Slow Design through Fast Technology :

The Application of Socially Reflective Design Principles to Modern Mediated Technologies

by

Silvan Linn

A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Science in Design

Approved April 2011 by the
Graduate Supervisory Committee:

Aisling Kelliher, Chair
David Tinapple
Prasad Boradkar

ARIZONA STATE UNIVERSITY

May 2011

ABSTRACT

This thesis describes research into the application of socially reflective, or "Slow", design principles to modern mediated systems, or "Fast" technology. The "information overload" caused by drastic changes in the nature of human communications in the last decade has become a serious problem, with many human-technology interactions creating mental confusion, personal discomfort and a sense of disconnection. Slow design principles aim to help create interactions that avoid these problems by increasing interaction richness, encouraging engagement with local communities, and promoting personal and communal reflection.

Three major functional mediated systems were constructed to examine the application of Slow principles on multiple scales: KiteViz, Taskville and Your ____ Here. Each system was designed based on a survey of current research within the field and previous research results. KiteViz is a visually metaphorical display of Twitter activity within a small group, Taskville is a workplace game designed to support collaboration and group awareness in an enterprise, and Your ____ Here is a physical-digital projection system that augments built architecture with user-submitted content to promote discussion and reflection. Each system was tested with multiple users and user groups, the systems were evaluated for their effectiveness in supporting each of the tenets of Slow design, and the results were collected into a set of key findings. Each system was considered generally effective, with specific strengths varying.

The thesis concludes with a framework of five major principles to be used in the design of modern, highly-mediated systems that still apply Slow design principles: design for fundamental understanding, handle complexity gracefully, *Slow* is a process of evolution and revelation, leverage groups and personal connections to encode value, and allow for participation across a widely distributed range of scales.

ACKNOWLEDGEMENTS

Thanks to

My supervisory committee —

Aisling Kelliher, Ph.D.

David Tinapple, M.F.A.

Prasad Boradkar, M.A.

As project collaborators, and for help developing code —

Shawn Nikkila

Ryan Spicer

For additional comments, suggestions and feedback —

Hari Sundaram

The Reflective Living research group

For funding and infrastructure support —

The ASU School of Arts, Media & Engineering

The Herberger Institute for Design and the Arts

The NSF IGERT program

For mental, emotional, and baking-related support along the way —

George, Alice & Winona Linn

Lavinia Manea

And to all the others who helped in their own way.

TABLE OF CONTENTS

CHAPTER Page

LIST OF FIGURES

FIGURE Page

FIGURE Page

Chapter 1

INTRODUCTION

Figure 1: (L-R) KiteViz, Taskville and Your _____ Here

1.1 — Overview

This thesis presents research into the application of socially reflective, or *Slow*, design principles to modern, mediated, highly information-dense, or *Fast*, technologies. The Slow design principles used in this process are extracted from an extensive literature survey. These Slow design principles are synthesized into three main tenets:

1. A Slow design should increase the depth and richness of an interaction.
2. A Slow design should emphasize local culture and engagement with the immediate community.
3. A Slow design should encourage personal and social reflection on one's actions and interactions.

The reasoning behind the development of these three tenets as central metrics is discussed further in sections 2 and 3. In the research process, the tenets were used as guiding

principles and evaluation metrics in the design and development of three mediated systems, intended to study methods of successfully applying Slow design to Fast media — KiteViz, Taskville, and Your ____ Here (Figure 1). KiteViz is a graphical visualization designed to display the Twitter activity of a small group of people, encouraging reflection about the social structure and relationships within the group. Taskville is a workplace game to help make mundane or repetitive tasks more interesting, and to help users collaborate better with each other. Your ____ Here is a situated physical-digital display system that augments an architectural environment, using user-submitted text messages to create a public discussion.

The results from multiple user studies carried out on each of these systems are presented, and conclusions about the effectiveness of the studied methods are drawn. In the conclusion of this thesis, the results are distilled into a set of easily applicable Slow principles to be used specifically in the creation of Slow experiences through Fast technologies.

1.2 — Statement of Problem

In the last decade, our society has seen dramatic alterations in social, technological and cultural structure, the nature of our relationships with each other and with technology changing in great depth and on a broad scale. Much of this change can be attributed to the rapidly expanding developments in highly mobile and universally accessible communications and connectivity systems. Historically, each great advance in communications technology has taken exponentially less time to become widespread than those that came before it. In *Technological Revolutions and the Gutenberg Myth,* Scott Cook identifies that it took nearly four hundred years for the the first true "information technology", the printing press, to have its full effect on the global dissemination of knowledge; improvements in both social structure (increased accessibility to education and literacy) and technological ability (mass-production of cheap paper) necessarily preceded any great changes (Cook, 1997). However, all technologies build upon the efficiencies and structures created by those of the past. It took

the cable telegraph less than a hundred years to become widespread after the discovery of the electromagnetic effect. Fifty years after the first experiments in wireless transmission, the average family gathered around the radio in the evenings; in less than the span of a generation the radio had been replaced with the television, and less than a decade after the invention of the World Wide Web, the germinal network had experienced its first global boom and crash. And yet the innovations in communications technology since the year 2000 put these to shame, placing us in a social and cultural world totally unlike anything possible only a few years before. A modern smartphone, increasingly seen as a basic tool of everyday life, has technological sophistication that would put Mr. Spock's "tricorder" to shame, while social networking sites like Facebook — used by nearly one in twelve people worldwide (Facebook, 2011) — enable a single human to maintain hundreds of active conversations with thousands of "friends" in a single day. The dizzying rate of convergence of all human communications technologies increasingly attempts to combine interactions, so that someone with a smartphone can maintain contact with their thousands of Facebook friends at any time, anywhere in the world, in a matter of seconds. A generation ago, only the most dedicated elementary school children maintained international pen pals, exchanging a few letters a month, while today it is simply accepted fact that teenagers living in the highly mediated and information-dense parts of the developed world can play interactive video games in real time with a squad of team members around the globe.

The integration of a new technology into human society has historically always had a somewhat bidirectional nature. A technology is created to support some aspect of human society as effectively as possible, but by its own existence it alters the structure of the existing interaction. For instance, prior to the existence of the written word, human communication was oral in nature, limited in depth by what a single person could remember and in scope by how many people could hear it. The invention of a symbolic language brought great advances in the dissemination, collaboration and permanence of knowledge —

but it also required the development of concepts such as punctuation and sentence structure to replace the formerly obvious oral concepts of tone, subject and object (Ferris, 2002). Similar alterations can be seen in the development of the printed word, of the telegraph, of radio, and innumerable other inventions. Most recently we can observe how the limitations of using a keyboard as input have resulted in time- and effort-saving lingo such as "rofl" or "gtg", recalling similar, earlier strategies used by stenographers and Morse code operators. New technological developments can do far more than simply change our *experience* of information — they can actually generate changes in the information *itself* as we work within the new opportunities and constraints.

This concept reinforces the notion that the sheer ubiquity and power of modern communications systems have resulted in the widespread adoption of new styles of interaction to better suit the nature of the technology. Commonly-used channels such as email, Facebook or Twitter increasingly require, encourage or even reward time-constrained and minimalistic levels of interaction. The shorter, more "efficient" interactions generate an increased volume and density of information, further encouraging shortened interactions in a continuous cycle; the mental expenditure needed to handle the resulting outpouring of information has resulted in a frequently-noted and increasingly common sense of disconnection and confusion in interacting with the basic elements of modern society.

Reactions against a perceived "acceleration" of life have existed in various forms all throughout the historical record. Traditions of asceticism and simple living reach back over eight thousand years, exemplified in religious groups from the wandering yogis of ancient India to the more modern Amish. Henry David Thoreau famously proclaimed his views on the subject of relaxed living in *Walden,* moving to a cabin in the woods to avoid urban life and succinctly stating – *"simplify, simplify!"* (Thoreau, 1995). Furthermore, with technological advancement has come a corresponding movement against it, from the aforementioned anti-industrialization Luddites of the early 19th century to the anti-nuclear-proliferation hippies of

the 1960s. Coincident with the information revolution of the last three decades, a notable reactionary development has been the Slow movement, expanding steadily since its birth in the late 1980s. Beginning as *Slow Food*, a reaction to the forgettable and superficial dining experiences created by a boom in fast food restaurants, the Slow movement as a whole has grown extensively in subsequent years. The Slow movement's primary tenets encourage increased contemplation, reflection, community focus, and mindfulness in all life interactions ("Slow Food International," 2010). These important goals, if properly applied, could be useful to help allay the increasingly hectic nature of human-technology interaction.

1.3 — Justification & Significance

Emphasizing a more measured, contemplative pace of living, the Slow movement intends to improve quality of life. However, much of the focus in application of Slow principles have been centered around the movement's more regressive aspects — notably, the rejection of modern technologies and methods in favor of ancient or traditional strategies. This is an effective strategy for the creation of artistic interventions or the promotion of Slow activism, but such methods rarely result in widely-adopted, effective alterations to the status quo. Designers and engineers building new products and interactions cannot afford to reject modern technologies simply because they are "Fast" products of the modern age. As Jennifer Rauch writes on the *Slow Media Blog*, "Slow Media are not a contradiction to the speed and simultaneousness of Twitter, Blogs or Social Networks but are an attitude and a way of making use of them" (Rauch, 2010). In order to truly effect change, this philosophy must underpin the development of Slow techniques; a framework is required identifying the ways in which Slow design can augment Fast technology, enriching interactions, promoting local culture and encouraging personal and social reflection.

This research ultimately aims to develop, based on both pre-existing Slow interventions and new experimental research into the area, a specific set of frameworks for

the modern designer, engineer, or artist which define how to successfully integrate modern "Fast" technologies and the concepts of the Slow movements.

1.4 — Definitions & Nomenclature

This section outlines and defines commonly-used terms that may be unfamiliar. It covers the more prominent theoretical concepts, ideological methodologies, and technical terms used within the thesis.

Theoretical

Slow: When used in this document with a capital S, this pertains to or involves the concepts underpinning the greater S*low movement*. This includes increasing richness of interaction with a product or service; extending interaction over longer timescales; an emphasis on locally-produced culture and content over that imported from the outside; encouraging interaction with the immediate community over that with the global society; and encouraging people to reflect upon themselves and their situation in relation to their community.

Fast: Used in this thesis with a capital F, this indicates the inverse of *Slow* as defined above. The term was developed in contradiction to its usage in *fast food* — "designed for ready availability, use or consumption and with little consideration given to quality or significance." ("fast-food," 2011). A *Fast* design or interaction attempts to place the most content into the smallest area, maximizing the amount of information that can be conveyed per unit of time.

Fast and Slow Technologies: These are technologies which by their nature support, rely upon or emphasize the elements of either a Fast or Slow interaction, as defined above. This thesis focuses on information and communication technologies, and so technologies are evaluated according to how they affect information transfer, retrieval and presentation. Those systems and interactions which create connections within local communities, which

allow openness and flexibility of interpretation, and which provide nuanced information in an intuitive way are considered Slow, while those that compress information into a small, efficient packet, which operate instantaneously on a global scale, and which encourage detachment and minimalism in the interaction are considered Fast.

As an example, a simple conversation between two people, in person, is an extremely Slow interaction — it only operates in the local sphere, and an enormous amount of nuance beyond the literal meaning of the conversation is naturally available in an entirely transparent manner through subtle body language, changes in intonation, facial expressions, and so on. Compare this easy richness to the relative difficulty of conveying humor or sarcasm in written language, for instance. Technologies that maintain these Slow aspects can themselves be considered Slow. Some examples of Slower technologies or interactions might include a written, posted letter; a telephone conversation; a traditional community bulletin board; or a group of friends sitting around and talking to each other.

The rich but natural interaction inherent to Slow technologies is contrasted to the efficiency and unambiguousness of a Fast technology. One of the Fastest communications technologies today might be Twitter; it encourages distillation of concepts to their core in order to fit them into 140 characters, stripping out nuance and explanation in order to pack in more pure content. Every post on Twitter becomes instantaneously visible to millions of people worldwide, and with more than 50 million new posts per day (Twitter, 2010) there is little time for any individual post to remain the topic before newer ones take its place.

Figure 2 is a graph demonstrating the author's subjective interpretation of where a number of information technologies fall on the spectrum of Slow to Fast. It can be difficult to precisely place technologies with respect to one another; for instance, a newspaper might be a national publication or a local weekly, and the content can vary from short factoids to in-depth editorials and analyses. As such it can skew as both a Slower and Faster technology than, say, a book or a magazine.

It is critical to note that relative Fastness or Slowness is not an inherent characteristic of the physical "hardware" upon which a system is built. There is nothing about a piece of paper that makes it Slow or about a microchip that makes it Fast. Rather, the Speed of a technology comes primarily from the layer that supports human interaction with it, i.e., the man-machine *interface* in the broadest sense of the term. The experience of the interface is in turn influenced by society's expectations of the system, by the nature of the information being conveyed, by the scale on which the interaction is situated, and by the relative positioning of the system within society as a whole. Technologies may also evolve over time, according to both the expectations of contemporary society and the development of new systems. The radio, for instance, would have been defined in the 1920s as the Fastest communications technology in the world, had the term existed. As the development of the Internet and television networks have mostly replaced traditional spoken radio in long-distance communication and broadcast media, radio is reduced to a Slower technology. Furthermore, as the concepts and technologies underpinning it (broadcasting audio to multiple receivers) become increasingly trivial, the basic concept becomes co-opted on smaller and smaller levels — Podcasting, for instance, can be seen as a natural progression of the "radio broadcast" from an extremely Fast, global technology to a Slower system that targets small communities with greater depth. Other technologies can be seen to have undergone similar evolutions; for instance, mass-produced printed literature has led to the development of local "zines".

Notwithstanding the constantly-changing nature of information technologies and the difficulties in creating a clear hierarchy, the general progression from Slow to Fast as technologies become increasingly informationally-dense and globally-focused should be clear in figure 2. The edges of the graphic display some key terms that might be used when describing a Fast or Slow technology, to assist in the categorization of technologies or interactions not covered on the graph.

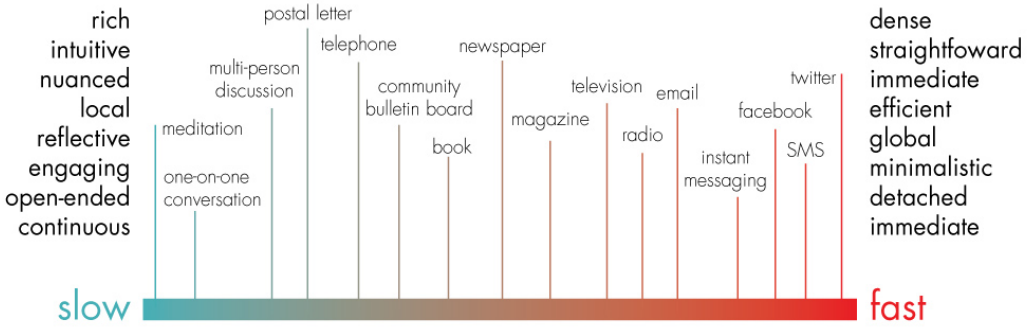


Figure 2: Some selected technologies graphed on a continuum from Slow to Fast

Ideological / Computational

Physical-Digital System: A system designed explicitly to apply both physical and digital paradigms of interaction. The structure of a purely digital system, such as an application running on a desktop computer, exists entirely in a digital space and only interacts with the physical world in order to exchange information with its users. A purely physical system, on the other hand, involves no digital components and relies entirely on traditional ergonomic interactions. A hybrid system incorporates elements of both, generating new interactions by adding digital elements to the physical world in ways that require contributions from both sides to fully experience. An example might be a projection-mapped architectural display, which modifies a purely digital interaction with a screen by integrating it with the built world.

Technical

Adobe AIR: An object-oriented programming environment based on ActionScript, the language primarily used to control the Adobe Flash web platform. The primary reasons for its choice in this research were true cross-platform compatibility (Windows, Mac OS X, Linux) and a high suitability for quickly programming visual media. Its primary disadvantage

is in computation speed, but none of the research discussed in this thesis is dependent on complex computation.

Ruby On Rails: An application framework typically used for web-based projects. A great deal of open-source RoR code exists to access online systems like Twitter and GMail, and to easily handle database storage and online administration.

1.5 — Assumptions & Limitations

This research makes certain assumptions about the area in which it is focused. While it is established fact that increasing levels of multitasking (as opposed to deep focus on one concept or task at a time) can lead to mental exhaustion and ultimately result in lowered quality and enjoyment of each task, each person naturally has a different limit to how much simultaneous interaction they can handle and perceives this in a different way. While some people identify that they have problems keeping up with increasingly terse email conversations, others are entirely comfortable sending tens of thousands of text messages per month. When information overload does become a problem, the reason is often dependent heavily on whether a system — mental or technological — to filter the content can be put in place (Weinberger, 2007) and how effective that filtering system is at providing the information that the user needs and hiding the rest (Shirky, 2008). Research into this area will be discussed more extensively in Section 2. So, while "information overload" is a well-established and researched phenomenon, this research relies upon studied users' subjective definitions of overload and their ability to cope.

Another major caveat to note is that Slow design is not a panacea, and it is not a universally applicable system of values and directives — nor is it intended to be. There are numerous situations where the usual benefits of a Fast interaction, such as high informational density, unambiguous content, or rapid transmission, are paramount, and in these situations Slow tenets are of little or no benefit. For instance, no one would suggest

replacing the 911 emergency system with an interface that in any way reduced the speed and efficiency of its message. Journalistic correspondence might benefit from increased engagement with local culture, but it is difficult to see how the other two tenets would apply in a way that would not decrease the timeliness and clarity of information. Slow design is intended to address the specific, identified need for increased richness of interaction resulting in more personally valuable reflection and community association in situations where these factors are desirable and where the interface can be made less outright *efficient* without a negative outcome.

Furthermore, the issues that Slow design addresses are not global in nature. A full quarter of the world's population has no electricity (Gronewold, 2009), while only 29% has access to the Internet (International Telecommunications Union, 2010). Given that effectively all modern information technologies require electricity, and the heavy reliance of new media systems on the Internet, a large percentage of the world's population cannot access the systems discussed in this thesis. Furthermore, research into concepts of information overload has primarily examined the developed world from a Western perspective, leaving questions as to how similar experiences might be interpreted in different global social or economic situations. With the exponential growth of Internet connectivity and the incredible popularity of technologies like mobile phones in the developing world, it is likely only a matter of time before these issues are studied in a broader context, but at this point the research is grounded in the Western world's experience of information technology.

This research is also necessarily limited in scope. Controlled user testing can only ever reach a small fraction of the potential users of a system, and so cannot hope to account for every eventuality or be applicable in every circumstance of product or system use. Rather than using large-scale statistical data-gathering methods, the series of user studies discussed in this thesis are treated more as case studies. This rests upon the well-recognized and established concept that nuanced, detailed impressions from a smaller group of users can

provide as much valuable research information as a wide-scale but more general survey instrument, particularly in an iterative design process like that used for each of these systems.

