborative engineering over the Internet. *Communications of the ACM*.

Daniels, G. H. (1970). The Big Questions in the Histiography of American Technology. *Technology & Culture, 11*(1).

Daniels, J. (2007). Race, Civil Rights, and Hate Speech in the Digital Era. *The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning*, 129-154.

Deflem, M. (2008). That's in a Name: Concerning the ASA Career Award. *Footnotes, ASA Newsletter, 36*(3), 8.

Derrida, J. (1976). *Of Grammatology*. Baltimore, MD: John Hopkins University Press.

Dewey, J. (1939). *Intelligence and the Modern World*. New York, NY: Modern Library.

Dohse, K. C., Dohse, T., Still, J. D., & Parkhurst, D. J. (2008). *Enhancing Multi-user Interaction with Multi-touch Tabletop Displays Using Hand Tracking.* Paper presented at the Proceedings.

Dourish, P. (2004). *Where the Action is: The Foundations of Embodied Interaction*. Cambridge, MA: MIT Press.

Dubé, L., & Paré, G. (2001). Global Virtual Teams. *Communications of the ACM, 44*(12), 71-73.

Durkheim, E. (1982). The Rules of Sociological Method and Selected Texts on Sociology and its Method. In S. Lukes (Ed.). New York, NY: Free Press.

Durkheim, E. (1997). The Division of Labor in Society. In L. Coser (Ed.). New York, NY: The Free Press.

Durkheim, É., & Pickering, W. S. F. (1994). *Durkheim on religion*: Scholars Press.

Eaton, K. (2009, August 19, 2009). If You're Applying for a Job, Censor Your Facebook Page. Retrieved March 16, 2011, from http://www.fastcompany.com/blog/kit-eaton/technomix/if-youre-applying-job-censor-your-facebook-page

Edwards, D., Ashmore, M., & Potter, J. (1995). Death and Furniture: The Rhetoric, Politics, and Theology of Bottom Line Arguments Against Relativism. *History of the Human Sciences, 8*(2), 25-49.

Egido, C. (1988). *Video conferencing as a technology to support group work: a review of its failures*. Paper presented at the Proceedings of the 1988 ACM conference on Computer-supported cooperative work.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). *Kit of Factor-Referenced Cognitive Tests*.

Ephrem, A., Brungart, D., & Parisi, J. (2006). *Effects of Background Noise on Communication in a Collaborative Team Environment.* Paper presented at the Human Factors and Ergonomics Society.

Erickson, T., & Kellogg, W. (2003). Social Translucence: Using Minimalist Visualizations of Social Activity to Support Collective …. *Designing Information Spaces: The Social Navigation Approach*.

Esenther, A., & Ryall, K. (2006). RemoteDT: Support for Multi-Site Table Collaboration. *Proc. Int. Conf. Collaboration Technologies (CollabTech)*.

Fischer, C. S. (1994). *America calling: a social history of the telephone to 1940*. Los Angeles, CA: University of California Press.

Fischer, G., Arias, E., Carmien, S., Eden, H., & Gorman, A. (2004). Supporting Collaboration and Distributed Cognition in Context-Aware Pervasive Computing Environments. *Human Computer Interaction Consortium Winter Workshop*.

Fischer, G., Czerwinski, M., Resnick, M., & Myers, B. (2006). Creativity Support Tools: Report From a US National Science Foundation Sponsored Workshop. *International Journal of Human-Computer Interaction*.

Fischer, G., Scharff, E., & Ye, Y. (2004). Fostering Social Creativity by Increasing Social Capital. In M. W. Huysman, V. (Ed.), *Social Capital and Information Technology* (pp. 355-400). Cambridge, MA: MIT Press.

Fisher, M., & Tucker, D. (2003). Games Online: Social Icebreakers That Orient Students to Synchronous Protocol and Team Formation. *Journal of Educational Technology Systems, 32*(4), 419-428.

Foucault, M. (2000). Truth and Judicial Forms. In J. D. Faubion (Ed.), *Power*. New York, NY: The New Press.

Froehlich, J., Chen, M. Y., Consolvo, S., Harrison, B., & Landay, J. A. (2007). *MyExperience: a system for in situ tracing and capturing of user feedback on mobile phones*. Paper presented at the Proceedings of the 5th international conference on Mobile systems, applications and services.