1.6 — Document Organization

This thesis document is structured according to the three mediated systems created in the research process. These three projects are *KiteViz, Taskville,* and *Your ____ Here*. On a basic level, this organization is chronological (KiteViz began development in October 2009, while the second iteration of Your ____ Here was installed in February 2011). However, it also orients the systems along a number of different *scales*. The systems expand in scale of intended audience, growing from targeting a small group of less than twelve (KiteViz) to the presentation of a Slow design system to the general public (Your ____ Here). The systems also expand and change in scale of interaction. KiteViz is a relatively passive system, which does not allow any direct user input, and which displays concepts like "relationship strength" (which can be quite hard to display computationally) in an entirely metaphorical way; Taskville allows user input over the period in which the system is running, but displays this inputted information in a representative manner rather than directly in the raw form; and Your ____ Here depends entirely on active user input to have any content at all, and displays the results directly and immediately. In this manner, the research examines several potential contributing factors to Slow design simultaneously using only the three major projects.

On a broader level, this thesis begins with an overview of the area of research and the identification of specific problem statements and research goals; examines the existing literature and research in surrounding and influential areas in breadth and depth; presents the overall methodology used to study the aforementioned problem statements and collect observations; presents the detailed specifics of each project undertaken in the research process, including theory, implementation, user study protocols and results; produces a set of conclusions based on the corpus of research; and finally proposes a set of five guidelines

to be applied in the design of experiential or computational media systems in order to successfully integrate Slow principles. The thesis concludes with appendices containing documentation of the survey instruments used and the research results. Copies of this document, supporting material, and software developed in the research process are available online at http://www.silvanlinn.com/msd/.

Chapter 2

LITERATURE REVIEW

Both prior to and during the research process described in this thesis, existing literature was consulted to provide a deep and broad grounding in the current state of the art. Works consulted cover theoretical research into information overload, personal reflection and the psychology of user interfaces; ideological papers and arguments surrounding the Slow movements; and technical papers documenting experimental mediated systems that apply concepts related to Slow design in their implementation.

For ease of understanding, this literature review is divided into four sections. The opening section provides an overview of the Slow movements in general and concepts in information psychology. This is followed by a section based on each of the principles of Slow design outlined in section 1: enriching interactions, promoting engagement with local culture, and encouraging reflection. Within each section, the relevant theoretical framework and examples of systems supporting it will be discussed.

2.1 —Information Overload and the Cult of Speed

The concept of a perceived technological "speeding-up" of life is far from new. Some commentators have suggested that the concept has existed as long ago as ancient Greece, beginning with the first attempts to organize the Library at Alexandria (Shirky, 2008). In the 18th century, during the first industrial revolution, widespread distrust of the new machinery just being put into use led to groups of traditional artisans (most famously the Luddites) actively waging war upon technology, destroying the machinery that threatened to replace their livelihoods (Sale, 1995). While this act could be seen as a straightforward workers' grievance, the key difference from earlier revolts against science can be found in the nature of the specific technology. The industrial revolution ushered in the age of

mechanization, arguably the single greatest leap forward in human productivity. By the time of the second industrial revolution and the dawn of mass-production in the late 19th century, technology had become entrenched enough that the distrust shifted from the technology itself to its most obvious feature: speed. The proliferation of the pocket-watch inflexibly divided time where it was formerly guided only by nature, the emergence of the automobile enabled ever-faster speed records to be reached and immediately shattered, and the introduction of efficient factory floor time management spread these technological accelerators far and wide. The emergence of the bicycle, enabling people to travel faster and further than on foot, prompted the French author Paul Adam to describe a "cult of speed" that encouraged people "to conquer time and space" (Kern, 2003).

These developments, though, pale in comparison to those that would follow. In just decades, transcontinental telephone lines and artificial satellites and information-processing devices led to an all-encompassing and prevalent experience of continuous, rapid connectivity and communication. The seminal media theorist Marshall McLuhan famously described a "global village" in which electric technologies allow all global citizens to behave as if living next to each other, their politics and societies hopelessly entangled (McLuhan, 1964). Notably, McLuhan does not suggest that this global connectedness would lead to any age of great understanding, but rather than it would merely increase discord as the "village" increased beyond the size of any single city.

As McLuhan was writing *Understanding Media*, the first general-purpose electronic computers were under development. It is perhaps no coincidence that the term *information overload* appeared around the same time. In his 1970 book *Future Shock*, Alvin Toffler draws a comparison between the *culture shock* experienced by a traveler in a foreign environment, and the confusion he perceived in people dealing with rapid societal change in their home culture. He defines "future shock" as "...the shattering stress and disorientation that we induce in individuals by subjecting them to too much change in too short a time" (Toffler,

1970, p. 2). Toffler notes multiple experiments designed to test the human capacity to perform increasingly complicated tasks with increasing density, invariably reaching a point where the subject is "reduced to blithering ineptitude" as "no matter the task, there is a speed above which it cannot be performed" (Toffler, 1970, p. 353). This point is what he terms the aforementioned *information overload.* Toffler takes a biophysical slant in his analysis of this phenomenon, noting that even the computers of his time were capable of presenting and processing data "billions of times faster" than any human nervous system was physically capable of moving the information to the brain (Toffler, 1970, p. 350). With the natural steady increase in processor power, even today's most basic computers operate at a rate far beyond the comprehension of any human.

This general concept of a mismatch between the amount of information available to (and presented to) a person and their ability to cope with and understand it has since been described in a number of different ways under various names. Jakob Nielsen, for instance, extends the concept of information overload to outright *information pollution,* claiming that "our lives are littered with extraneous details that smother salient information" (Nielsen, 2003). He colorfully describes email spam as "attention theft" and compares websites or interfaces that provide a great deal of superfluous information to "packing the forest with cardboard rabbits: frustrated wolves are bound to hunt elsewhere." The message he expounds is essentially that quality, not quantity, of interaction is the aspect that matters most to creating value and utility. Richard Saul Wurman, the famous "information architect" and creator of the TED Talks, proposes that a large factor in the problem is what he terms "information anxiety" — the discomfort generated when there is a large amount of information available but it fails to provide the receiver with valuable *knowledge* (Wurman, Leifer, Sume, & Whitehouse, 2001). Wurman claims that "a weekday edition of the New York Times contains more information than the average person was likely to come across in a lifetime in 17th-century England," (Wurman et al., 2001, p. 5) but obviously few people

will find all of the information in the newspaper to be critically useful and interesting — the unread sections of the paper simply amount to noise and make it harder for the reader to find what they are actually looking for.

On the other hand, Clay Shirky (as noted briefly in section 1) suggests that the problem people describe is in fact not a true "overload" of information, but actually a lack of proper techniques for *filtering* the information that is available. He claims that information overload has been the default state of humanity as far back as the creation of the Library at Alexandria, which contained more knowledge than one human could absorb in a lifetime, and that the only reason we do not consider a modern library or bookstore to be a source of overload is because of the development of filtering and cataloguing systems (i.e., library science) that allow people to easily find exactly what they require. In Shirky's view, modern communications channels simply lack effective systems to present the data that people find meaningful and hide the rest, forcing us to wade through it all on our own.

In *Everything is Miscellaneous*, David Weinberger expands upon Shirky's concepts by suggesting that old methods of interacting with information, centered around paradigms of handling physical, tangible information, are simply no longer applicable to new systems. For instance, a printed photograph can only be filed in one particular location in an archive, making a clear mapping between the photograph and the way in which it is accessed (i.e., going to the filing cabinet and taking it out). On the other hand, a digital photograph can be accessed through any number of different searches that end up in the same location, or hyperlinked to make the single file appear on multiple pages, causing it to appear in hundreds of different equally-valid "locations" simultaneously and breaking traditional concepts of information management (Weinberger, 2007). Beyond just new kinds of filters, new forms of information require basic modes of interaction that simply have not yet been developed — an interface which controls and mediates the interaction, moving it to a level that the user can comprehend. Unfortunately, many interface concepts have failed

specifically because they *themselves* required that the user learn large numbers of unfamiliar strategies for basic operation (Myers, Hudson, & Pausch, 2000).

Finally, other researchers note that despite the overload some experience, others have no problem whatsoever handling new developments and changes in how they access information. Mizuko Ito's work, for instance, studies the relative ease with which many children and teenagers pick up and use modern technologies, becoming rapidly engaged and learning easily from the process (Itō, Baumer, & Bittanti, 2009). Children and young peoples' natural ability and willingness to learn, combined with their lack of having experienced the "old way" in any depth, may contribute to their higher tolerance for newer, Faster interactions. And of course this ability is not merely limited to children; some people will be lifelong early-adopters, picking up and experimenting with new Fast technologies whenever they are introduced.

Obviously, the nature and the extent of "information overload" as a real problem is a heavily debated and highly subjective concept, experienced differently by every person. Some people may be able to seamlessly integrate new technologies and modes of communication into their lives, becoming the first users of new channels like Twitter. Yet it cannot be argued that some subset of the global population *does* experience a problem with the tremendous volume of information they interact with on a daily basis. In the current age of the World Wide Web, McLuhan's aforementioned "global village" has become more of a "global living room"; our televisions, personal computers, and smart phones all participate in the international network and clamor for our attention, beckoning us with the opportunity for connection and interaction. This consciousness is reflected in the popular media: In a *New York Times* survey, 30 percent of users under the age of 45 claimed that use of their electronic devices (smartphones, laptops, and related tools) made it harder to focus (Connelly, 2010). "Unnecessary interruptions" at work, such as superfluous reply-all emails and distracting instant messages, are estimated to cost $650 billion per year in lost

productivity (Lohr, 2007). The complex advancements in communications technology have naturally spawned a variety of attempted and makeshift solutions, often far from ideal. The Inbox Zero project devotes itself entirely to identifying ways to reduce the amount of time spent reading and responding-to email, with a focus on maintaining a minimum number of emails in a user's inbox, but even the act of sorting the mail requires a certain time investment (Mann, 2010); other people simply declare outright "email bankruptcy" (a term in existence since 2002) and delete their entire inbox, read and unread. Interestingly, a growing set of technology users have begun to look towards the past, examining for instance how prolific letter-writers of the past responded by hand to the large volumes of mail they received each day. It is surprising how relevant some of the strategies can be: H. L. Mencken, who received 10-80 letters each day, reportedly was only able to remain on top of his obligations when entirely undistracted by the arrival of other communications (the postman) and was so perturbed by the ringing of a telephone that he wrote that he wished "that Alexander Graham Bell had been run over by an ice wagon at the age of 4." (Stross, 2008). Even those two rather temporally slow channels of communication are capable of causing significant upset; a smartphone supporting half a dozen or more different channels while remaining in arm's reach of the owner at all times constantly threatens mental disruption.

2.2 — The Slow Movement and Related Concepts

Most of the above-mentioned mediated interactions can be termed "Fast", as defined in *Definitions & Nomenclature.* A Fast interaction is efficient, taking minimal time to enable maximal interaction, in a way that does not engage the user any more than is necessary. Multiple layers of information are often presented using strong coding; a trivial example of a Fast factor in communications might be the aforementioned development of texting lingo such as "brb" or "ttyl". While a Fast interaction is often considered to be the

ideal type, the growing area of the "Slow movements" suggest that there may be more than efficiency to value in an interaction.

Figure 3: Logo of Slow Food International

The origin of the term "Slow", as defined in *Definitions & Nomenclature,* began with the Slow Food movement, founded in 1989 as a reaction to "fast food and fast life" ("Slow Food International," 2010). Perceiving an increasing lack of uniqueness in food culture, and decreasing interest in people's food choices and how they impacted the world, the founders of the movement began a mission to promote biodiversity in crops, the preservation of social and cultural connections made through food, and reflection on the consumer's place in the world. The key principles of the Slow Food movement — social and cultural relevance, personal and communal reflection, and "richness" or "depth" in favor of speed and quantity — have since been integrated into a number of other movements, ranging from urban planning to parenting. The movements are growing steadily; in 1999 the *World Institute of Slowness* was founded, and more recently in 2009, the inaugural issue of *Slow* magazine, dealing with all things "Slow", was published in Australia.

Some of the earliest technological interactive investigations that can be considered "Slow" were conducted by Weiser and Brown, who advanced the concept of Calm technology in 1995 (Weiser & Brown, 1995). They identify a fundamental characteristic of different forms of technology: some are *encalming* (for example, a "fine writing pen"), while

others are *enraging* (for example, a pager which "bombard[s] us frenetically"). These terms can be seen as prototypes of Slow and Fast, respectively. Weiser and Brown suggest that "Calm technology engages both the center and the periphery of our attention, and in fact moves back and forth between the two." The key is that a Calm technology maintains an accessible source of information, without requiring a constant, "centered" interaction in order to interpret it. They identify "three signs of calm technology", namely that (1) the technology's required interaction "easily moves from center to periphery and back"; (2) the technology "enhance[s] our peripheral reach by bringing more details into the periphery"; and (3) the technology locates us "at home, in a familiar place", helping us be "connected effortlessly to a myriad of familiar details". The third sign is the most relevant to this research, suggesting that familiarity with an interaction or elements thereof (such as its situation in a familiar physical environment) can improve the interaction's subjective quality.

Such technologies can help increase the depth and richness of our interactions by providing us with alternate, often metaphorical, ways of contemplating them. Weiser & Brown present the example of a dangling string connected to a motor, which reads information from a network cable passing above (Figure 4); as traffic on the network increases, the string dances and shakes. With no pre-defined conceptual mapping for a bouncing string hanging from a ceiling, viewers must create their own, thus reflecting more deeply on the object's existence. Designers can use the natural proclivity of the human mind to see patterns and meaning where none is explicitly given to increase depth of interaction.

Figure 4: Natalie Jeremijenko's "Dangling String", an example of a Calm technology which makes intangible information (network data rate) apparent in an abstract but easily comprehensible manner

In the last decade, this idea of integrating the tenets of the Slow movement with "Fast" technology has gained traction. By their account, Hallnäs and Redström were the earliest users of the term "Slow technology", referring specifically to computerized technology that promotes a Slow interaction (Hallnäs & Redström, 2001). They correctly predicted the current ubiquity of inexpensive, mobile computing power, and that its existence would require some form of Slower interaction to be properly navigated. Their research focused on the creation of technologies for the promotion of "reflection and moments of mental rest", through two primary methods. First, through the use of systems that expose their functionality, encouraging people to reflect on the technology itself, and second, through technology in which "time is a central and explicit notion." Projects they describe leverage features such as a simple, un-exciting, almost sedate user interaction to prompt the user to question the role of the object.

Perhaps the most ambitious Slow movement of importance to designers today is the highly theoretical "Slow Design" initiative. The concept of Slow Design centers around a set of principles proposed by Carolyn Strauss and Alastair Fuad-Luke with the aim of

emphasizing the "the spiritual, emotional and mental 'art' of living" (Strauss & Fuad-Luke, 2008). The authors see Slow Design as the next "evolution" of sustainable design, going beyond merely a focus on environmental well-being to the incorporation of personal and societal well-being as well. In their paper the authors both develop a theory of Slow Design and provide examples of products that demonstrate aspects of their framework. They break the topic into three "spheres of influence" that create a Slow design — the individual, the environment, and the socio-cultural. Though they address the topic from the historical perspective of industrial and product design, they include a number of generalizable desired outcomes of a Slow Design. Among others, these include "creating moments to savour and enjoy the (human) senses", "balancing the local with the global and the social with the environmental", and "designing for space to think, react, dream and muse" — three concepts that align well with the Slow tenets discussed earlier of creating richness of interaction, engaging the local community, and encouraging reflection. Again, because the authors' background is in product design, they identify "Fastness" as generated by the economic, political and social realities of the modern consumerist culture — mass-manufacturing, disposability and planned obsolescence, and access to credit are all seen as Fast influences. Each of these, like other Fast interactions, emphasizes superficiality, efficiency and quantity over all other aspects. Strauss and Fuad-Luke do include temporal Slowness as a facet of the interaction, but not as the only facet, or the end-goal. Rather, they suggest that a Slow Design can take advantage of interaction over a longer timescale to allow and encourage users to deepen their engagement with the product or service. As Strauss and Fuad-Luke's paper is highly theoretical, it does not propose a specific methodology, but its concepts have been used as a basis for the development of systems that apply Slow elements, such as King and Forlizzi's "Slow Messaging" system for couples living at a distance (King & Forlizzi, 2007). Note that this thesis' use of the term "Slow design principles" can be confusing in the context of Strauss and Fuad-Luke's use of "Slow Design"

— the principles presented in chapter 7 are a framework for the application of the three Slow tenets referred to throughout this document, not Strauss and Fuad-Luke's own theories.

Other areas of study have developed concepts that are similar in basic theory to the underlying motivations for the Slow movements. For instance, the term "Glocalization", as popularized by Barry Wellman, has been used to describe a strategy of "thinking globally and acting locally" (Wellman, 2002) — apparently in line with the Slow movements' goals of expanding the role of local culture in an increasingly globalized world. The interpretation of glocalization concepts, and precisely how similar the goals are to those of the Slow movements, varies depending on the field from which it is implemented. For instance, Keith Hampton demonstrates how the Internet, an inherently global network system, may be co-opted by smaller groups within a local community to enhance their own interactions (Hampton, 2010). In this interpretation, glocalization of the Internet strongly supports the second tenet of the Slow movements. On the other hand, glocalization in the business and product development world is frequently understood as the strategy of slightly modifying a single, standardized product for a specific local culture in the interest of appealing to as many people as possible. This often involves simply stripping out "premium" features to reduce cost and ignoring the actual unique contributions and insights of the locals; in this circumstance innovation flows only "downhill, from the headquarters of the multinational corporation out into the world" (Govindarajan & McCreary, 2010). Clearly, this has a negative effect on the actual end-users of the product while benefiting the larger corporation. The Slow movements, in contrast, are clear that creating personal and societal well-being on the immediate scale is the ultimate goal.

Another philosophy similar in concept to the Slow movements is presented by John Maeda in his book *Laws of Simplicity* (Maeda, 2006). Maeda develops a number of guidelines aimed at the creation of *simplicity* in design, interaction and life in general. He makes

reference to "simple" (often minimalistic) products and services, like the Google search engine, the iPod or the Tamagotchi "virtual pet", demonstrating how focusing on the key elements of an interaction and eliminating the superfluous can create a compelling product. He sums up his principles with the acronym "SHE" — shrink, hide and embody. Maeda proposes ten laws, but four have particular relevance to this research. The first, "Reduce", suggests that one of the easiest ways to achieve simplicity is through "thoughtful reduction" — not simply blind feature-limitation, but the reduction of an entity to its important core by removing nonessential elements. The second, "Difference", claims that both simplicity and complexity are required for either to be meaningful; the simple interaction or product can demonstrate its value best through way of contrast to the more complex alternatives. The third, "Emotion", acknowledges the need for "self-expression and...human warmth"(Maeda, 2006, p. 67) in design. By extending a sense of humanity in an interaction and leveraging natural human social cues, the entity gains greater value to its users. Finally, the fourth law, "The One", emphasizes the subtlety of simplicity — "simplicity is about subtracting the obvious, and adding the meaningful"(Maeda, 2006, p. 89). The elements that make a design or an interaction deep and reflective are often far from straightforward, even intangible, and rely heavily on the user's specific interpretation of "meaningful" to be valuable.

Maeda's concepts, and indeed even his usage of the term "Simplicity", align quite well with the tenets of the Slow movements. While Maeda focuses on the person-product interaction and does not specifically address the value of engaging people with each other and with their community, his "Emotion" suggests the development of reflection and contemplation in a design, and "The One" clearly states the value of *meaningful* — deep and rich — interactions rather than simply those that are *obvious* but superficial.

Integrating the Physical and Digital Worlds

Hiroshi Ishii et al. of the MIT Media Lab first proposed the idea of "tangible bits" in 1997 as a method of "coupling the bits [of information] with everyday physical objects and architectural surfaces" (Ishii & Ullmer, 1997, p. 1). They describe their inspiration as "beautiful artifacts" of the past, made of oak and brass, which demonstrated a sensitivity to aesthetics and afforded a richness of interaction that they did not perceive in existing computer interfaces. Ishii's work focuses primarily on creating physically-embodied methods of interaction with information, but describes theories that have a high relevance to Slow design principles — in particular, the ability to create a deeper, richer connection with the user through the use of unloaded channels. Much as how Slow food encouraged people to search beyond the simple, high-calorie tastes of fast food, Ishii's interfaces encourage interaction beyond the mouse and keyboard, imitating ancient, instantly-recognizable, evolutionarily-coded experiences such as gravity and wind; these "tangible" interfaces can be described as an extended physical *metaphor* for the actual data-processing and -displaying operating behind the scenes.

The concept of a metaphorical display need not be based on physical phenomena. Many physical, digital and hybrid displays have been developed to appeal to a user's peripheral attention, with the ability to provide focused information upon request (Ishii & Ullmer, 1997; Weiser & Brown, 1995). Capitalizing on well-understood socio-cultural concepts, these types of interfaces can utilize powerful everyday metaphors to facilitate knowledge construction and sharing. Visual metaphors have been defined as graphic structures that use 'the shape and elements of a familiar natural or manmade artifact…to organize content meaningfully and use the associations with the metaphor to convey additional meaning about the content" (Eppler, 2006, p. 204). For example, displaying the

time of day as a changing position of the sun in the sky requires no special knowledge to understand. In general, a visual metaphor takes advantage of some commonly understood idea to convey a more complex concept. Prior work indicates the success of implementing visual metaphor interfaces for supporting workplace communication. For instance, in Terrell and McCrickard, the authors developed a visual representation of their office, using the metaphor of a map to identify individual employees by their relative location. (Terrell & McCrickard, 2006). Their system was designed to allow employees to easily determine whether their colleagues were in or out, and if out, where they were, in order to reduce the prevalence of useless instant messages "stacking up" at an empty desk. The authors note that their metaphorically-based system encourages use of the primary system (the IM client), while not duplicating its functionality – a key factor in helping to reduce cognitive load.

A second important thrust in physical-digital integration has been in the implementation of digital interfaces in built architecture. Ishii et al. have conducted extensive research into the embedding of interfaces in the built, physical world, with the goal of breeding familiarity — much as the Slow principles encourage an emphasis on the unique intricacies of local culture. Their work intends to use the pervasive nature of the urban environment to "employ both the foreground and background of users' attention" and take advantage of human "natural parallel background processing" ability (Ishii & Ullmer, 1997, p. 238). Systems that combine the built physical world with digital information have become increasingly common, with projection-mapping of an image onto an architectural element being a particularly well-established technique. Rafael Lozano-Hemmer's seminal work, for instance, uses numerous forms of lamps and projectors to interrupt, disrupt and augment public urban space, integrating powerful electric illumination, digital submissions (via the internet) and the built world into cohesive experiences (Lozano-Hemmer, 2011).

Figure 5: Rafael Lozano-Hemmer's "1000 Platitudes" (Lozano-Hemmer, 2011)

The complexity of "ownership" of a public space like a plaza or the exterior of a building results in many outdoor projection-mapping systems having provocative overtones. For instance, the SMSlingshot system developed by the VR|Urban collective is an exploration into physical/digital integration of text-messaging (VR/URBAN, 2010). An image is projected onto a wall, and participants may use a digital "slingshot" to first enter a short message, then "shoot" it at the wall where it explodes in a burst of "paint". In this manner, SMSlingshot (Figure 6) allows users to create their own graffiti-like art on the underlying building without dangerous legal ramifications, provoking discussion.

Figure 6: SMSLingshot (L) (VR/URBAN, 2010); L.A.S.E.R. Tag (R) (Graffiti Research Lab, 2007)

Other systems explore issues of user-generated content, public ownership and political commentary even more blatantly; for instance, the Graffiti Research Lab's "L.A.S.E.R. Tag" (Figure 6) allows passersby to use a powerful laser pointer to "write" anything at all on the entire side of a skyscraper (Graffiti Research Lab, 2007), while Julius von Bismarck's "Image Fulgurator" allows an activist or prankster to remotely insert customized lettering or images into tourists' snapshots (von Bismarck, 2008).

The availability of online development tools and in particular, API (application programming interface) services are expanding opportunities for casual users to more directly interact and engage with online content. Twitter, for instance, provides an API structure (Twitter, 2011) through which users can create their own programs that interact with the "cloud" of information stored on the Twitter servers. By granting users access to the raw data they collect, service providers can allow users to analyze and represent the content as they see fit, in ways that can lend both insight and meaning. However, even without explicit access to the internal structure of a service, many online platforms can, by the Internet's highly interconnected and modular nature, be repurposed. The Google Voice product (Google Inc., 2011), for instance, provides a free voice-over-IP and text-messaging system to users within the USA, and with judicious use of existing web application frameworks, these utilities can be leveraged by external users in their own projects.

The flexibility of the Short Message Service (SMS, or text message), now available on nearly every mobile phone sold worldwide has led to many instances of its repurposing as a flexible, highly-accessible remote backchannel for media systems. Its ubiquity allows it to serve where formerly a much more expensive and dedicated interface would have been required, or to increase depth of interaction where something like a simple physical button may have once been all that could be implemented. For instance, O'Hara et al. presented a system that allowed users to send personalized messages from a mobile phone to a situated

display, changing the nature of the communication from a two-person-bidirectional interaction to one that can reach unlimited people, but is unidirectional (O'Hara et al., 2005), opening the option for new and varied styles of interaction.

Contributions

The research in this thesis expands upon the aforementioned methods of creating richness in digital interactions. While it uses the general concepts from Ishii's tangible interfaces, ie., an emphasis on creating interactions to which the user can react on an intrinsic level, it does not use *physically* tangible methods to do so, instead encouraging this form of natural mapping through visual metaphor. KiteViz and Taskville use visual metaphor as a means of increasing depth, but they go further than Terrell & McCrickard by using abstracted artistic metaphors (communication = flying kites, for instance) rather than a literal representation of reality on a miniature scale. Finally, while projection-mapping of media onto architectural elements is a well-established practice, the specific implementation differs; Your ____ Here is somewhat unique in its combination of accepting free-form user content but also integrating seamlessly into the built world.

2.4 — Promoting Engagement with Local Culture

Enhancing Group Collaboration & In-Person Interactions

The Slow movements encourage connecting to others on a personal, face-to-face level rather than through a mediating technology, where possible. In studies of workplace efficiency and job satisfaction, informal communication within organizations has been identified as an important component of successful workplace collaboration (Zhao & Rosson, 2009). A classic example of informal communication is the water-cooler conversation, where colleagues casually exchange information while strengthening social

bonds. However, some studies suggest that an increase in computer-mediated communication (CMC) such as e-mail reduces the opportunity for informal interactions in the workplace (Walther, 1996). Several recent studies suggest the rich potential of social communication tools such as IM (instant messaging) and Twitter for enhancing workplace communication (Terrell & McCrickard, 2006; Zhao & Rosson, 2009). However, an important caveat highlighted by this research points to problems with the overall cognitive load involved in keeping up with a high levels of micro-blogging activity.

A key aspect of the aforementioned water-cooler conversation is its face-to-face nature. Since the water cooler is located in a single central location, employees tend to encounter each other in the area, supporting spontaneous discussion and interaction. Research into *situated displays* attempts to encourage this form of personal closeness by requiring that users of a system be gathered in a single area. "Nnub" is a digital notice-board system which imitates traditional community notice boards, around which people would gather to view and discuss community events. Users can upload information to Nnub via a web interface, but the primary method of interaction is with a situated touchscreen that imitates and builds upon historical community practices (Redhead, Dekker, & Brereton, 2010). A similar system, FrostWall (Figure 7) , uses projectors and frosted glass windows embedded in wall panels to convert an office hallway from a simple thoroughfare into an informal digital information exchange (Kjeldskov, Paay, O'Hara, Smith, & Thomas, 2009). The authors make special note that the novelty of the interface and the group nature of the interaction rapidly lead to playfulness, an important factor in the creation and enhancement of social cohesion.

Figure 7: Frostwall (L) (Kjeldskov et al., 2009), Hermes photo display (R) (Cheverst et al., 2005)

A number of research directions in group collaboration center around maintaining group "awareness"; that is, rather than focusing on detailed and information-dense communications, the emphasis is on keeping a sense of "position" within the group and a peripheral idea of each colleague's situation. To this end, Cheverst et al. developed *Hermes (*Figure 7*)*, a system to promote awareness among small groups. This situated photo display allows users to submit and organize photos through a combination of a web client, a physically-installed wall tablet, and a bluetooth-enabled mobile phone (Cheverst et al., 2005). As more users submit photographs to the system, passersby are able to intuit the general state of the group from the photographic collage. The centralized nature of the display also encourages in-person interaction and discussion as intended by a situated display system.

Finally, systems to enhance group cohesiveness often rely on pre-existing group activities as a structure, either by leveraging them directly or through the use of a metaphor. Cooperative games are an obvious starting point, and a number of game-like systems to increase group cohesion have been developed. Toups et al., for instance, present a game to improve the speed and quality of team interactions in emergency response, basing their system on a simulation of the team-based aspects of firefighting, and demonstrating positive effects on team coordination (Toups, Kerne, & Hamilton, 2009).

Crowdsourcing & User-Generated Content

One of the critical tenets of the Slow movements is the leveraging of locally-produced content and local culture over the importation of content from external sources. The use of mobile communications technology to collect and analyze elements of local culture is well-established in literature. Hulkko et al. describe the use of mobile phones as "mobile probes" (vis-à-vis Gaver et al.'s *cultural probes* — (Gaver, Dunne, & Pacenti, 1999)) to gather incidental and serendipitous information from the general public (Hulkko, Mattelmäki, Virtanen, & Keinonen, 2004). Small applications installed on mobile phones prompted users throughout the day with open-ended questions like "what kind of information do you need at the moment?" and encouraged them to either type the response in a digital diary or take a relevant photograph using the device's camera function. In their study, the highly contextual nature of the content-sourcing system resulted in a number of unique experiences that the authors suggest can result in unexpected insights and encourage users to participate more deeply in the interaction.

The technique of *crowdsourcing*, the distribution of large-scale tasks to the general public, is not new. The Oxford English Dictionary, for instance, was developed in part through a call to the public to read works and submit unique words to the dictionary project (Berg, 1993). However, the technique *has* increased massively in scale in recent years, as Internet connectivity reduces the logistical challenges in coordinating massive public efforts to a point where people will participate in a project in exchange for recognition or simply the enjoyment of the event itself (Howe, 2006). While the idealized goal of replacing expensive hired labor cheaply with underemployed members of the public (e.g. Amazon's Mechanical Turk service (Amazon.com Inc., 2011)) has yet to find a truly successful implementation, the increasing digitization of everyday life and the affordances of internet connectivity are

allowing user-generated content to reach new heights of publicity; websites such as YouTube (YouTube LLC, 2011) base their fame entirely on user-submitted content.

It is important to note that crowdsourcing is not required to be distributed among a large group to be effective; if the target population is small and specific, then a targeted system may be the best strategy. Cheok et al's *Blogwall*, for instance (Figure 8), is composed of a public display that accepts SMS messages from members of the public, modifies them by extracting keywords and retrieving related lines of poetry from a database, and displays them on an indoor projection screen (Cheok et al., 2007). By associating user-generated content with existing works of literature and publicizing the results, it is suggested that the system creates an unusual and surprising display that encourages further interaction.

Figure 8: Blogwall (Cheok et al., 2007)

The Slow movement as a whole has always incorporated aspects of "local culture." In the Slow Food movement, this emphasizes the use of locally-grown produce and traditional recipes; to Slow Media proponents, this is taken to mean locally-produced media, relevant to the immediate community. The concept has until recently been somewhat troublesome to apply to the mediated world, with the inherent dichotomy of developing high-tech interfaces and hardware on a small scale posing considerable problems. These

issues could theoretically be solved through the use of small-scale do-it-yourself technologies. The central problem has been the barrier to entry into the world of digital flexibility and creativity. Though more and more aspects of our lives involve or even require connections to the information world, the opportunities for users to deeply modify their interactions with digital information have been limited by both expense and training. Thus, in line with the Slow Design ideal of allowing users to create their own sets of meaning for a given interaction, there is an increasing effort to develop systems and methods in which users can easily build their own interactions with the system. For instance, the *Arduino* electronic prototyping platform ("Arduino," 2010) was designed as a framework to allow users with little or no electronics experience to begin creating their own electronic products, while the *Processing* environment (on which the *Arduino* programming language is based) serves a similar purpose for computer-based systems (Fry & Reas, 2010). Both of these popular systems are heavily utilized in educational, prototyping, artistic and do-it-yourself hobbyist circles.

Contributions

This research draws heavily upon the concept of using a situated system to create a spontaneous "gathering area" where users can encounter each other and engage in informal discussion. All three projects apply this element in some fashion: KiteViz and Taskville use the "water-cooler" metaphor fairly literally by creating a workplace gathering, while Your ____ Here alters the concept slightly and creates a system whose value is tied specifically to the location in which it is implemented. The only connection between system users is presumed to be that they all use the same local area, so the area itself becomes the topic of discussion. KiteViz and Taskville do not rely on crowdsourcing to gather the data on which they rely, being designed for specific groups, while Your ____ Here is entirely crowdsourced and cannot exist without submissions from the public.

2.5 — Encouraging Personal and Social Reflection

Reflective Practice

The educational theorist John Dewey describes reflection as the examination of the basis for a belief — the questioning of the underlying structure of an action or an assumption (Dewey, 1910). Dewey placed particular emphasis on the *connectedness* of the reflective act — the process is characterized by the drawing of connections between areas of pre-existing experience, ensuring continuity and the creation of a holistic, self-supporting world-view. Dewey further noted the necessity of engaging in reflection in a group or community environment for the act to be of value: "One has to assimilate, imaginatively, something of another's experience in order to tell him intelligently of one's own experience" (Dewey, 1916, p. 6). In more recent years, the reflective act has been identified as the key element contributing to mastery of a subject: Donald Schön, in *The Reflective Practitioner*, suggests that a large part of experts' knowledge in a subject area is not merely technical experience, but the result of "intuition" and "art" developed through many years of continuous learning through self-reflection. Thus reflection, and the integration of the reflective practice into daily life, forms an important part of successful individual and community interactions by providing a method for a person to evaluate the impact of their behavior and actions in detail. This evaluation is a crucial action for the mental health of individuals, and when conducted en masse, for the long-term health of the society we inhabit.

Engagement in reflective practice on the societal level has been promoted in numerous circumstances under various names. For instance, Trevor Hancock, founding member of the Canadian Green Party and co-creator of the Alliance for Healthy Cities, defines "social sustainability" as development that, among other things, "enhances...the

physical, mental and social well-being of the population...promotes education, creativity and the development of human potential...[strengthens] our sense of connectedness to our history and environment...[and promotes] citizen participation and involvement." (Hancock, 2010). The simple act of stepping back and considering the greater circles one inhabits can lead to new insights and increased well-being.

Slow Design principles have been previously utilized to spur social action and cultural reflection. Bissas and Hayashi present a unique combination of Slow Food and Slow Design, using whimsically designed objects and artistic interventions to encourage reflection on the impact of farming techniques. (Bissas & Hayashi, 2008). For instance, a zucchini with an MP3 player hidden inside (Figure 9) allows users to plug in a set of headphones and hear the farm at work from the vegetable's perspective, placing them in that context. Community-reflection research, on the other hand, has generally focused more on increasing simple awareness of others. Hallnas and Redstrom present *Soniture,* or acoustic furniture, which collects and replays sounds in an environment over a long period of time, allowing listeners to begin to develop an understanding of the past history of an area through its aural signatures (Hallnäs & Redström, 2001). Merely being aware of others does not encourage reflection, though — in order to properly engage the user, it is critical that all aspects of the interaction be placed in a deeper context, or that the suggestion of such a context be planted.

Figure 9: Using the "neuromantic" project to listen to audio recorded from a cabbage's point of view, encouraging reflection on the farming process (Bissas & Hayashi, 2008)

Microblogging

Microblogging has emerged as a powerful short-format communication service where participants discuss daily activities and share and seek information (Java, Song, Finin, & Tseng, 2007), often using systems to reflect upon their own work and lives, or to emotionally de-stress (Zhao & Rosson, 2009). Twitter is currently one of the more popular microblogging tools, with recent studies indicating its ability not only to support casual information posting, but also its potential to facilitate conversational interactions and informal collaboration (Honeycutt & Herring, 2009). The dominant Twitter interface across multiple applications remains a chronologically sorted activity list, which while useful for viewing individual posts or 'tweets', is less valuable for following multi-threaded conversations, detecting trends or interacting with metadata. Twitter visualizations displaying geographical information (Troy, 2010), connections between users (Neuro Productions, 2009) and general statistical information (Cortesi, 2010) have been developed, but opportunities remain for creating microblogging interfaces that specifically use reflective visual strategies for encouraging informal communication within groups.

Contributions

In attempting to create reflective experiences, this research focuses heavily on Dewey's concept of "examination of the basis for a belief." Each system is designed to encourage questions by presenting information in an unexpected fashion and exposing obscured elements. The ability of the systems to create local engagement is also leveraged, allowing users to reflect in groups and provide alternative explanations or theories to one another. As noted in section 2.3, reflection may be promoted by simple awareness of others; KiteViz and Taskville attempt to promote this awareness, while Your ____ Here derives its entire value from the contribution of "others." Finally, the natural tendency of users to reflect via microblogging services is utilized in KiteViz and Taskville, which solicit submissions through Twitter.

Chapter 3

OVERVIEW OF METHODOLOGY

3.1 — Methodological Approach

The research documented in this thesis was structured to examine the application of Slow design principles to Fast media on multiple *scales,* as discussed in section 1.6. The factors contributing to a successful interaction change dramatically depending on how broadly the interaction is targeted, on how many people the system is designed to support, and on the "activity" level of the interaction — whether it is a highly interactive experience or a mostly passive visualization. This research began on the level of a small user group, with expansions growing in scale to encompass larger numbers of people and study. The overall methodology of this process can be described as a multi-tiered, project-based approach. Three projects were developed to examine how concepts in Slow design could apply to Fast media and technologies on different scales and different levels of interaction.