Garfinkel, H. (1967). *Studies in Ethnomethodology*. Englewood Cliffs, NJ: Prentice Hall.

Godin, S. (2008). *Tribes: We Need You to Lead Us*. New York, NY: Penguin Group.

Goffman, E. (1959). *The Presentation of Self in Everyday Life*. Garden City, NJ: Doubleday.

Goffman, E. (1975). Role-Distance. In D. E. Brisset, C. (Ed.), *Life as Theater: A dramaturgical sourcebook* (pp. 123-132). Chicago, IL: Aldine Publishing Company.

Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., et al. (2006). The international personality item pool and the future of public-domain personality measures. *Journal of Research in Personality, 40*, 84-96.

Goudy, W., & Potter, R. (1976). Interview Rapport: Demise of a Concept. *The Public Opinion Quarterly, 39*(4), 529-543.

Gouldner, A. W. (1970). *The Coming Crisis of Western Sociology*. New York, NY: Basic Books.

Guzdial, M. (2008). Education: Paving the way for computational thinking. *Commun. ACM, 51*(8), 25-27.

Habermas, J. (1979). *Communication and the Evolution of Society*. Boston, MA: Beacon Press.

Hall, E. (1966). *Distances in Man: The Hidden Dimension*. New York, NY: Doubleday Anchor Books.

Hananel, S. (2011, February 7, 2011). Feds settle case of woman fired over Facebook site. *Associated Press*. Retrieved from http://news.yahoo.com/s/ap/20110208/ap_on_re_us/us_facebook_firing

Harboe, G., Metcalf, C., Bentley, F., Tullio, J., Massey, N., & Romano, G. (2008). Ambient social tv: drawing people into a shared experience. *CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*.

Heath, C., Knoblauch, H., & Luff, P. (2000). Technology and social interaction: the emergence of'workplace studies'. *The British Journal of Sociology*.

Hey, T., Tansley, S., & Tolle, K. (2009). *The Fourth Paradigm: Data-Intensive Scientific Discovery*: Microsoft Research.

Hofstede, G. (1993). Cultural Constraints in Management Theories. *The Executive, 7*(1), 81-94.

Hofstee, W. K. B., de Read, B., & Goldberg, L. R. (1992). Integration of the Big-Five and circumplex approaches to trait structure. *Journal of Personality and Social Psychology, 63*, 146-163.

Hollan, J., Hutchins, E., & Kirsh, D. (2000). Distributed cognition: toward a new foundation for human-computer interaction research. *ACM Transactions on Computer-Human Interaction (TOCHI)*.

Homans, G. (1958). Social Behavior as Exchange. *American Journal of Sociology, 63*, 597-606.

Honan, E., Knobel, M., Baker, C., & Davies, B. (2000). Producing possible Hannahs: Theory and the subject of researcher. *Qualitative Inquiry, 6*(1), 9-32.

Honeycutt, J., & Patterson, J. (1997). Affinity Strategies in Relationships: The role of gender and imagined interactions in maintaining college roommates. *Personal Relationships, 4*, 35-46.

Kafai, Y., & Resnick, M. (1996). *Constructionism in Practice*. Mahwah, NJ: Lawrence Erlbaum Associates.

Karahalios, K. (2004). Social Catalysts. *Doctoral Disseration, 24 June 2004*.

Kaufman, M. (2003, February 2003). Robert K. Merton, Versatile Sociologist and Father of the Focus Group, Dies at 92. *New York Times*. Retrieved from http://www.nytimes.com/2003/02/24/nyregion/robert-k-merton-versatile-sociologist-and-father-of-the-focus-group-dies-at-92.html

Kellogg, W. A., & Erickson, R. T. (2002). Social Translucence, Collective Awareness, and the Emergence of Place. *Proceedings of CSCW2002*.

King, J., & Star, S. (1990). *Conceptual Foundations for the Development of Organizational Decision Support Systems.* Paper presented at the Hawaii International Conference on Systems Science.