KiteViz is designed to operate on the scale of a single user-group, primarily passively, and accepting no direct user input. The group might be a close circle of friends, a research team, or a collection of 10-15 colleagues. It is a mostly passive display, processing data into abstracted information behind the scenes and requiring the user to interact on the display's timescale, with only a single display interaction permitted (clicking on a user). It is also a highly metaphorical system, abstracting all the Twitter content into a different form.

Taskville was developed to operate on the scale of multiple interconnected small groups. The reference implementation is multiple departments in an office or shared work environment. Other examples might be multiple classes within a school, competitive sports teams, and so on. Taskville is significantly more interactive, with participants able to submit content directly to the system, but the output is still metaphorical in nature.

The third research project, Your ____ Here, was developed to examine Slow principles on the largest level — the general public. The system scales to flexibly accommodate as many people as can find and interact with it in the installed area. In the studied implementation, this corresponded to the population of a number of departments within The Design School, the School of Arts, Media and Engineering, and any unaffiliated passersby — several thousand people in all. The system is highly interactive, with users able to submit messages and see them appear in the system in a matter of seconds, and it forgoes the abstraction and interpretation of KiteViz and Taskville in favor of displaying precisely what each user chooses to submit. Insights come entirely from the users' reflection rather than the system's shaping of the content.

3.2 — Theoretical Framework

There have been many interpretations of the principles of the Slow movement since its founding over two decades ago. Each separate sub-movement — Slow food, Slow parenting, Slow art, Slow city-design, and so on — requires a different implementation to suit its specific characteristics. However, study of the elements of each movement and the influences leading to its creation (see section 2.1) led to the identification of three overarching principles:

1. Create an increased depth and richness in interaction. The primary trigger for the initial Slow food movement was the loss of complexity in food flavor and quality engendered by fast food restaurants. Thus, a critical goal in all Slow movements has been a return to (or the new creation of) interactions defined by their richness of detail and fundamental depth rather than their speed or efficiency. Colloquially, users should "get more out of" a Slow interaction than they would from a traditional one, with many layers of value and enjoyment below the obvious and superficial.

2. Emphasize local culture and engagement with the immediate community. A secondary trigger for the Slow food movement was a backlash against fast food's global reach and total standardization. Converting this to a progressive statement rather than a regressive one, this tenet emphasizes value in the uniqueness of small-scale local culture. Whether the cultural element is a traditional recipe, a hidden swimming hole, a local bar song, or a piece of folk knowledge, there is value to be had in going "off the beaten path" and discovering an area's rich cultural intricacies.

3. Encourage personal and social reflection on one's actions and interactions.

As noted by Dewey (section 2.3), the reflective act is critical to lifelong learning, the acquisition of new skills, and developing the basis for a holistic worldview. All of the Slow movements encourage examination of one's own actions and interactions, and consideration of how they fit into one's immediate life and broader levels of community. The ultimate goal is to develop a socially and culturally sustainable existence, improving the overall well-being of one's self and community. The third critical tenet is therefore incorporation and upholding of the reflective act wherever possible.

As discussed in section 2.1, the information explosion has led to an existence where the importance of reflective and contemplative concepts in interaction is frequently de-emphasized. Text-based and mobile messaging encourage condensation of communications to only the most obvious level in the name of "saving time" and transmitting as much information as efficiently as possible. The increasingly far-reaching tendrils of the Internet have expanded our "immediate" community to effectively the entire globe, and the ubiquity of communications technologies lead us to send email messages to people sitting in the next room over. The constant stream of new messages on ever-diversifying channels leaves us little time to sit back and reflect on one action before the next is demanded. It seems as though the "wired" existence is entirely at odds with Slow concepts — and indeed, more

regressive groups suggest that the solution is simply to reject the trappings of the electronic way of life and return to an earlier time.

However, this is not the only solution. Fast technology is not a problem in and of itself, and has changed the world for a better place in innumerable way — and it isn't going away. A better solution to the conflict is to *leverage* Fast technologies in methods that promote Slow interactions, by ensuring that each of the three tenets is met. Slowness is inherent to the user's perception of the system, not to the underlying drivers. A Slow interaction could theoretically be generated exclusively using Twitter or Facebook, if the user interaction is handled in a way that is socially and mentally sustainable. As noted in section 1.5 (Assumptions and Limitations), the application of Slow concepts to Fast media does not form a universal solution to all problems, but does address a subset of very real issues that exist for some number of people worldwide.

The research in this thesis is influenced by existing work that the author felt held some potential of creating an aspect of a Slow interaction. Situated displays, for instance, may encourage interaction with the local community by virtue of their users encountering each other in person. Metaphorical displays may be able to increase the depth of an interaction by displaying more complex information in a superficially simple but fundamentally rich fashion. Information presented in an unexpected fashion, for instance integrated into the walls of a building, may cause the viewer to stop and reflect as they process the new interaction. In this research, new and existing ideas suggestive of the elements of Slow interactions are combined with Fast technologies in a series of prototype interactive media systems, which are then tested and evaluated for their effectiveness in generating Slow interactions in the system's user-base.

3.3 — Research Methods

Methods used in this research have varied according to the specific project, as different scales of interaction require different approaches to be properly evaluated. All studies centered around the use of a prototype media system which implemented Slow tenets in its design. These systems were then evaluated for effectiveness in user studies, with identified changes implemented when the system would be re-tested. Thus, the structure of each project can be described as the traditional cyclical *iterative design process* of conceptualization, implementation, evaluation, and modification.

Specific research methods used included written and digital surveys; expert heuristic evaluations; focus groups and group interviews; individual interviews; qualitative and quantitative evaluation of user-submitted content and use patterns; non-interactive observations; and group brainstorming sessions. The details of each method are elaborated upon in the following sections according to their use in each project.

Chapter 4

KITEVIZ

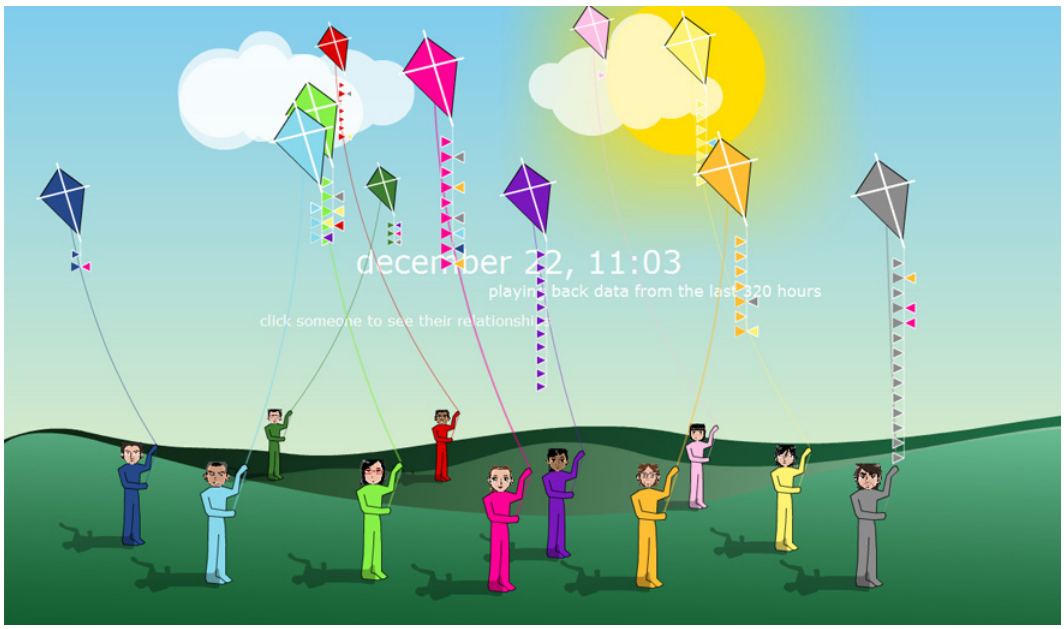


Figure 10: KiteViz version 1.02 displaying a full group and a large number of tweets

4.1 — Theory & Background

KiteViz was the first system developed to implement Slow design principles. The system is at heart designed to enhance *computer-supported collaborative work*, or CSCW; that is, the use of modern technologies to communicate and share information in a workplace. A common problem in modern workplace communication is sorting through extensive backlogs of online conversations, as people overuse the "reply-all" function of their email software and save time by breaking messages into fragments only comprehensible in the greater context of a discussion (Bernstein, 2011). Recent spillover of workplace communications into short-form messaging systems like SMS and internalized "microblogging" systems exacerbate the problem, with confusion and exhaustion resulting as people attempt to follow conversational threads and keep up with rapid discussions. KiteViz examines ways of alleviating this load, focusing on conversations taking place within

the Twitter microblogging service. The overarching goal of the system was to help users interpret the greater social structure of a conversational working group on Twitter, making nuances apparent in a way that would promote reflection, engagement and richness — meeting the tenets of Slow design.

Further information about the design and implementation of KiteViz may be found in the paper "Speak More Slowly! Developing better community awareness through localized reflective media systems" (Linn & Kelliher, 2010), published and presented at the IDSA (Industrial Designers' Society of America) 2010 International Conference and available at http://www.silvanlinn.com/msd/.

Since this was the initial exploration of the area, the scale of the design was deliberately limited to focus only on a small group of people — up to 10 or 12 co-located workers or friends. The concept for the system grew out of an observation of the enormous density of content on microblogging services. In the workplace, these services – which allow users to exchange small pieces of content with "the group" as a whole, rather than with a specific person – purport to increase collaboration through their one-to-many nature and their condensed and efficient structure (Zhao & Rosson, 2009). The most prominent microblogging service today is Twitter — perhaps the quintessential definition of a Fast social media system. Messages on Twitter are limited to 140 characters, prompting immense condensation of ideas to only the most important facts, and yet the volume of information is enormous, reaching over 600 submissions per second (more than 50 million per day) in early 2010 and steadily growing (Twitter, 2010). When people wish to emphasize the speed and density of modern social media, Twitter is one of the first systems to come to mind.

Figure 11: An example Twitter feed, displaying disjointed chains of information

When a user signs up for a Twitter account, they can choose to "follow" any number of other accounts on the site. When a user makes a new post ("tweet") on the service, the tweet will immediately appear in the feed of all of that user's followers. The Twitter feed therefore takes on the form of an infinitely-scrolling continuous list of every tweet by every account a user follows, arranged in chronological order (Figure 11).

Twitter is used for a variety of purposes; some of the most common activities include keeping in touch with colleagues, raising the visibility of group issues, seeking information from others, and releasing emotional stress (Zhao & Rosson, 2009). Prior to the development of KiteViz, the Reflective Living (RL) group – a research group of 12 members in the interdisciplinary School of Arts, Media and Engineering at ASU, and the author's host group – had begun using Twitter for communication. While microblog posts are generally self-contained statements that make sense on their own as short "information bites", Reflective Living's use of the system was somewhat unusual as the group members had begun using it primarily like an instant-message system, posting sentence fragments that only

made sense in the context of an earlier post. As each Twitter user sees all of their followed accounts' posts regardless of the intended target, RL Twitter feeds quickly became a disjointed mess representing dozens of different conversations. This was confirmed by RL members' friends who were outside the group; as they only followed one member of the conversations, they had even less context for a given post, and were informally reported to have commented to RL users that "none of your tweets make sense any more".

The nature of the communication taking place within RL posed interesting questions. Since the system was primarily used for communication, we hypothesized that there might be stronger and weaker conversational relationships forming between users. Since users often sought assistance or suggestions from each other, we wondered if users might use the system to seek out others when they were unreachable. Some users appeared to be more active in the daytime, others in the middle of the night. Some appeared to use the system exclusively for conversation, while others balanced their discussions with postings of interesting links or quotations. However, the organization of the Twitter web interface is effective at displaying only one highly specific set of information about Twitter activity: who said what, and in what order. The creation of a deeper level of interaction resulted in an incomprehensible mess, but with the suggestion of a greater social structure.

This situation was an ideal opportunity for evaluating deeper, Slower interactions with one of the Fastest technologies in existence. Questions regarding information available in the Twitter stream that simply was not exposed by the default web interface included: How do people in my local group use Twitter? Do they mostly post anecdotes about themselves, random observations, factoids, and the like, or do they use it more as a conversational tool, interacting with other users? At what times are my colleagues most active on Twitter? Is there a specific time when most of the group is accessible? What sub-groups form within a larger user group? Which users talk to each other on a regular basis?

KiteViz was developed to address these questions. Based on a review of literature, a situated, metaphorical interaction system was conceptualized. KiteViz is designed for group use in a public forum, to encourage in-person interaction and discussion. It is intended to be visually attractive, and to operate on a preset timescale to encourage longer interaction and promote reflection. It deliberately eliminates the *content* of any Twitter activity, focusing only on the more nuanced structures that were overwhelmed in the traditional interface. Data is rendered in a visually metaphorical structure to allow users to rely on instinctual experience and draw natural conclusions. Various potential metaphors were considered: vines growing on a wall, each vine representing a user and each leaf a post; or perhaps sheets of paper blowing in the wind, a dust devil for each user and each sheet within the cloud a tweet. The metaphor that was eventually chosen, though, was that of people flying kites on a grassy hilltop. Kites have historical associations with communication, being used in various cultures to transmit messages over a distance, and the human characters would more clearly indicate that the display was showing the work of individual people. Ideally, the whimsicality of the metaphor would lead to increased interaction and enjoyment in the use of the system.

Figure 12 is a radar chart of KiteViz along five major axes/scales that influenced the development of the system. These are *abstraction of data; number of participants; scale of setting; identifiability;* and *interactivity*. Abstraction of data refers to the literalness of the information transmitted to the user. KiteViz, displaying all its data metaphorically with no literal content (i.e. "your relationship score is 0.82") scores high on this axis. KiteViz rates low on both the number of participants and the scale of the setting, designed for interaction with only about 10-30 people within a single co-located group. It also rates low on interactivity, with only one true interaction possible with the display; most of the interface is a visual display to be observed rather than controlled. Finally, KiteViz gains a high score in identifiability, with each system user represented as a specific, unique character on the bottom of the screen.

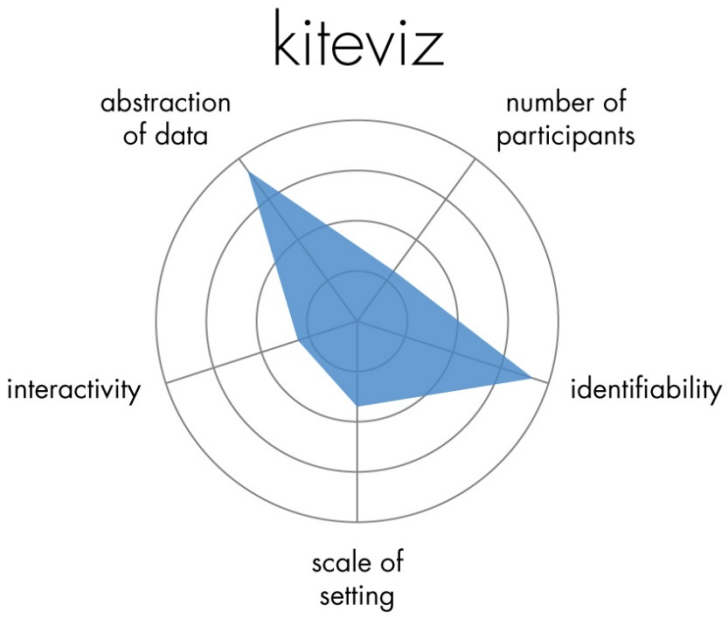


Figure 12: KiteViz graphed on a "radar chart", indicating the system's relative positioning along five key axes.

4.2 — Implementation

KiteViz is implemented as two programs operating together in a client/server architecture (Figure 13). A server application accesses Twitter, reads the feed belonging to each user in its database, extracts relevant Tweets, and calculates basic metrics like the total number of posts per user and the percent of those that are replies. A client accesses the server and displays the relevant information on a situated screen. The client and server communicate over an Internet connection, and so may be located on two different computers in different locations. Copies of the source code for both the server and client applications are available for download at http://www.silvanlinn.com/msd/.

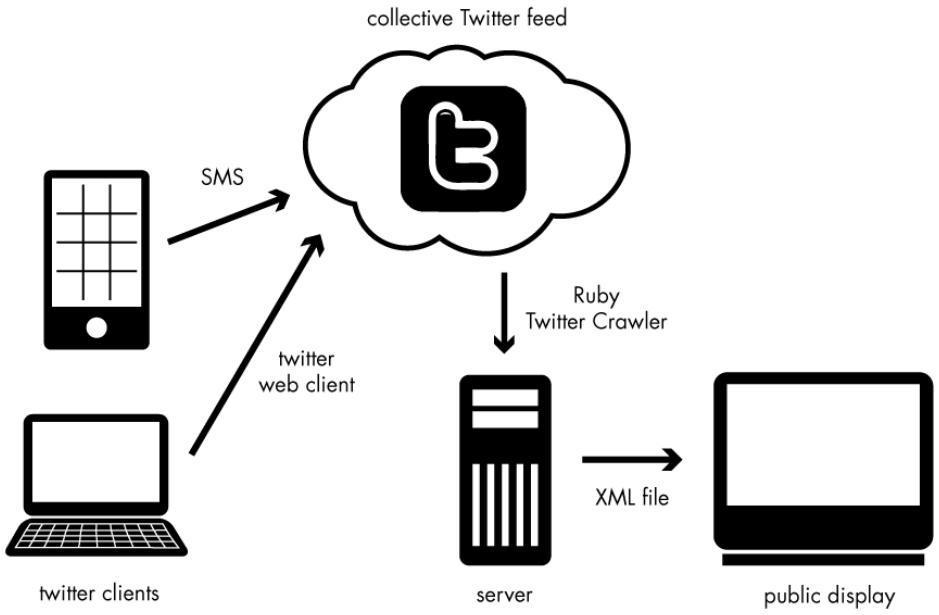


Figure 13: KiteViz' system architecture

Server

The KiteViz server system is built in Ruby On Rails. It is designed to access a single Twitter account and collect activity data for the accounts followed by that user. Thus, in our sample implementation, an account titled "rl_ame" was created, which followed the Twitter accounts of each member of the Reflective Living group. The KiteViz server is registered with Twitter as an external application (required for access to their server structure), and set to gather a fixed number of Tweets (typically the last 500-1000, representing several months' activity for our group) from each user. These Tweets are stored in a database containing their content, the time they were made, the creating user, and the identification number of the user to which they were directed with an @username comment (if applicable).

Based on the gathered Tweets, the server performs a calculation of the relationship between each user-pair, resulting in a numerical score. This score is based on the number of mutual replies users have made between each other, suggesting their level of

conversationality. The score is calculated as (the number of tweets directed from user A to user B) plus (the number of tweets from user B to user A) divided by the total number of tweets for both users. Resulting values range from 1.0, a relationship where every post between those two users was reciprocated, to 0.0, where two users never communicated with each other. Each user has a score for their connection to each other user, though the relationship score from A to B may not be the same as the score from B to A. This particular score is stored in the user-database along with relevant information like the user's full name and user-ID.

Twitter sets rate limits on how frequently it can be queried for data. A UNIX *cron* job (automated timer script) running on the server is used to trigger "crawling" of the Twitter servers for new Tweets every ten minutes; this value can easily be adjusted to accommodate for the levels of Twitter use within an organization. Within Reflective Living, it is extremely rare for there to be more than five tweets per hour across the entire group, and therefore the ten-minute value was selected as a good baseline.

Client

The client application is written in Adobe AIR. The client is cross-platform and will run on any system with a reasonable processor speed and screen size; in testing, it ran adequately on any system newer than about eight years of age (new in 2002-2003). The design scales natively to a screen of any size, but not universally. On a larger screen, the character avatars will be smaller (relative to the background terrain) than on a low-resolution screen, resulting in sharper images and increased space to display kites and flags.

On initial startup, the client queries the server application for data. The server returns two XML files. First, it returns one containing a list of all the members of the research group, along with their names, user names, and a unique ID number. Second, it returns a file containing all the tweets generated by group members for the past week of

activity, each entry also containing user ID numbers, timestamps, and a "reply-to ID" (representing to which user the Tweet was directed) if applicable. In the setup phase, the KiteViz client first generates the background images, then iterates through the list of group members, and for each one generates a uniquely-colored character avatar. The colors, which are used for easy recognition of a given user and their Tweets, are selected from a local database generated beforehand in consultation with the group members.

Visual Design & Operation

KiteViz displays Twitter activity as a visual metaphor. The client system renders a terrain made of rolling hills and distant mountains, with clouds drifting above. A rendered sun and moon travel through the sky, rising on the right and setting on the left. The aforementioned character avatars are displayed on the hills; different models exist for male and female users. Each user is given a custom (pre-designed) head graphic, and the color of their shirt or jumpsuit is set to a pre-selected value for easy differentiation. Characters are given a small amount of depth cueing – those higher in the y-axis are scaled to be smaller, to provide the illusion of distance.

Each user avatar flies a kite on a string. The kites are assigned the same color as the avatar's shirt, and placed high in the air with some random variation in altitude. Kites drift randomly in the air, but constrain their oscillations around a centroid which uses basic physics equations to remain somewhat separate from the other kites, ensuring that flags are always mostly visible.

Once the system is started, an internal timer begins running. This timer begins, by default, one week prior to the moment the client system was started. The timer updates both the position of the sun and the moon on the sky, and the value of a text field displaying the currently selected date; this forms a "timeline", where days are compressed into a span of seconds and represented in an abstracted but realistically mapped manner. When the

timeline's "playhead" reaches a point at which a user posted a Tweet, an event is dispatched to represent this on-screen. A "flag" graphic and associated line representing a string are added to the bottom of the user's kite, where the tail attaches, and an expanding translucent ring effect (similar to a ripple in a pool of water) is generated at the flag's location to draw attention to the new tweet (Figure 14).

Figure 14: Flags appearing on kite tails, accompanied by ripple effects

Flags are one of two types: single- or double-sided. A single-sided flag is composed simply of a triangle pointing to the right, while a double-sided flag is composed of two triangles arranged to point at each other, in the manner of a bow-tie (Figure 15). Single-sided flags represent a tweet made to no one in particular – a reflection on the world or an interesting factoid, for instance. Double-sided flags represent a reply to another user, using the *@username* syntax. The right-facing triangle always carries the creating user's color, while the left-facing half (if applicable) carries the color of the user to which the tweet was a reply. As a secondary feature to increase the visibility of "reply" posts, these posts also generate a temporary line connecting the two relevant users' avatars together.

Figure 15: Single- and double-sided flags. The double-sided flag on each kite tail represents a pair of posts between the orange and green users, one from orange to green (on the orange flag) and another from green to orange (on the green flag).

As time passes in the display, flags appear on kite tails and lines between users appear and fade out. By the end of the played-back week, the kite tails display a complete record of all tweeting activity in the group and connections between users. Viewers can make observations such as how the user primarily uses Twitter (eg., a user who mostly uses Twitter as a microblog would have primarily single-sided flags; a user who is more conversational would have more double-sided flags on her kite tail). Users can also see from the reply flags exactly who replies to who the most frequently.

By remaining and observing the display over a longer period of time, users can develop a deeper understanding of the information contained in the system and make inferences about the activity patterns within the group. A large cluster of activity in a short time (i.e., many new flags appearing and their associated ripples spreading out) indicates that users were more active at that particular time; if there are lines connecting the avatars in the same time frame, then the users were likely engaged in a conversation. This activity on the display might hint at connections between users or specific times when the group is more active.

A further feature is available by using the attached mouse to click on a specific user. Selecting a user in this manner will shuffle the display, rearranging avatars in a pattern around the selected user (Figure 16). In this new display, the proximity of one user to another represents the strength of those two users' relationship score. The connection is also displayed as a line of varying thickness connecting the two avatars together. With this strategy, the user group can be subdivided into smaller sub-groups, with the "inner circle" representing the strongest connections, relationship score decreasing steadily towards the outside of the group until reaching the outermost users, who have no apparent Twitter connection with the selected person.

Figure 16: The display shuffled to show connections around the light-green user; the strongest connections are with the red and purple users, while there is no connection between the green user and the pink, orange or dark blue users.

4.3 — User Studies

Evaluation of KiteViz took place over a number of weeks and was composed of two primary tests. First, the visual design and metaphorical approach of the application was

evaluated in a heuristic study by expert graphic designers. Second, a user study comprising a survey, testing of the system, and a series of interviews was conducted, with members of the author's research group forming the target population. The system was physically installed on a public display in a high-traffic area of the Reflective Living lab (Figure 17), where it would be seen on a regular basis by both the regular inhabitants of the space and by users passing through.

Heuristic Evaluation

It can be difficult to accurately evaluate something as subjective as the visual design of an interface. In order to evaluate the effectiveness of the visual metaphor and theoverall quality of the display, a heuristic evaluation strategy was selected based on work by Mankoff et al., who demonstrated the utility of the technique in identifying problems and potentials with an artistic or abstract graphical display. In a heuristic evaluation, experts in the field in question are asked to make their own professional evaluations of the system, using a preselected list of factors, or "heuristics" (Mankoff et al., 2003). In the KiteViz study, participants with multi-year graphic or interface design experience were recruited from the Design School and the author's own contacts to perform these heuristic evaluations of the KiteViz application's interface. Specific categories of evaluation were selected based on Mankoff et al's suggestions; they propose twelve, but only eleven were selected due to one ("interface accelerators") being non-applicable to the display. Further details and the heuristics in question may be found in Appendix B. The selected experts, familiar in the design and evaluation of similar applications, were given these specific categories in which to rank the system under investigation.

Figure 17: The "kiosk" machine on which KiteViz was first installed, in a high-traffic corridor in the Reflective Living research lab

Four participants (two male, two female) with ages ranging from 25-52, and with graphic or interface design experience ranging from 6 to 30 years were recruited. As logistical difficulties prevented all participants from viewing the display in its installed location, a web-only version of the visualization was created and installed on a publicly-accessible (though not publicized) web server. Participants were directed to this website, where they were presented with the visualization, some basic instructions for use, and a description of the overall project concept. Participants were asked to explore and interact with the display long enough to "get a feel for it", then provide their opinions in an associated online survey form.

Group Study

The KiteViz application was simultaneously used over a period of two weeks by the Reflective Living group. Participants were administered a pre-test survey to identify and describe the nature of their informal communications using Twitter, and their use of existing

alternative Twitter interfaces. For this study, the KiteViz application was displayed on a large screen in the Reflective Living common space. In this position it was viewable by all members of the research group, as well as by passersby in the area. Interaction was afforded by a mouse centrally placed on a podium in front of the display.

Original plans had included a set of full individual user interviews to discuss and evaluate usage of the system following a multi-month longitudinal study. Due to the timeframe of the research, KiteViz was implemented shortly before the Christmas break of 2009-10; for unknown reasons, use of Twitter in Reflective Living fell off dramatically over the break and never fully recovered the strength it had enjoyed as the system was being developed. With far less usage than expected, the value of extended interviews was questionable. Therefore, instead of in-depth interviews, informal interviews and group discussions focused on gathering qualitative impressions of the system and its use were conducted with small groups of RL members.

4.4 — Results

Heuristic Evaluation

The heuristic evaluations generated valuable and useful information about the system. Of the 16 questions on the form, five concerned demographic information, with the remaining eleven concerning one heuristic each. Heuristics such as "useful and relevant information", "consistent and intuitive mapping" and "match between system and real world" ranked highly, suggesting that the system is generally successful at supporting Twitter use and meets an acceptable standard of usability. The three heuristics that had the largest number of identified shortcomings were "user control and freedom", "sufficient information design" and "easy transition to more in-depth information". In general, users felt that they simply wanted to know more about the users and their interactions. One of the primary requests was for further explanation of how the relationship score was calculated. One

participant suggested that specific numerical values could be displayed with the connections to make the distinctions clearer, while another wanted a form of directionality, to determine "who started all the communication".

Another issue identified by multiple expert users was their assumption that the relationships in the display evolved over time. In the current implementation, a single reply tweet does not make enough difference to a relationship score to be immediately visible. However, users indicated that they were interested in seeing how relationships changed over the week, and in using the system to view aggregated information over shorter time periods.

Group Study

Eight of the eleven active research group members participated in the pre-test survey. Respondents' ages ranged from 21 to 34, with gender evenly represented (4 males and 4 females). Users generally considered themselves “not very active” or “reasonably active" on Twitter, with only one person indicating that he felt like an “active” user of Twitter. The difficulty of various group-oriented tasks (e.g. "Determining what kind of personal groups people form in the office”) were ranked on a Likert-type scale of 1 to 7, with the most difficult task considered to be finding out when someone was active online. However, within the responses there was a high level of deviation, with some users ranking a particular task the most difficult, while others considered it the easiest.

In the written response section regarding perceptions of individual and inter-group Twitter activities, study participants generally agreed that microblogging tools did a good job of conveying information about their own Twitter activities, though one user suggested that most tools focused too much on the “here and now” and did not provide a valuable historical perspective. The questions of whether existing interfaces could convey a sense of group dynamics and communication patterns were more conflicted. Subjects indicated that group dynamics could be inferred from viewing other content – “by observing @replies, I

get a sense of who's communicating with who more frequently" – but that with no historical view or direct representation of that information, it was hard to understand. A comment made by a number of users was a concern that relationships on Twitter would not be relevant to "real-life" relationships and communication patterns.

Informal interviews and discussions with users suggested that the system was indeed effective at making social structures apparent. Users generally understood the day-night representation of the passage of time; standing and watching the system run, users would make comments like "x had a lot to say at four in the morning" on seeing a chain of events appearing on one user's kite tail. Users immediately understood that a line between two users indicated a conversation between them, but the meaning of double-sided kite flags, in contrast, was not always grasped as quickly.

An extremely common question, asked nearly every time a new user (even those outside the research group) was shown the system was "what does the height of the kite represent?" The height of the flags was initially set randomly within a specific range simply for graphical interest; if a user made so many tweets that their kite tail extended off the screen, their kite would lift up to ensure that all flags remained on the screen, but this was the extent of the variation. Users, however, clearly attributed value to this dimension.

The ability to view relationships between users was a source of entertainment. Most users spent some time clicking themselves and others, viewing the relative proximity and making joking comments about how they perceived the information — for instance "x and y really love talking to each other" or "ha ha, z talks to everyone except her advisor!" Users generally spent more time clicking on users than simply observing the system. Clicking on the users frequently led to experimental clicking on kite flags; users stated that they were interested in viewing the content of the tweet, despite this information not being available.

Users brought up an interesting point regarding the relationship score: whether it was updated in real time. The relationship score was calculated based on many months of

Tweeting data, and so an individual tweet would be unlikely to alter the value of the score by much. At least one user repeatedly selected the same user pair over and over, letting the simulation play in between, explaining that she was watching to see if the relationships changed.

Users universally enjoyed the appearance of the system, indicating that it was attractive and unique compared to other Twitter displays they had used. They commented on the androgynous appearance of the characters due to their jumpsuit-like clothing, but this was not seen as a specifically positive or negative feature.

However, users did identify specific graphical annoyances. Perhaps the second most common question after inquiring about the height of the flags was "why don't the shadows move?" In the initial implementation, character shadows were static sprites extending off to the left side, and did not move as the sun changed position. In development, this inaccuracy was understood but was considered to be an acceptable stylistic choice. However, users were perturbed to the point of suggesting that if the shadows could not move, they should be removed entirely.

4.5 — Discussion

Overall, KiteViz was a mixed success. Its merits can be evaluated according to how well it supports the three tenets of Slow design.

1. Increasing the depth and richness of interaction: KiteViz did make apparent deeper levels of information that were not as easily visible in the basic Twitter interface — most notably, the "relationship" score between two users. Users enjoyed exploring this particular aspect of the display and uncovered details of relationships and use patterns they had not been aware of before and were unable to access through traditional methods. In this specific sense, the display was successful at producing a richer interaction.

On the other hand, results in both the heuristic study and the informal group interviews indicated that users desired *more* depth of interaction. Users wanted to view the actual content of tweets, especially to see what provoked an interaction that they had just observed on the display. One user in the heuristic evaluation wanted to see a mathematical measure of the relationship score between two users when clicked on. While this value was intentionally hidden to try and maintain a focus on the social structure of the group, perhaps this was a mistake. The depth and richness of the interaction could arguably be improved without compromising the display by adding the tweet content in a hidden format, such as in a pop-up that appears when clicking on a flag. In a sense, this would serve the same purpose as the non-changeable timeline, encouraging exploration of the system. However, a more effective solution would be to map information to other aspects of the display without necessarily showing it in a literal manner; as discussed in (3) below, users seem to naturally gravitate towards searching for meaning in the metaphor, a potential source of great richness.

2. Engaging the local community: The effectiveness of KiteViz in this respect is difficult to evaluate. The system did a good job of promoting group cohesiveness and discussion through the relationships system; users joked and poked fun at each other about the rivalries or deficiencies in communication that were suggested by the connections. Since it was understood (mentioned by users in the study and heuristic evaluation) that a relationship score on Twitter was not necessarily connected to the users' real-world relationship, this discussion was entirely good-natured. In this sense, the system did engage its users with each other. As noted in the results,some users expected the relationships to evolve if clicked at different times, despite this being imperceptible thanks to the scale of the relationship calculation. Potentially, a good method of creating engagement would be to reduce the relationship score to a shorter timescale so that users could see it evolve over the week.

As noted, one of the original intentions of using a large situated display (as opposed to an individual desktop client) was to encourage water-cooler-style interactions around the display itself as users gathered to observe Twitter activity. This interaction was observed a few times, but after the initial user study, interest dropped. It is impossible to separate this lack of interest from the falloff in general Twitter usage around the same time. Elements which changed from moment to moment, such as that resulting from the aforementioned modification to the relationship score, might help prolong interest and prevent the display from becoming "stale"; this could be evaluated in a future version.

3. Encouraging personal and social reflection: In this case, KiteViz appeared to be a success, more so than expected. While much of the commentary about the relationship calculations was facetious, some users did state that they were surprised at aspects of their relationship scores. Sometimes users had only a small Twitter relationship with someone they considered to be a close colleague, while at other times they found a strong Twitter relationship where they had expected none. This dichotomy could not exist if the user had not reflected upon and considered his or her relationships with others in some sense; perhaps it could result in behavior alterations to correct perceived "deficiencies".

The metaphorical nature of the display was intended to promote an open mind in examining social structure, and it was effective enough that users began assigning meanings to elements which actually carried none, such as the height of the kites; one user used her natural experience and hypothesized that more flags on the tail would lead to a lower kite position, and thus that height represented a quick glance at the total number of tweets. These types of reactions suggest that the display encouraged users to search for additional meaning and information about their Tweeting activity within the display, a form of self-reflection. They became engaged enough in the display that issues such as the shadow not moving with the sun stood out. The conclusion that can be drawn from this is that the metaphorical display was indeed an effective way of causing users to search for patterns and

meaning — and that in future versions, each design element must be considered extremely carefully and in sufficient detail, to ensure that when users begin searching for meaning they can find it.

From these results, the author concludes that KiteViz was a qualified success. The relationship score feature was the most effective aspect of the system, serving all three Slow principles: displaying rich information in a clear way, encouraging interpersonal communication, and promoting reflection on self and others. The metaphorical display turned out to be a powerful way of placing deep meaning in a visually appealing manner, without making the underlying drivers immediately obvious; it was so effective that users began to insert meaning where none was intended, demonstrating that the system could support further richness without any increase in visual clutter whatsoever. However, this power also requires that each element of the display be fully considered for its metaphorical implications and overall consistency with the holistic image, as users are likely to examine the display in great depth. The long-term appeal of such a situated system, i.e. its ability to continue to create reflection and personal engagement once users have explored all aspects of the display, is unclear and should be further evaluated in a future version, but it is hypothesized that alterations to the system to make the display change more obviously over time, allowing users to reflect upon changes and make temporal comparisons, could work effectively towards this end.

4.6 — Updates and Future Developments

KiteViz was updated after the initial user study to add some of the features that had been requested earlier. The new version was not planned to be immediately tested in any explicit user studies, and so therefore no major structural changes were made, but the alterations are mentioned as they address some of the issues found with the first version. They can be seen as a "refinement" of version 1 without changing the fundamental nature of

the display. Current public and group demonstrations of KiteViz use this updated version rather than the original.

1. The initial static shadows were removed due to their disconcerting nature. In the updated version, these shadows were replaced with simple blurred ellipses underneath the characters. This strategy is commonly used as a time- and processor-saving shorthand in real-time 3D rendering. While this is less "accurate," informal conversations with the previous users viewing the updated system indicated that it was a better solution.

2. The androgynous jumpsuited character design was replaced with separate male and female character models. Twitter does not, as of the time of writing, either request or make explicit a user's gender; therefore, this differentiation cannot be automatically assigned. In the updated version, separate male and female character models are assigned using a pre-generated database associating known username and gender. Through similar informal conversations, previous users indicated that they enjoyed the more accurate aesthetic, but still felt that there was nothing explicitly "wrong" with the previous design. As this hand-built system cannot accommodate new users without manual modification, the original jumpsuited character design remains in the code as a fall-back measure.

3. The background design and sky colors were updated between versions. No specific user feedback prompted these changes; it was simply decided that the aesthetic could be improved upon. The rolling terrain was updated to be more complex and include layers of mountains in the background, and sky colors were made more natural. Glow filters on the stars and moon were removed to make the hard-edged "illustrated" cartoon aesthetic more consistent across all elements.

Figure 18: Updated version of KiteViz, showing improved graphics

The main limitation with the system was in the timescale of interaction; after a relatively limited amount of experimentation, users began to lose interest. Implementing a more detailed but still coherent and consistent metaphor, and mapping further information to the new metaphorical characteristics of the display, would encourage deeper interaction. The system should also be modified to make temporal changes in the system content more immediately apparent, so that users can view the structure of the display evolving over time in synchrony with their life.