Kivimäki, M., Kuk, G., Elovainio, M., Thomson, L., Kalliomäki-Levanto, T., & Heikkilä, A. (1997). The Team Climate Inventory (TCI)--four or five factors? Testing the structure of TCI in samples of low and high complexity jobs. *Journal of Occupational and Organizational Psychology, 70*, 375-389.

Krier, D. (2005). *Speculative Management: Stock Market Power and Corporate Change*. Albany, NY: State University of New York Press.

Kuhn, T. S. (1996). *The structure of scientific revolutions / Thomas S. Kuhn*. Chicago, IL :: University of Chicago Press.

Kuutti, K. (1996). Activity theory as a potential framework for human-computer interaction research. *Context and Consciousness: Activity Theory and Human- ….*

Landis, J., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159-174.

Langheinrich, M., Nakamura, A., Abe, N., Kamba, T., & Koseki, Y. (1999). Unintrusive customization techniques for Web advertising. [doi: DOI: 10.1016/S1389-1286(99)00033-X]. *Computer Networks, 31*(11-16), 1259-1272.

Lanier, J. (2010). *You are Not a Gadget*. New York, NY: Alfred A. Knopf.

Larson, J. J., Christensen, C., Franz, T., & Abbott, A. (1998). Diagnoising Groups: The pooling, management, and impact of shared and unshared case information in team-based medical decision making. *Journal of Personality and Social Psychology, 75*(1), 93-108.

Latour, B. (1979). *Laboratory life : the social construction of scientific facts / Bruno Latour, Steve Woolgar ; introd. by Jonas Salk*. Beverly Hills :: Sage Publications.

Latour, B. (1992). Where are the missing masses? The sociology of a few mundane artifacts. In W. B. J. Law (Ed.), *Shaping Technology* (pp. 225-258). Cambridge, MA: MIT Press.

Latour, B. (1993). *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.

Latour, B. (1996). On actor-network theory: a few clarifications. *Soziale Welt, 47*(4), 369-381.

Lenzer, G. (1998). *Auguste Comte and Positivism*. Picastaway, NJ: Transaction Books.

Leonardi, P. (2003). *The Mythos of Engineering Culture: A Study of Communicative Performances and Interactions.* University of Coloarado.

Lerner, M. (Ed.). (1950). *The Portable Veblen*. New York, NY: Viking.

Lindley, S., Couteur, J., & Berthouze, N. (2008). Stirring up experience through movement in game play: effects on engagement and social behaviour. *CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*.

Lohtia, R., Donthu, N., & Hershberger, E. K. (2003). The Impact of Content and Design Elements on Banner Advertising Click-through Rates. *Journal of Advertising Research, 43*(04), 410-418.

Louden, R. (2007). *The World We Want: How and why the ideals of the Enlightenment still elude us*. Oxford, UK: Oxford University Press.

Maher, M., & Rutherford, J. (1997). A model for synchronous collaborative design using CAD and database management. *Research in Engineering Design*.

Malone, T., & Crowston, K. (1990). What is coordination theory and how can it help design cooperative work systems? *Proceedings of the 1990 ACM conference on Computer-supported ….*

Malone, T., & Crowston, K. (1994). The Interdisciplinary Study of Coordination. *ACM Computing Surveys, 26*(1), 87-119.

Maynes-Aminzade, D., Pausch, R., Seitz, S., & MIT, C. (2002). Techniques for interactive audience participation. *Fourth IEEE International Conference on Multimodal ….*

Mennecke, B. E., Triplett, J. L., Hassall, L. M., & Conde, Z. J. (2010). *Embodied Social Presence Theory*. Paper presented at the Hawaii International Conference on System Sciences.

Mentis, H. M., Reddy, M., & Rosson, M. B. (2010). *Invisible emotion: information and interaction in an emergency room*. Paper presented at the Proceedings of the 2010 ACM conference on Computer supported cooperative work.

Merton, R. K. (1968). *Social Theory and Social Structure*. New York, NY: Free Press.

Milgram, S. (1974). *Obedience to Authority*. London, UK: Tavistock Publication.

Mill, J. S. (1864). *Utilitarianism*. London, UK: Longman, Green, Longman, Roberts, and Green.

Mills, C. W. (1951 (2002)). *White collar: the American middle classes*. New York, NY: Oxford University Press.

Mills, C. W. (1959 (2000)). *The Sociological Imagination*. New York, NY: Oxford University Press.

Mills, C. W. (1963). Culture & Politics. *Power, Politics, and People: The Collected Essays of C. Wright Mills* (pp. 236-246). New York, NY: Oxford University Press.

Mizruchi, M. S., & Marquis, C. (2006). Egocentric, sociocentric, or dyadic? Identifying the appropriate level of analysis in the study of organizational networks. *Social Networks, 28*(3), 187-208.

Morris, M., Ryall, K., Shen, C., Forlines, C., & Vernier, F. (2004). Beyond" social protocols": multi-user coordination policies for co-located groupware. *Proceedings of the 2004 ACM conference on Computer supported ….*

Munro, B. (1981). Dropouts from Higher Education: Path Analysis of a National Sample. *American Educational Research Journal, 18*(2), 133-141.

Nardi, B. (1996). … context: A comparison of activity theory, situated action models, and distributed cognition. *Context and Consciousness: Activity Theory and Human- ….*

Nardi, B. (2005). Beyond Bandwidth: Dimensions of Connection in Interpersonal Communication. *Computer Supported Cooperative Work (CSCW)*.

Neff, G., Fiore-Silfvast, B., & Dossick, C. S. (2010). A CASE STUDY OF THE FAILURE OF DIGITAL COMMUNICATION TO CROSS KNOWLEDGE BOUNDARIES IN VIRTUAL CONSTRUCTION. *Information, Communication & Society, 13*(4), 556 - 573.

Nelson, R. R., & Wright, G. (1992). The Rise and Fall of American Technological Leadership: The Postwar Era in Historical Perspective. *Journal of Economic Literature, 30*(4), 1931-1964.

Newman, D. V. (2001). Impersonal interaction and ethics on the World-Wide-Web. *Ethics and Information Technology, 3*(4), 239-246.

Ogburn, W. F. (1964). Technology and Governmental Change. In O. D. Duncan (Ed.), *On Our Culture and Social Change: Selected Papers*. Chicago, IL: University of Chicago Press.

Oren, M., & Gilbert, S. (2009). ConvoCons: Encouraging Affinity on Multitouch Interfaces. *Lecture notes in computer science, 5612*, 651-659.

Oren, M., & Gilbert, S. (2010). *Building Better Design Teams: Enhancing Group Affinity to Aid Collaborative Design.* Paper presented at the Design, Computing, and Cognition, Stuttgart, Germany.

Oren, M., & Gilbert, S. (2011). *Framework for Measuring Group Social Affinity for Computer Supported Cooperative Work.* Paper presented at the CHI '11, Vancouver, BC, Canada.

Oren, M., Harding, C., & Bonebright, T. (2008). Design and Usability Testing of an Audio Platform Game for Players with Visual Impairments. *Journal of Visual Impairment and Blindness, 102*(12), 761-773.

Paccagnella, L. (1997). Getting the Seats of Your Pants Dirty: Strategies for Ethnographic Research on Virtual Communities. *Journal of Computer-Mediated Communication, 3*(1), 0-0.

Parsons, T. (1937). *The Structure of Social Action*. New York, NY: McGraw-Hill.

Parsons, T. (1954). Psychology and Sociology. In J. Gillin (Ed.), *For a Science of Social Man: Convergences in Anthropology, Psychology, and Sociology*. New York, NY: Macmillan.

Perrson, S., & Warell, A. (2003). *Relational Modes between Industrial Design and Engineering Design - a Conceptual Model for Interdisciplinary Design Work*. Paper presented at the 6th Asian Design International Conference.

Peshkin, A. (1993). The Goodness of Qualitative Research. *Educational Researcher, 22*(2), 23-29.

Plato. (1963). The Republic of Plato. In F. M. Cornford (Ed.). Oxford, UK: Oxford University Press.

Porter, J. N. (2008). *Is sociology dead? Social theory and social praxis in post-modern age*. Lanham, MD: University Press of America.

Poster, M. (1990). *The Mode of Information: Post-Structuralism and Social Context*. Cambridge, MA: Polity.

Powers, W. (2010). *Hamlet's BlackBerry: A Practical Philosophy for Building a Good Life in the Digital Age*. New York, NY: Harper.