On an infrastructure level, KiteViz is rather open and could theoretically display content from any system involving a number of interconnected users in a group. With the proper back-end, it could serve as an interface to Facebook, to an email account, to a discussion forum, or any other similar system.

It was determined in the Taskville user study that a major driver of interaction around a situated display is content that explicitly deals with comparisons and interpersonal relationships. As KiteViz is structured better for single-user interaction, it does not

necessarily have to be installed on a public display. Converting the system to a flexible desktop, smartphone or tablet social-network visualization application could prove successful.

Chapter 5

TASKVILLE

Figure 19: Taskville with a few days' worth of submissions being displayed in city form

5.1 — Theory & Background

Taskville (Figure 19)is a distributed social media workplace game designed to function on a broader scale than KiteViz. It evaluates how Slow design principles may be applied to the interactions between multiple, separate but similiar user groups within an organization. The development, implementation and testing of this system was a joint project with Computer Science PhD student Shawn Nikkila, whose research focuses on effective "gamification" of the workplace, and Taskville was designed to implement and evaluate these concepts in addition to Slow interactions. In the development process, Shawn was responsible for system programming and the author was responsible for art direction and the generation of a cohesive visual structure; all other tasks, such as the development of gameplay theory and system structure and the implementation, were shared between the two

partners. Extensive documentation of the system is available in *Playing in Taskville: Designing a Social Game for the Workplace*, a CHI 2011 paper which focuses entirely on Taskville and the full details of its implementation (Nikkila, Linn, Sundaram, & Kelliher, 2011). However, in the interest of retaining focus, this section will primarily discuss the aspects of Taskville's design and testing which support Slow interactions.

Advances in communications technology, the adoption of flexible working schedules, and a growing emphasis on multidisciplinary teamwork have combined to produce radical structural and procedural changes in contemporary enterprises. As noted in section 2.5, collaboration among group members within these diverse, distributed teams is critical to effectively solve complex problems and extract maximum satisfaction from a job.While on a global scale the changes in enterprise structure may result in cost-saving and a general increase in a company's efficiency, at the level of the individual worker there can be measurable negative consequences; workers may feel "lost" in an organization whose structure is beyond easy comprehension, or sense a lack of meaning in tasks that form part of a larger project but which themselves have no clearly identifiable outcome. This may lead to workers experiencing feelings of disconnection, apathy and decreased cooperativeness (Jackson, 1996).

The issues experienced by workers in these distributed enterprises may be analyzed and interpreted by mapping them to the tenets of Slow interaction. The author hypothesizes that disconnection from and apathy towards work may result from an unreasonably high number of trivial or repetitive tasks that afford no real "depth" of engagement (tenet #1), or from inadequate opportunities to properly observe and reflect upon one's contributions to increasingly large-scale projects (tenet #3); decreased effectiveness of cooperation may be a result of electronic interactions taking the place of in-person socialization and communication (tenet #2).

These tenets were formed into research questions. How can a system support individual reflection on one's own specific contribution to the workplace, and the relation of this contribution to that of others? How can tedious, repetitive tasks be raised to a level where they become richer, more interesting events? How can a workplace system encourage its users to engage in collaborative discussion and reflection, particularly in a specific place that becomes a forum for personal interaction?

Specifically from Shawn's research, questions included – can a game system increase engagement with and enjoyment of what is effectively a task-management tool? And how can fun and recreation be incorporated into the workplace without reducing productivity or disrupting work patterns?

These research questions shaped the conceptual framework of Taskville. The system applies elements of video game design, most notably an emphasis on friendly competition with others and a video game-based aesthetic, in its overall structure. These interactions take place both on the individual level and the inter-group level, accurately representing the structure of a medium to large organization. Video games often use stylized representations of reality to convey meaning to the player; relying on this concept, and the success of the metaphorical structure of KiteViz, Taskville also represents its content in a metaphorical fashion. In order to generate in-person discussion, the primary interface is a situated display, but Taskville also provides a simple and ubiquitous method of input so that the system does not require a break in workflow to operate. The use of a simple rule set decreases cognitive load and simplifies interaction, with depth and richness generated by the interactions and competition between participants in the game.

These conceptual requirements were taken into account in the details of implementation. Taskville displays the accomplishments of groups within an organization using the metaphor of a growing city, one city for each group. Workers submit their tasks to the game using a simple text interface – Twitter was seen as a good system as it could accept

data from both computer-based and mobile sources – but can only view output on a co-located public display. Submitted tasks generate different types of building based on the user's time involvement and collaboration with others. Players are encouraged to compete both with each other in their group's city, and as a team against cities belonging to other groups.

Figure 20 graphs Taskville along the same five axes used in the development of KiteViz. Taskville is a more "balanced" system, operating on a medium scale in most aspects. The data is less abstracted than in KiteViz, with each display interaction creating a specific unique type of building, and information like "total number of tasks completed" clearly visible. The number of participants and setting scale are both increased relative to KiteViz, but do not reach beyond the level of one medium-sized organization — the system ideally supports perhaps one hundred users or so. It scores lower on identifiability, as users are separated within the system but the details of their tasks are not shown, and it takes some experience with the system to understand which flag color corresponds to which user. Finally, Taskville scores highly on interactivity, supporting many different types of interaction on both the input and output sides.

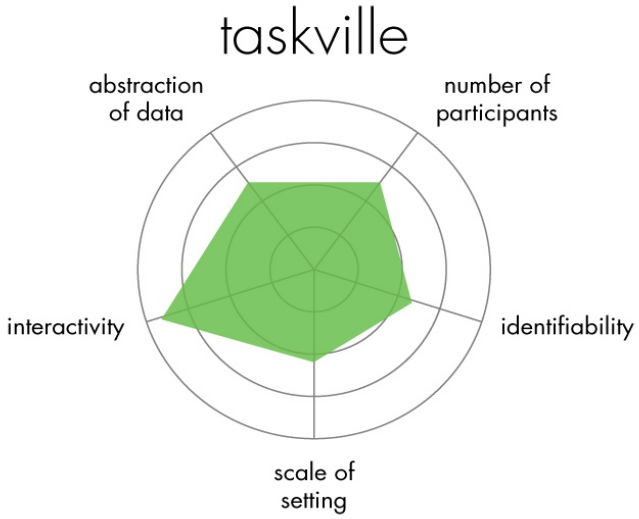


Figure 20: Taskville's positioning along the same five key axes discussed earlier

Taskville, like KiteViz, is implemented as a client-server architecture, for the same reason – flexibility in the structure of the system (Figure 21). We were able to use one centralized server to collect data from all users, with multiple clients located in each target group's department displaying the relevant information. As with KiteViz, copies of the source code for the server and client are available for download at http://www.silvanlinn.com/msd/.

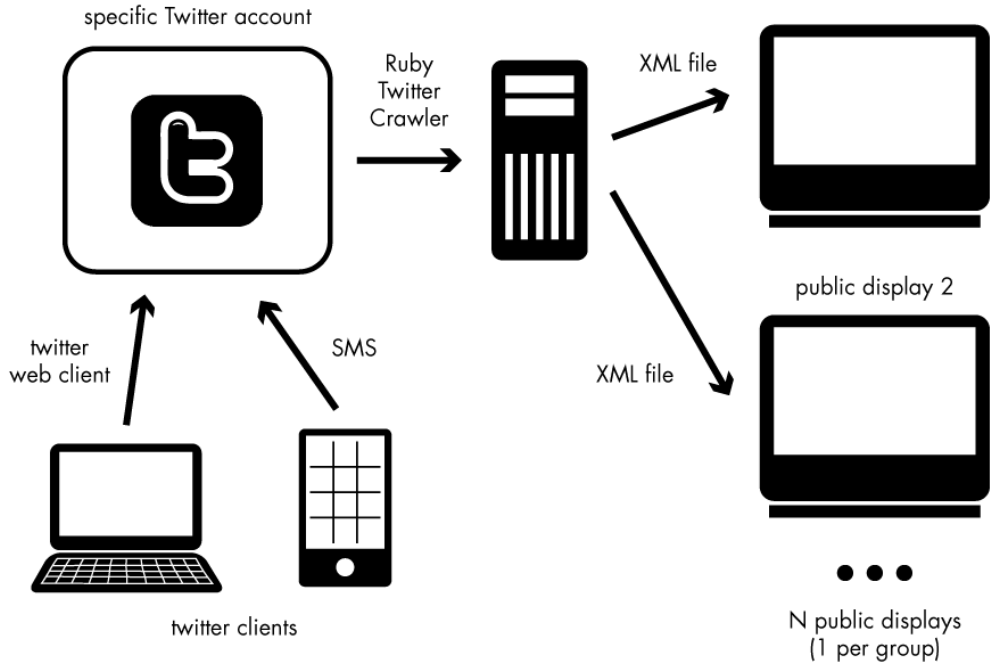


Figure 21: Taskville system architecture

Server

Taskville's server is a modification of that used in KiteViz: a Ruby On Rails system which "crawls" Twitter to access data stored on their servers. The server stores all

information about the Taskville game world. An administrator first creates the appropriate groups if they do not already exist. The participating users are then created and added to the groups. A new game "region" is specified by the administrator, including the size of the region in "tiles" (a chessboard-like grid). The administrator then sets the starting point of each city in the region, and associates this point with the proper group. At this point, setup is complete and users belonging to the cities in this region can start interacting with Taskville. Users submit tasks via Twitter by sending a direct message to a specific user account. The server parses the task (details discussed below) and generates one of several representative buildings for the user, storing its location and type in its internal database.

Much like KiteViz, the Taskville server re-crawls Twitter for data on a regular basis. Because the increased number of users results in an increased quantity of information, Taskville crawls every 60 seconds, close to the limit where Twitter will automatically reject any further queries.

Client

The client application, also like KiteViz, is written in Adobe AIR. It is cross-platform compatible and resolution-independent, and communicates with the server by requesting XML files. However, where KiteViz is entirely new code, Taskville leverages the *Flashpunk* open-source video game engine to simplify the display of the world and drawing of game entities. The client converts the database information from the server into a visual representation of the city, querying the server for new data on a regular basis and growing the city by adding buildings as appropriate. The client application also supports basic interaction with the system using a mouse or other pointing device, discussed in the following section.

Visual Design & Operation

Taskville's interaction is split into two parts: the input system and the output system. The input system is text-based and takes place through Twitter. When a user completes any work-related task (the definition of "task" is deliberately left open for reasons discussed later), they can submit it for inclusion to the system by sending a specially-formatted direct message to a central Twitter account. The syntax of the message is as follows:

t [number of hours spent on task] @[any users collaborated with] [description of task]

The initial "t" indicates to the system that the following statement represents a new task submission. The next value is the number of hours the user spent on the task, as a whole integer; values less than one are rounded to one hour. The user may then enter the name of any users they collaborated with in the completion of the task, prefixed with @ to indicate a username. Finally, the user may enter any description of the task they choose. An example submission, therefore, might be

t 3 @cooldude programming the arduinos

This indicates to the system that the user spent 3 hours "programming the arduinos" with the user "cooldude." All of the parameters except the *t* are optional; submitting just a *t* will create a new 1-hour single-person task with no description, submitting *t 5* will create a 5-hour single-person task with no description, and so on. Upon submission of a task, all users of the system will receive a message in their twitter feed stating "[username] just built a [type of building] in [user's city]!", but no other feedback is given. The syntax is intended to be straightforward, easy to remember, and tolerant of errors, giving the user a simple way to interact with the system

A question that immediately arises is "what exactly is a 'task'?" The co-developers and their respective advisors spent a great deal of time debating the proper definition and how different definitions might affect the outcome of the system. For instance, one person considered going to a meeting to be a task, while another felt that this definition was disrespectful to the other meeting participants. It was generally accepted that housework such as doing the dishes should not be considered a task for research purposes as this takes place outside the work environment, but it was more difficult to make a decision regarding tasks that might take time from work but do not result in the completion of any work-related goals, such as having a car's oil changed. Eventually it was decided to leave the exact definition up to the users, stating only that it should be "work-related"; we anticipated that the public and shared nature of the system would encourage users to self-police, ensuring fairness.

Taskville's primary output method is its situated metaphorical displays (Figure 19). These displays show a bird's-eye view of a large, flat, grassy area, divided into a number of square tiles which appear as lozenges due to the isometric projection. Initially, the entire field is made of empty grass tiles except for a number of 2x2 tile "town hall" buildings representing the center of each group's city-to-be. As users submit tasks to the system, the client draws different buildings according to the type of task and "parachutes" them down from the sky onto a tile in the user's city (Figure 22).

Figure 22: A building "parachuting" down into the city

The height of a building varies according to the length of time the user spent on the task, with short 1-hour jobs resulting in a 1-story house and 8-hour full-day jobs creating a tall skyscraper (Figure 23). The number of tiles occupied by the building is controlled by the number of users collaborated with: single-person tasks take up one tile, two-person tasks are granted a building that fills a 2x2 area, and tasks involving three or more people working together are given a large 3x3 segment of the city. The system attempts to group a given user's buildings together, forming "neighborhoods" within the greater city. For easier identification, buildings are given small colored flags according to the creating user, much as in KiteViz.

Figure 23: Some of the Taskville buildings

The visual style used in the display is known as *pixel art*. Pixel art deliberately uses low-resolution sprites and a simplified color palette (Goldberg & Flegal, 1982); as this style represented the state of the art in game graphics a number of decades ago, today it is

primarily used for its "retro" feel. A modern high-budget video game might use model textures at a resolution of more than 4 megapixels, but our pixel art building sprites do not exceed 256 pixels on their longest axis. As a result, the placement of each pixel must be carefully considered, and there is a hard limit to the resolution of details in the art. A major advantage, though, is that highly detailed art assets can be created in a shorter time than if more complex textures were used, and because of the careful placement of each pixel, no information is "wasted." This factor should theoretically encourage users to spend a longer time at the display — there is "always something new to see" in the cities.

Various other features both increase visual interest and provide valuable information. "Literal tag clouds" drift across the city, displaying keywords from each city's submitted tasks ("paper", "user study", etc) and hinting at the types of activity going on in each group. Users can use either a mouse or a "Wiimote" motion controller to browse the display; clicking on a building will indicate the building's owner(s) and the length of the submitted task (in early versions this act also displayed the precise task definition, but this feature was removed due to privacy concerns discussed below). Finally, at the top of the screen, a status bar displays the name of the city, and the top four submitting users within that group. To encourage friendly competition, the user with the greatest number of submitted tasks is assigned the title of "mayor", and the next three highest are "city council members".

5.3 — User Studies

An initial one-week pilot study of *Taskville* was conducted as an initial evaluation of the potential of the game. Based on insights gained from this preliminary study, we modified the application and launched a primary user study using an improved version of *Taskville*. Users were recruited from research groups within the School of Arts, Media and Engineering, making a point of separating the groups according to the building in which their labs and offices were located. The geographical separation of the groups meant that,

though members from both groups were acquainted with each other, they did not interact with each other on a regular, daily basis.

Pilot Study

A total of 16 players across both groups took part in the pilot study, which evaluated Taskville over one week. Users were initially administered a pre-test survey to determine baseline values of concepts such as "awareness of my own activity" and "motivation to complete tasks". Each user in the study was then added to the Taskville server, and large client displays were installed in major thoroughfares in each group's host building. Users were given instructions on the operation of the system and interacted with it for a period of one week, at which point a post-test survey (identical to the pre-test) was used to look for any changes in activity after the implementation of the system. The core responses were collected through a series of Likert-type scales, where the users were asked to assign a numerical value to their awareness of their own work, the work of others in their group, and the work of others outside their group. Questions asking how many tasks the user felt they completed per week were compared to submission data in Taskville to observe any discrepancy that might indicate a lack of self-awareness of working patterns.

Following the trial run of the system, we also conducted two semi-structured group interview sessions, one with each group. In these interviews we asked the participants en masse to discuss their experiences with the system, noting especially any particularly valuable new insights or perceived shortcomings. These sessions used a pre-determined list of questions, but participants were encouraged to interject and provide their own insights at any time.

Second User Study

After making changes based on the results of the first study, a second study was conducted. This user study involved 19 participants across both groups. The protocol was

similar to the pilot study: the same pre- and post-test survey was administered, and group interview sessions after the conclusion of the study were used to gather qualitative usage impressions and subjective experiences. The second study ran for a period of eight days.

5.4 — Results

In the pilot study, statistical information from the surveys suggested that there was indeed a problem of working self-awareness in the studied group. Players claimed in the survey that, on average, they completed 7.4 ± 1.1 tasks per week. However, usage data from *Taskville* shows that players completed approximately 10.6 ± 1.7 tasks during the one week study period, indicating that they undervalued their own level of work. By comparing the before and after results to Likert-scale questions such as "I am aware of the number of tasks that I complete each day" or "I am aware of the number of tasks that my AME colleagues in other groups are working on each day", we discovered that study participants had a greater awareness of how many tasks they worked on (subjective awareness rated at 5.1 ± 0.4 after the study versus 4.3 ± 0.5 before), how many tasks fellow group members were doing (3.9 ± 0.6 versus 2.1 ± 0.4), and how many tasks colleagues outside of their group were doing (3.5 ± 0.3 versus 1.9 ± 0.5).

Overall feedback from the semi-structured group interview sessions following the pilot study was positive, with some reservations. A major concern raised was that *Taskville* might be used by superiors as an evaluation tool, as anyone at the display could navigate to a building and view the associated task description, owner, and time of submission. Therefore, we replaced this ability with the aforementioned "literal tag clouds" generated from an aggregate of all the group's tasks. Multi-tile buildings (Figure 24) were implemented at this point as part of an exploration into collaboration, and a special "reward" building was created for the player with the highest number of tasks submitted each day. It was hoped that this would encourage users to engage more deeply with the system.

Figure 24: Multi-tile buildings (a restaurant and a bowling alley)

In the second user study, we used the same survey method to gather quantitative data. However, the surveys this time demonstrated an extremely poor response rate. Only twelve of the nineteen users that were recruited submitted any tasks to the system, and after rejecting two surveys due to the participant entering critical information incorrectly, only three surveys were completely usable. Thus, the majority of the valuable information from the study came from the semi-structured group interview sessions.

In both sessions, participants were generally positive about their experience, feeling that the game was entertaining and engaging to play. Users enjoyed the competitive aspects of the game, one stating that "it's fun to see how I rank among my peers". The visual presentation and city-building mechanic were positive experiences for others, who stated “I love the parachuting", and "it's cool and fun to see [a new building]".For others, the ability to reflect on one's work was found valuable: "I could actually go back and look at my sent things, and take a look at the work I'd actually done, to remind myself of when I actually did that stuff."

One issue that was repeatedly raised was the definition of "task", as had been anticipated and debated in the system development. While there were occasional confusions (one user submitted a dream as a 6-hour task) and some minor intra-group arguments over whether one user's submission of "did the dishes" should count, users did not indicate that the system had felt unfair. The flexible definition served to promote discussion more than anything else.

The placement of the system in a public area was confirmed to be a motivator of competitive play. Players claimed that this was "cause you see people clustering around [the display], and kinda pointing stuff out — it's like "oh, so and so's got this [building] now", and whatnot."

We had anticipated that the most engaging competition would be the inter-group competition, as we felt that the groups would perceive each other as "outsiders". Surprisingly, there were few mentions of this aspect of the game in either interview session. Instead, members of both groups claimed to have been more interested in being the mayor of their own city, i.e., to submit more tasks than their co-workers. Players stated that "[nothing] posted at [the opposing group] ever sparked, like, a 'oh, I've gotta retaliate' thing", and that "I only cared what people in [my group] were doing -- because I could affect this environment."

Reactions to the new additions to the game were mixed. The literal tag clouds were received positively; players enjoyed seeing the most common types of tasks, something that was not apparent in earlier versions of the system, while users who had participated in the first user study appreciated the increased privacy. The new multi-tile collaborative buildings and reward structures, however, were more controversial. One player stated that he "did not know about [the multi-tile buildings] until a few days in," as he had not fully read the instructions, while another noted that he "[found] the definition of 'collaboration' about as challenging as the definition of 'task'." Users understood the multi-tile collaboration building system though they did not make much use of it, but most users agreed that they did not understand what the reward buildings were for or how to create one.

The interview sessions identified some issues with the presentation of game mechanics. A number of players did not read the emailed game instructions, and so did not fully understand features like the colored flags on buildings, why buildings were placed where they were, or how to get a multi-tile structure. However, users provided solutions and

suggestions to their specific issues. In order to see the city's growth, one user requested the ability to "scroll through time," while another suggested that we "make a legend available, so that we know what buildings mean what ... what you have to do to get ... some really special building." In general, comments about the visual design were positive, praising the art style and expressing that the interface was easy to understand, with only a few minor negative comments (such as a suggestion to increase the font size).

Levels of engagement varied from user to user. One sub-group of friends became extremely involved in a battle for the Mayor's position, saying that "coming out of class, we always end up clustering over here [at the display] and kind of talking about it" and that the competition itself "inspired death threats [and] ice-cold stares" (users clarified that this statement was a joke, not the literal truth). On the other hand, another participant submitted all his completed tasks fifteen minutes prior to the conclusion of the study, saying that "I didn't really think about it during the week". He did indicate a general dislike of social networks such as Twitter, which could have been a significant barrier to entry, but stated simply that the game "wasn't really working for me. I wasn't really motivated with it."

In a similar vein, members of both groups expressed an interest in alternate ways of interacting with the system. Twitter was generally considered "really simple", in both a positive and negative manner; some users enjoyed the lack of complication, while other users requested more complex desktop clients or web interfaces, to allow them to examine the game in more detail.

5.5 — Discussion

As noted in section 5.1, Taskville was created to investigate more than the principles of Slow design. Issues such as mathematical modeling of collaborative work patterns were studied, but are not discussed in this section. Rather, the discussion focuses again on how effectively the system supported the three tenets of Slow design.

1. Increasing the depth and richness of interaction: in Taskville's case, this was considered to be measured primarily by how effective the system was at increasing the motivation and enjoyment of completing repetitive everyday tasks. Survey results in the pilot study showed no measurable change in self-rated enjoyment of work tasks or motivation to complete them; the unusable survey data in the second study prevented us from making quantitative evaluations of how effective the updates such as the reward buildings were. However, the qualitative and subjective responses from the group interviews do suggest increased engagement with the tasks — the fact that some study participants actively engaged in competition with their group members to attempt to become the mayor implies that Taskville was responsible for a new reason to complete small jobs. Participants may have initially had no real desire to carry out these tasks beyond "because I have to," but Taskville appears to have engaged the users' competitive urges and placed a richer meaning behind task-completion.

Further interpretation of the study results suggests that Taskville can inherently add value to the meta-interaction of working in a co-located group. The competitive game structure and the opportunity for increased reflection upon the group give additional layers of meaning to the work process as a whole. Of course, this is heavily dependent on the person in question. As noted, over one third of the users who signed up for the study did not participate, and at least one stated outright that the game did not interest him. Evidently some people do not extract much value from competition; it would be interesting to examine the variability of this aspect in greater depth. Overall, Taskville appears to be successful at increasing the richness of workplace interactions, with the caveat that the competitive structure is not a universally popular feature.

2. Engaging the local community: In this sense, Taskville appeared to be extremely successful. Users stated outright that the public display spawned water-cooler style interactions; people would rush after class to view the status of the game and their ranking

relative to one another and to discuss the game's progress. Interpersonal engagement with others was intense, as suggested by the aforementioned "death threats and icy stares". Several other building users (primarily students attending class) and people who worked near the installed Taskville displays also informally expressed interest in the system, despite their not being represented in the user study or even the studied groups. Some of this engagement was undoubtedly a straightforward result of Taskville being a situated display, requiring that users gather in a common area to observe the game state. However, despite also being a situated display, KiteViz did not generate such a fervent response. Potential reasons for Taskville's increased success may be its more video-game-like appearance suggesting greater interactivity; greater publicity due to the larger user group; the increased traffic flow afforded by the placement in two locations simultaneously; or the inherently communal nature of the friendly competition. In retrospect, it seems obvious that interactions which intentionally rely upon the pre-existing connections between users act as the best motivators of further interpersonal engagement — KiteViz' ability to examine relationships and Taskville's competitiveness and one-upmanship.

3. Encouraging personal and social reflection: Taskville was both qualitatively and quantitatively proven to accomplish this goal. Survey results in the pilot study showed a measurable increase in subjective "awareness" of the state of work-related tasks on the user, group and intergroup level. This result was further confirmed by the qualitative group interviews: users repeatedly confirmed that the act of submitting tasks and observing their neighborhood and city grow shed new light on their personal working habits. The specifics of these reflections were varied; one user felt that observing his output compared to the other participants encouraged him to work harder, while another thought that the system proved she "worked too much" and had not spent enough time on her own personal development. These types of self-examinatory reflective statements, potentially leading to life changes and increased personal satisfaction, are the ideal outcome of a Slow design.

As noted, the system also promoted extensive reflection on the nature of a "task" and, by extension, users' individual work habits. Some users divided their projects into large numbers of short tasks, resulting in sprawling residential neighborhoods, while others only submitted one extremely long task for each assignment, creating small numbers of densely packed skyscrapers. Still others would submit a new task each time they moved from one project to another, so that multitasking resulted in more buildings than an equivalent amount of focused work. During the interviews, the representation of different working patterns in this metaphorical manner served as a motivation for discussions about the nature of work. With so many proven new reflective experiences generated and personal insights gained, Taskville inarguably fulfills the third tenet of a Slow design.

The author concludes that Taskville was less successful than KiteViz at promoting deeper relationships over superficial interactions, but that it was equally or more successful at engaging users in discussion and reflection. There are a number of potential explanations for this relative effectiveness. "Work" is a highly tangible but relatively difficult concept to define; it is possible that the new interpretation afforded by the city metaphor allows users to draw comparisons to more concrete and widely-understood concepts like urban density. Another interpretation might note that "work" forms an enormous and often highly conflicted part of a person's life; people may be inherently searching for new interpretations of their working life and thus are more receptive to reflection on the subject. It is clear in any case that Dewey's concepts remain fundamentally true: the core of powerful reflection is the examination of existing notions, prompted by a new or unexpected interpretation of something previously accepted without question.

5.6— Updates & Future Developments

Collaborator Shawn Nikkila has maintained this line of research and extended it with updates. The system seeks to examine patterns of collaboration within an office more

deeply, and to add new elements of visual metaphor corresponding to different metrics. For instance, if the system detected that a user had not submitted a task in some time, it might begin to replace that user's buildings with "decayed" models to represent the lack of attention, replacing them only when the user returned to their original rate of submission. The author remains involved with this project as the artistic director and developer, but the system's research goals have shifted entirely to Shawn's interests.

Chapter 6

YOUR ____ HERE

Figure 25: Your ____ Here in operation one night in the first testing period

6.1 — Theory & Background

Your ____ Here (pronounced "your blank here") is a system designed to implement the principles of Slow design on a wider level than either KiteViz or Taskville, by broadly interacting with members of the public at large (Figure 25). The system was developed in partnership with Media, Arts and Sciences Ph.D. student Ryan Spicer. Like the two earlier projects, Your ____ Here is separated into client and server applications; Ryan wrote the server code and the remainder of the system was developed by the author.

The initial driver behind this system's concept was a series of administrative decisions within Arizona State University. For a number of reasons pertaining to internal re-organization, the College of Design and subsequently the School of Design Innovation were disestablished, preparing for the creation of a new school with new branding and internal structure. With the reorganization affecting several different departments within the former College, discussions abounded among the affected faculty and students as to what the new replacement institution (incorporating the Schools of Architecture and Landscape

Architecture) might be. The concept for Your ____ Here was inspired by one particularly strange side-effect of the disestablishment: changes to the prominent exterior building signage reading "College of Design". The suddenly-deprecated sign had apparently been scheduled for removal after notice of the disestablishment, but with no new branding available, total demolishment of the sign would have left the building without a title. In an apparent stopgap measure, only the words "COLLEGE OF" were removed, leaving the word "DESIGN" awkwardly off-centered above the entrance door (Figure 26).

Figure 26: Altered signage above the building's entrance

This strange temporary signage seemed to be a metaphor for the state of the institution. The disestablishment had been quite sudden and therefore would require some time to develop a clear new mandate. The name and mission of the emerging school necessitated considerable debate, with at least a somewhat shared understanding that it should have something to do with design. Conversational references to an entity with no name and no replacement led to sarcastic epithets like "the College Formerly Known as Design."

Drawing on the successes of metaphorical representation in KiteViz and Taskville, Your ____ Here was conceptualized as a system that would, using the sign as a metaphor for

the state of the school, promote questioning, discussion and reflection in a public forum. The large population of the former colleges/schools and remaining programs, and the high traffic of the area in which the dismantled sign was installed, would provide an ideal opportunity to examine Slow design principles at the level of the general public. Targeted research questions were developed, including: how can Slow design be effectively applied in a high-traffic common area, where people are unlikely to stay for more than a few minutes? How can Fast technologies developed for mass communication be Slowed down? Will users choose to spontaneously engage with a system for which they have no preexisting knowledge and no instructions?

The core interaction of Your ____ Here was based on a single hypothetical question: "What would I name the new school if I had the choice?" The system is designed to grant passersby that choice, by using digital augmentation to allow them to change the sign itself. This question evolved into a more general goal of using the sign as a seed to promote discussion, with the word "design" appearing more and more serendipitously ideal for our purposes. It formed a specific enough limitation in a sentence that it would hopefully stimulate create thought, but at the same time it was relatively open to interpretation, forming the root of words such as "designer" and "overdesigned" and being a common concept in disciplines from studio art to scientific research.

The aforementioned goals shaped the structure of the system. Your ____ Here is flexible enough to allow a wide variety of different statements to be properly applied to the sign in a readable fashion. In order to promote discussion, it stores a record of all other submissions, presents them provocatively, and allows users to respond to them. Since the target users are random members of the public, the system is designed to be noticed immediately and comprehended in seconds; this requires a prominent and attractive appearance and a straightforward conceptual model. In order to maximize participation, access to the system is trivial, with neither input nor interpretation of output requiring any

special experience. Content is not attributed to a specific person, so openness is encouraged and the set of stored statements appear to be the product of a sort of collective unconscious. This approach requires some filtering, since offensive submissions seem to the creator to be untraceable and are therefore somewhat encouraged, but the benefits appeared to outweigh the deficits. Finally, the system is portable and easily modified; beyond the initial user testing, the basic system structure can be used in any number of similar situations.

Your ____ Here uses a projection mapped to the building's exterior wall to augment the signage. The literature contains numerous examples of projection-mapping of images onto building surfaces, but these usually focus only on the potential of a building as a physically enormous screen. Your ____ Here instead directly integrates with the architecture of the building, forming a unified, relational installation. With the pervasive nature of text-messaging in contemporary society, and the fact that essentially every mobile phone available for sale can send and receive texts, that the SMS channel forms an ideal input; to interact with the system, users require no more specialized hardware than their phone. Text messages are also limited to 160 characters, and they inherently limit the extent of the submission to a scale appropriate for signage. Systems such as Blogwall (Cheok et al., 2007) and InfoGallery (Gronbæk, Rohde, Sundararajah, & Bech-Petersen, 2006) have examined the manipulation of displays with mobile phones; however, the Blogwall system is an indoor, screen-based system, the size and location of which limits the possible audience scope, and in the InfoGallery system information transfer is primarily one-way, in that users can interact with existing content but cannot submit their own. In contrast, Your ____ Here's placement in an outdoor plaza makes it accessible to a much broader community of users, and the system is built entirely around user-generated content.

Further information about Your ____ Here can be found in "Discursive Architecture: integrating buildings, displays and text messages" (Linn, Spicer, & Kelliher, 2011) , a workshop paper from CHI 2011. This paper, copies of the system source code, and

a more packaged version of the system ready for operation by a user with some experience building and installing software from the command line, are all available at http://www.silvanlinn.com/msd/.

Figure 27 graphs Your ____ Here on the same five axes as Taskville and KiteViz. Your ____ Here rates extremely low on both abstraction of data and identifiability; the information projected onto the wall is exactly the same data that users submit to the system, using no metaphor or other computational interpretations of the information whatsoever, while all submissions are anonymous to the public unless the submitter chooses to include their name. Your ____ Here obviously rates highly on number of participants and setting scale, as it is a public system. Finally, its interactivity falls somewhere in the middle — the system has only one true interaction (submitting a text message), but this interaction is what defines the system as a whole, and hence remains important.

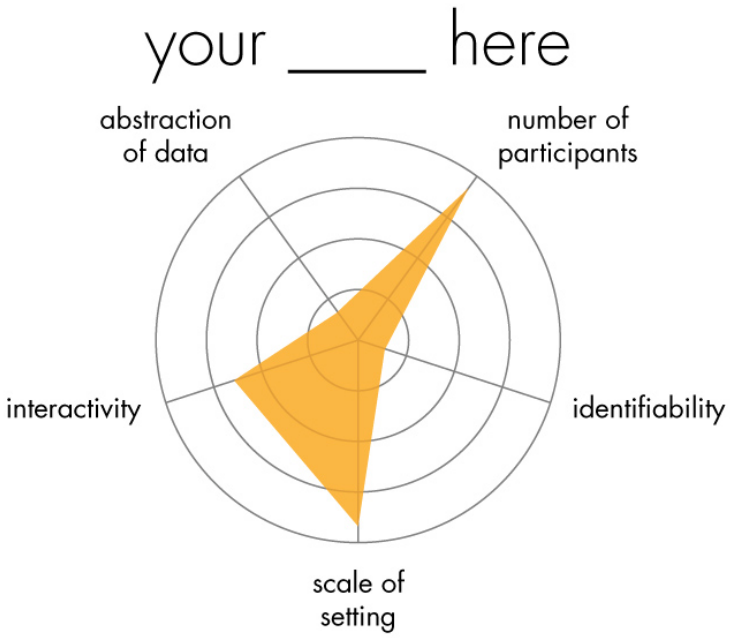


Figure 27: Your ____ Here graphed on the same five-axis radar chart as KiteViz and Taskville

6.2 — Implementation

Your ____ Here, like KiteViz and Taskville is structured as a client-server system (Figure 28). The server application handles user input: the receiving, filtering, formatting and storage of text messages submitted to the system. A client application handles the output: the accessing, displaying, transformation, and animation of stored messages. This theoretically allows for flexibility in both implementation and administration. Only a single server and a single telephone number is required for multiple simultaneous client installations, and the separation between the two allows an administrator to easily act as a "middle-man" and censor or otherwise restrict offensive messages submitted to the server before they reach the client, and therefore the public. If users wish to use more than one telephone number for multiple simultaneous systems, they can simply run a second instance of the server.

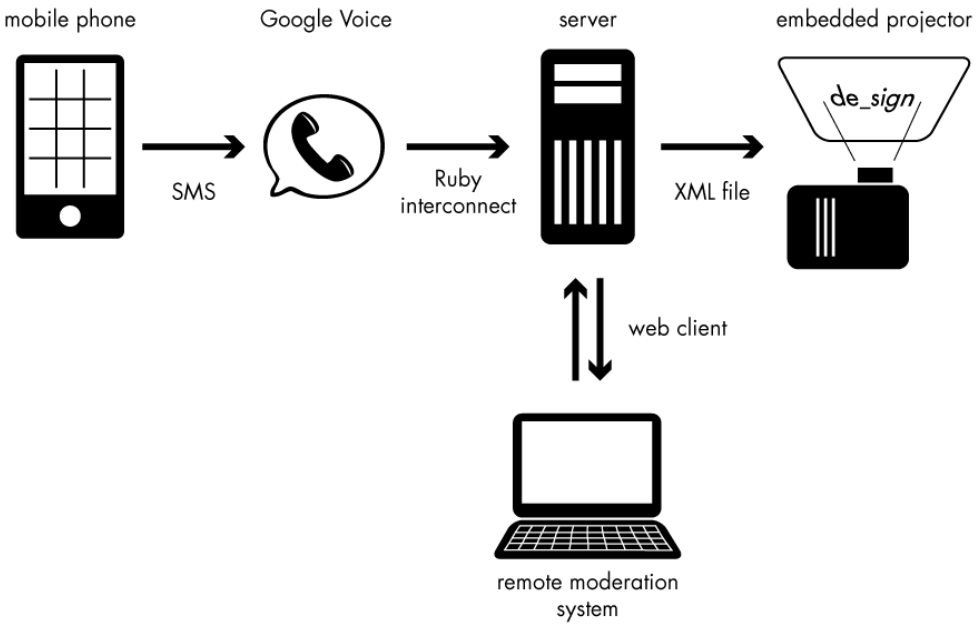


Figure 28: Your ____ Here system architecture

Server

The input system is centered around a Google Voice account. Google Voice is a commercial web application and infrastructure that provides free voice-over-IP telephone connections to users in the USA. Signing up for an account grants, among other features, a local telephone number, an inbox for received text messages and telephone calls, and structures for forwarding messages to other telephone numbers or other Google products. In *Your ____ Here*, text messages received at the Voice number are immediately forwarded to an associated GMail email account.

This email account is checked for new messages using a server written in Ruby on Rails. Every 45 seconds (the rate is limited by Google's anti-spam protocols), the server queries the GMail account for any unread messages. If an unread message is detected, it is downloaded, and all content except the first line is stripped to simplify processing and avoid abuse of the system. This stripped first line of text is added to an SQL database in an "unchecked" format.

Obviously, a prominent issue in the development of a public-facing system like Your ____ Here, especially given its association with a highly visible public institution like Arizona State University, is handling any user-submitted profanities or offensive comments. Your ____ Here takes a two-tiered approach to this problem: messages are checked against a blacklist of offensive words, and are simultaneously displayed on an administrative web page for active moderation of submitted content. The blacklist is composed of roughly three thousand common English obscenities, including compound variants, and other potentially objectionable words such as "killing" or "bomb". While it was recognized that such a draconian blacklist would likely lead to a number of false-positive rejections, this outcome was determined to be better than the alternative of having offensive statements appearing on university property — and, in any case, users would prove to be extremely creative in finding alternate ways of bypassing the word filter. For these cases, an administrator can log into the

Ruby server at any time (via an HTML page) and observe all of the submitted text messages, including those that were automatically rejected. An active observer can spot questionable messages that might have escaped the word filter and remove them from the display list before they are activated. While this system is labor-intensive, it is guaranteed to work effectively.