Ramanahally, P., Gilbert, S., Niedzielski, T., Velázquez, D., & Anagnost, C. (2009). *Sparsh UI: A Multi-Touch Framework for Collaboration and Modular Gesture Recognition.* Paper presented at the World Conference on Innovative VR (WINVR).

Rheingold, H. (1993). The Virtual Community

Riche, Y., Riche, N. H., Isenberg, P., & Bezerianos, A. (2010). *Hard-To-Use Interfaces Considered Beneficial (Some of the Time).* Paper presented at the CHI, Atlanta, GA.

Richmond, V., & McCroskey, J. (1995). Immediacy - Nonverbal Behavior. *Interpersonal Relations*. Boston, MA: Allyn & Bacon.

Ridgeway, C. (1993). Gender, Status, and the Social Psychology of Expectations. In P. England (Ed.), *Theory on Gender / Feminism on Theory* (pp. 175-197). Hawthorne, NY: Aldine De Gruyther.

Robertson, T. (1997). Cooperative work and lived cognition: A taxonomy of embodied actions. ... *on Computer Supported Cooperative Work*.

Rogers, Y. (2004). New theoretical approaches for HCI. *ARIST: Annual Review of Information Science and Technology*.

Rogers, Y., & Brignull, H. (2002). Subtle ice-breaking: encouraging socializing and interaction around a large public display. *Workshop on Public*.

Russell, D., & Sue, A. (2006). Secrets to Success and Fatal Flaws: The Design of Large-Display Groupware. *IEEE Computer Graphics and Applications*, 33-41.

Russell-Rose, T. (2011). Changing terms for changing times: Usability, HCI, UCD, & more. Retrieved 14 March 2011, 2011, from http://isquared.wordpress.com/2011/02/01/changing-terms-for-changing-times-usability-hci-ucd-more/

Salant, P., & Dillman, D. (1994). *How to Conduct Your Own Survey*. New York, NY: John Wiley & Sons, Inc.

Sapp, G., & Korsching, P. (2004). The Social Fabric and Innovation Diffusion: Symbolic Adoption of Food Irradiation. *Rural Sociology, 69*(3), 346-369.

Schmid, A. (2000). Affinity as social capital: its role in development. *Journal of Socio-Economics, 29*(2), 159-171.

Scott, S. (2003). Territory-based interaction techniques for tabletop collaboration. *UIST 2003 Conference Companion*.

Scott, S., & Carpendale, S. (2006). Investigating Tabletop Territoriality in Digital Tabletop Workspaces. *eng.uwaterloo.ca*.

Scott, S., Grant, K., & Mandryk, R. (2003). System guidelines for co-located, collaborative work on a tabletop display. *Proceedings of the eighth conference on European Conference on Computer-Supported Cooperative Work*, 159-178.

Sears, A., & Jacko, J. (Eds.). (2008). *Human-Computer Interaction Handbook: Fundamentals, Emerging Technologies, and Emerging Applications*. New York, NY: Lawrence Erlbaum Associates.

Shapin, S., & Schaffer, S. (1989). *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life*. Princeton, MA: Princeton University Press.

Simmel, G. (1950). The Sociology of Georg Simmel. In K. Wolff (Ed.). New York, NY: The Free Press.

Simon, H. A. (1996). Economic Rationality: Adaptive Artifice. *The Sciences of the Artificial* (pp. 25-49). Cambridge, MA: MIT Press.

Sokal, A. D., & Bricmont, J. (1998). *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science*. New York, NY: Picador.

Sparsh UI. (2009). Retrieved 12 October 2009, from http://code.google.com/p/sparshui

Stasser, G., & Titus, W. (1985). Pooling of unshared Information in group Decision Making: Biased Information Sampling During Discussion. *Journal of Personality and Social Psychology, 48*, 1467-1478.

Stump, E. (2003). *Aquinas*. New York, NY: Routledge.

Suchman, L. (1987). *Plans and Situated Actions: The Problem of Human-Machine Communication*. New York, NY: Cambridge University Press.

Suchman, L. (1993). Response to Vera and Simon's Situated Action: A Symbolic Interpretation. *Cognitive Science, 17*, 71-75.

Suchman, L. (1995). Making Work Visible. *Communications of the ACM, 38*(9), 56-64.
Suchman, L. (1999). Reconstructing Technologies as Social Practice. *The American Behavioral Scientist, 43*(3), 392-408.
Suchman, L. A. (2007). *Human-Machine Reconfigurations*. New York, NY: Cambridge University Press.
Tapscott, D. (2008). *Grown Up Digital*. Columus, OH: McGraw-Hill Publishing.
Thompson, T. (1984). Freud Redux: Psychoanalysis Turned Inside Out. *The North American Review, 269*(4), 14-28.
Tierney, W. G. (2002). Get real: Representing reality. *International Journal of Qualitative Studies in Education, 15*(4), 385-398.
Tilly, C. (2002). *Stories, Identities, and Political Change*. Lanham, MD: Rowman & Littlefield.
Tucker, R. (1978). *The Marx-Engels Reader*. New York, NY: W. W. Norton & Co.
Tuddenham, P. (2007). Distributed tabletops: territoriality and orientation in distributed collaboration. *portal.acm.org*.
Tuddenham, P., & Robinson, P. (2007). Distributed Tabletops: Supporting Remote and Mixed-Presence Tabletop Collaboration. *Proceedings of the Second Annual IEEE International Workshop on Horizontal Interactive Human-Computer Systems*, 19-26.
Tuddenham, P., & Robinson, P. (2007). Distributed Tabletops: Supporting Remote and Mixed-Presence Tabletop Collaboration. *Horizontal Interactive Human-Computer Systems, 2007. TABLETOP '07. Second Annual IEEE International Workshop on*, 19-26.
Vetere, F., Howard, S., & Gibbs, M. (2005). Phatic Technologies: Sustaining Sociability through Ubiquitous Computing. *First International Workshop on Social Implications of ….*
Vogel, S. (1996). *Against Nature: The Concept of Nature in Critical Theory*. Albany, NY: SUNY Press.
Volkswagon. (2010). thefuntheory.com. Retrieved 16 March, 2011, from www.thefuntheory.com
Volti, R. (2010). *Society and Technological Change*. New York, NY: Worth Publishing.
Ward, L. F. (1897). *Dynamic Sociology: or applied social science, as based upon statical sociology and the less complex sciences*. New York, NY: D. Appleton and Company.
Ward, L. F. (1906). *Applied Sociology*. New York, NY: Ginn & Company.
Warkentin, M. E., Sayeed, L., & Hightower, R. (1997). Virtual Teams versus Face-to-Face Teams: An Exploratory Study of a Web-based Conference System*. *Decision Sciences, 28*(4), 975-996.
Weber, M. (1904). Max Weber on the Methodology of Social Sciences. In E. A. Shillis & H. A. Finch (Eds.). Glecoe, IL: Free Press.
Weber, M. (1994). Max Weber Selections in Translation. In W. G. Runciman (Ed.). New York, NY: John Wiley & Sons.
Wellman, B., & Haythornthwaite, C. (Eds.). (2002). *The Internet in Everyday Life*. Hooken, NJ: Wiley-Blackwell.
Whittaker, S. (2003). Theories and Models in Mediated Communication. In A. Graesser (Ed.), *The Handbook of Discourse Processes*. Hillsdale, NJ: Lawreence Erlbaum.

Whorf, B. L. (1956). Languages and Logic. *Language, Thought, and Reality*. Cambridge, MA: The MIT Press.

Wing, J. M. (2006). Computational thinking. *Commun. ACM, 49*(3), 33-35.

Wolfram, S. (2002). *A New Kind of Science*. Champaign, IL: Wolfram Media.

Woodman, W. F. (Unpublished). The Theoretical Yardstick.

Zimbardo, P., Maslach, C., & Haney, C. (2000). Reflections on the Stanford Prison Experiment: Genesis, Transformation, and Consequences. In T. Blass (Ed.), *Obedience to Authority: Current Perspectives on the Milgram Paradigm* (pp. 193-238). Mahwah, NJ: Lawrence Erlbaum Associates.

Žižek, S. (1998). Four Discourses, Four Subjects. *Cogito and the Unconsciousness*. Durham, NC: Duke University Press.