If the message passes the blacklist, it is then examined to ensure it contains the appropriate word or phrase for proper building integration (e.g."DESIGN"). If this also checks out, the new message is classified in the database as an accepted phrase and flagged as "new", indicating that it should be selected first when the server is called for a new phrase.

Client

The client-server system uses XML as an interconnect between the two halves (Figure 28). When the client requests data from the server, an XML file is automatically created using the latest server data available. Each file contains three tags: the entire message (e.g. "i love to design cars and motorcycles"), the "before" section ("i love to"), and the "after" section ("cars and motorcycles"). Timing is handled asynchronously; the server automatically checks GMail once every 45 seconds, while the client synchronizes with the server at a user-settable rate (by default every 15-20 seconds).

The client application is written as an Actionscript application using the Adobe Flex environment. It requires the Adobe AIR framework to be installed on the host computer but is otherwise platform-independent. The client's primary features are handing the display and animation algorithms, and allowing users to properly align text with architectural or other physical features. The overall visual structure of the display is a black field (which is invisible when displayed with a projector) and several lines of text: one "instruction" line, two blocks for the "before" and "after" segments of a displayed message, a static line containing only the submission phone number, and one optionally visible block that can be used as a

placeholder for the physical signage in testing. The text blocks' font face, size and color are usually selected for a combination of readability and effectiveness of integration with the physical signage. Specific details will be discussed in the user study section. The "instruction" line contains up to six short user-settable messages that will be cycled through one at a time, using a prominent animation to update the text; the sudden motion contributes to visual interest and ideally attracts attention from passersby who may not have noticed the display. The two user submission blocks cycle randomly through the database of accepted submissions, using similar animations in their update activity. The line containing the telephone number remains constantly on for permanent reference.

Animation is handled using a library to automatically break up text strings into their individual letters, and then applying transformations to each generated element. This allows text to be written to screen letter-by-letter, word-by-word or all at once, with any arbitrary motion. For example, programming the block element's *y*-location to begin at an arbitrarily high value and run down to zero (baseline) over some time period causes the text to "fall" in from the top of the screen. For further details, see Appendix A — Code Samples.

The system may be configured and run directly from its installed location, but to make setup as straightforward as possible it is better to do so using a standard monitor connected to the client computer. On installing and running the client software, the administrator in charge of the system is presented with a black field and a preset layout of the four text fields (Figure 29). In the center are the two fields for the user-submitted message. Above is the dynamic instruction field, and below is the static field for the text-messaging number. In the suggested implementation, the top field is used to display a rolling list of ideas, topics or provocative questions; the bottom maintains a single easy instruction like "send a text with 'design' in it to [phone number]". To adjust the display, the system uses a combination of keyboard commands for the most common functions, and an XML

preferences file saved on the client computer for those that are more obscure; a static help screen can be called up by the administrator by pressing "H" (Figure 30).

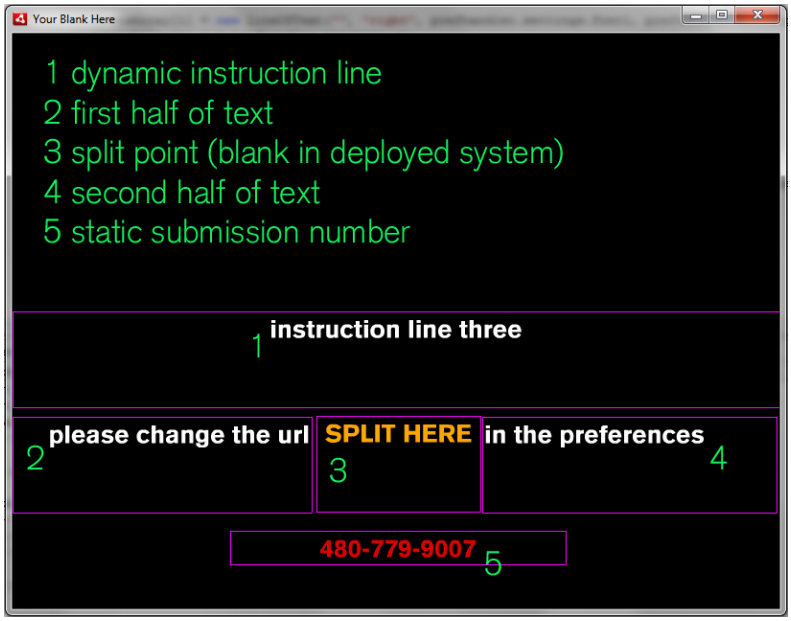


Figure 29: Your _____ Here main screen, displaying setup/administration controls

Figure 30: Your ____ Here keyboard help screen

Other parameters are adjustable by editing the XML file, including the color and font size of the text in each box, the content of the strings of text cycled through in the dynamic text box, the content of the lower, static text box, and how frequently the dynamic text box cycles through its options. Thus, all relevant settings can be read from and adjusted in the preference file with a text editing program, while the more frequently-used and graphically-dependent functions are set interactively with shortcuts. Pressing the S key saves the relevant parameters to the settings file for backup and later access.

6.3 — User Studies

Your ____ Here has been implemented and run in two distinct areas. Initially, it was deployed in the location of the aforementioned "DESIGN" signage — on the exterior facade of the south building ("CDS")of the former College of Design, which has subsequently been renamed to The Design School. A number of weeks later, it was deployed in two simultaneous installations in the Digital Culture building of the School of Arts, Media and Engineering.

Figure 31: Plaza in which Your ____ Here was initially installed, viewed from the projection balcony. The projection surface is the concrete facade in the upper left.

First Installation

As discussed earlier, the initial installation location was selected prior to development of the system. The location providing the best combination of brightness and angular fidelity for the projected image turned out to be the public balcony of a university café, overlooking the central plaza between the north and south Design School buildings (Figure 31). Incidentally, at this point the system was known as De_Sign, as future installations had not been planned and a more general name was not required.

The client system was physically assembled using a Mac Mini connected to a lightweight desktop projector. The projector was positioned on a table facing the intended projection facade, resting on a sandbag for ease in positioning. Power was accessed from an external infrastructure power outlet with a long extension cord. The server application was run on the Reflective Living central server, located in the RL laboratory, with the campus wireless network forming the bridge between the two.

One of the original goals for the first installation was to construct a strong security housing, allowing the system to be installed and running unattended for 24 hours a day without risk of destruction or theft. The housing was designed and built, but never actually used; lengthy problems gaining approval to install a permanent fixture to the exterior of the building led to a "plan B" option. Instead, the co-developers alternately remained present with the hardware for the duration of the study, installing the system shortly before sundown (when the image became visible) and removing it between 9:00 and 10:00 PM each night, when pedestrian traffic began to fall off. Owing to these limitations, the system was installed for a period of ten days, running for 4 to 5 hours each night.

The projector that was available for the study was a small and rather dim (2300 lumens maximum) projector meant for portability and indoor conference rooms. The large open plaza between the projection location and the signage meant that the total image throw was around sixty feet (twenty metres). While this meant that the projected image was more

than large enough to cover the entire wall, it was far beyond the projector's intended range. Attempts to use colored text failed as the filtering process cut out too much light for the text to be visible. Therefore, in order to maximize the amount of light reaching the wall, all text was set to pure white. The font chosen, a blocky "pixel" font called "Hooge", was selected to maximize boldness of the image and remain as visible as possible.

In this installation, the system's dynamic text field was programmed with various provocative messages intended to both promote discussion and encourage use of the system. On the first day, we simply used six messages like "How do you design your life?" and "Let us know what design means to you!", but disappointing levels of submissions quickly led us to include phrases like "see your words here in seconds!" to emphasize the functional nature of the system.

System evaluation and analysis involved using a combination of data collection methods including non-interactive observation, spontaneous, rapid "man-on-the-street" interviews with passersby who stopped to watch, and automatic collection of all submitted text-messages. As one or both of the system developers were attending to the system at all times, it was simple to make observations spanning the entire testing period.

Second Installation

Your ____ Here was installed in a second location 2.5 months after the initial testing. The targeted population in this case was the user group of a newly opened Arts, Media and Engineering building ("Stauffer B"), housing the Digital Culture program. Specifically, the installation was designed for operation during the building's Open House event; since this event would be taking place in the daytime and the attendees would spend most of the their time indoors interacting with projects and demonstrations, it was decided that the target location should also be indoors in the main open house area. A flat white section of interior wall panel, roughly 20 feet by 4.5 feet (6 metres by 140 cm) and located

close to the ceiling, was selected as the projection surface. In order to emulate the initial installation, a physical sign reading "digital culture" was created. The wordmark was laid out in Adobe Illustrator using official ASU typography guidelines, scaled to provide a mix of legibility and "extra" space for submitted text, then laser-cut from Masonite board and painted a light gray-blue, the color selected to be legible in the dark without detracting from the projected image (Figure 32). The letters were assembled on strips of clear acrylic and hung in an appropriate location on the wall panel. A larger, much brighter projector purchased for the Digital Culture space was mounted in a location allowing it to cover the entire 20x4.5' wall area, and connected to an RL portable computer system used for traveling or embedded installations.

Figure 32: Digital Culture wordmark

A smaller, tertiary installation was also implemented for the Digital Culture Open House. While there was no chance of a standard projection being visible outdoors in the middle of the Arizona day without an unimaginably powerful and expensive projector, Stauffer B has a number of exterior bay windows over small indoor alcoves, formerly used by the ASU TV station to publically display their programming. One of these windows was repurposed for Your ____ Here in a rear-projection system. A large sheet of butcher paper (coarse, semi-translucent paper stock) was printed with the words "digital culture" in the center, and mounted over the inside of the window so that the words would read properly from the outside. The desktop projector and Mac Mini from the original installation were placed behind this projection screen, the projection path bounced off a large mirror to simultaneously cover the entire screen area from a short throw and invert the image for rear

projection. Viewed from the outside, this had the effect of producing ghostly, illuminated white words on the paper beside the printed red "digital culture" lettering, with no apparent means of support or generation (Figure 33).

Figure 33: Tertiary Your ____ Here installation (rear-projection) — white lettering is projected and red lettering is printed on the translucent screen

The server application can host a theoretically unlimited number of clients, so both Stauffer B installations drew from the same source and consistently had access to the same database. However, due to the nature of the random selection function on the server, each projection would likely be displaying different phrases at any given time.

These two new installations of Your ____ Here ran for roughly 7 hours on the day of the Open House, from 11AM to 6PM. The dynamic questions remained similar to those used in the first installation, modified to ask for interpretations of "digital culture", with one phrase used to promote the research group ("welcome to reflective living's your ____ here").

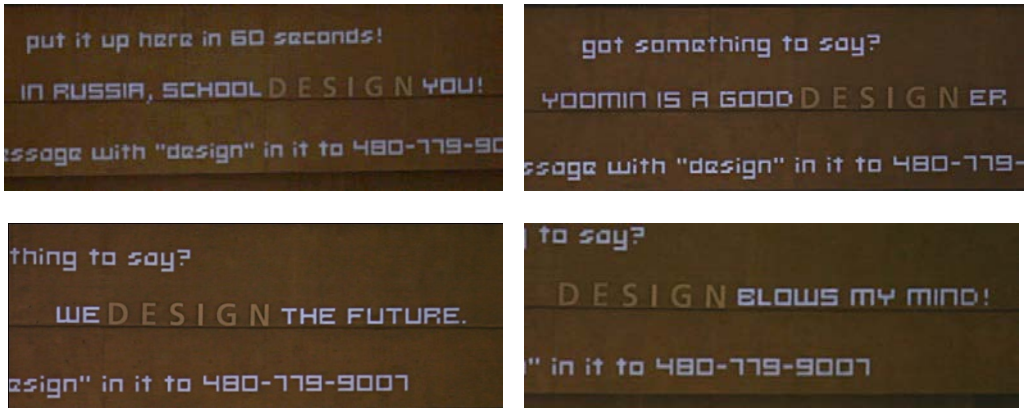


Figure 34: Some of the submissions to the first run of Your ____ Here

All submissions from both runs of Your ____ Here are available in Appendix C. Please note that some of the content, included in its entirety in this thesis, was deemed offensive enough to warrant rejection.

First Study

In the initial installation, Your ____ Here ran for a 10-day period. It should be noted that this was during the university exams period, though whether that would increase or decrease submissions is unclear. Large groups would pass by after exiting a review or an examination, but classes had ended, and therefore the baseline number of students may have been lower. The client system was activated each evening from sundown until the number of people in the area fell off to less than one passerby per minute. Quantitatively, we received a total of 144 messages for a mean of 14 submissions per night, though this number varied from as low as three to as high as thirty-five. Of the 144 submissions, 95 were accepted, for an acceptance rate of 66%.Of the 49 rejected messages, only 20 were rejected for being inappropriate; another 19 were well-intentioned but did not contain the word "design", with the remainder either being duplicates or random strings of gibberish (later determined to be from users submitting non-ASCII characters).

The nature of inappropriate content changed over time. In the first few days, there was relatively little profanity submitted, but over the course of testing, users began submitting more offensive material. As most of the early attempts were automatically blocked by the blacklist, users became more creative; we received Spanish cursing, implied obscenity without actually using offensive words, and eventually even crude artwork using ASCII symbols (such as " t(' . ' t) Design ", which appears to be a cartoon of a left-facing character raising both of its middle fingers). Throughout the entire study, various users had their content rejected by the blacklist for being inappropriate when it in actuality was not (for instance: "design is killing me" was rejected for the word "killing"), but these represented only a small fraction of all rejections.

The database of messages was sorted into different categories based on the perceived intentions of the submitter. Messages were allowed to fall into up to two categories. The largest group of messages, totaling 30 submissions (20% of the total), were classified as "bragging" – messages such as "[name] is the design man" or "Design > business" ("design is better than business"). The next-largest set was school-related messages in general, such as "I'm so done with design for this semester!" Statistics also display the popularity of self-reference, with 23 messages along the lines of "I can design everything, give me a job"; and pop-culture references or internet memes with 16 messages similar to "all your design are belong to us".

While the number of users and their level of interaction varied, overall the response to the system was positive. Qualitatively, a significant percentage of the plaza's passersby were observed interacting with the system. Most people in the area would watch it as they walked by, particularly turning to look when an animation was triggered; most of the outright walk-pasts were, somewhat ironically, people engrossed in their mobile phones. Subjectively, around a third to 40% of the users stopped for some length of time to see the

messages change, submitted a message themselves, and/or discussed the display with their colleagues, with increased engagement near the end of the testing period.

Generally the system had the highest level of interaction when a small group of people (2-10) encountered the system simultaneously [figure 4]. In these circumstances, people were likely to point out the display to one another and stop to observe it for some time. Users were overheard encouraging each other to submit messages, i.e. "Does it really work?" "Try it and see!" When one user in a group submitted a message, the others seemed more encouraged to submit ones themselves, particularly after the initial "wow, it really works" discovery as the message appeared on the wall. We observed Your ____ Here creating more complex interactions as well: some users would spend time “one-upping” or "trash-talking" each other by sending in successive bragging messages, while others were overheard to discuss the content of the messages or the system in general even if they had not submitted anything. At least one viewer telephoned a friend to say “I just saw your name on the wall.” Many people would look around to see where the projection was coming from; around half a dozen of these later approached the developers and expressed an interest in the system.

Not all responses were positive. The only truly negative response observed was on the first night when one person was overheard remarking to her friends that "I can't believe they're advertising on the side of buildings now." This remark prompted the inclusion of the clarified instructions on subsequent days.

Second Study

In the second installation, the system ran for only one day in the Digital Culture building (Figure 35). The system received a total of 90 separate submissions — nearly two-thirds as many as in the entire first run of the system — and had a 79% acceptance rate. However, the open house had a significantly higher density of people than the outdoor

plaza, and the event was of course intended in part to demonstrate projects in the School of Arts, Media and Engineering.

Figure 35: Second installation of Your ____ Here

Content submitted fell into most of the same categories as in the first study. Far less of the submissions were "bragging", while far more created sentences describing "digital culture" in some aspect (e.g. "digital culture > analog culture"). There was far less intentional profanity; most of the rejections were from malformed sentences not including "digital culture." A notable difference is that, almost certainly due to the population of academics and engineers, there was a new category of "attempts to break the system" by including characters that would cause our interpreter to fail. These were clearly labeled as such — " does digital culture have a parser? /;;\\t{}{!" includes many common interrupt symbols and explicitly refers to our sentence parsing script. A more complicated system may indeed have failed, but since our sentence processing was quite limited, there were no issues in the run.

There were a few submissions that were notable for their uniqueness. One individual (identifiable to the administrators as the same person each time due to the same telephone number being used) repeatedly submitted arguments against Apple Computer, stating "Windows has a place in digital culture just as much as anything from Apple" and the like. Another submitted nearly the same attempted-system-breaking sentence — "We in digital culture, we fear an unmatched {" — seven times, subtly modifying it each time it was rejected to try and get it through. However, rejection had nothing to do with the actual intent of the submission, but rather that the blacklist was detecting the word "fear".

6.5 — Discussion

Your ____ Here, like the two earlier projects, may be evaluated for its success by how effective it was at fulfilling the three tenets of Slow design.

1. Increasing depth and richness of interaction: As the central topic of this research is how Fast technologies may be used in Slow design, Your ____ Here should be evaluated under that rubric. The key Fast technology in Your ____ Here is of course SMS, because of its dense informational structure, immediacy of access and distracting nature. While the system does not replace the primary SMS interaction of person-to-person communication, it does create an alternate use. Users may send a short message, but rather than having it interpreted at face value, it becomes part of a greater collective discussion about a place or concept. It becomes a public message with thousands of potential viewers, able to make a statement much like a piece of graffiti artwork. In this sense, Your ____ Here certainly *promises* to increase the depth of the SMS interaction.

Whether people actually used the system in a way that supports this is debatable. Though discussion of a central concept was the original goal, the freedom of the system resulted in a wide variety of different uses, from bragging about oneself to proselytizing for a religious faith, and people use text messages for many of these things already. However, the

author argues that simply the nature of how the message is displayed makes the act richer. A normal text-message usually has no context within a greater multi-person discussion upon which to reflect; nor does it force creative incorporation of an existing concept to create a new interpretation. Even if the content is merely juvenile profanity, the nature of the interaction is changed by its target. Therefore, Your ____ Here does an effective job of temporarily increasing the richness of text-messaging on a public level.

Figure 36: A crowd interacting with Your ____ Here in its initial installation

2. Engaging the local community: In this aspect, Your ____ Here is clearly effective, as this was the core of its interaction. Observation confirms that users in the area around the installation would gather and socialize with each other in complex ways, using their text-messages to support the in-person interaction (Figure 36). The plaza became a gathering-area rather than just a thoroughfare, and users commented positively on the integration of the display into its surroundings.

The display was also co-opted by the local community for its own purposes. A number of submitted messages referred directly to events taking place within the school, either advertising upcoming ones or celebrating those that were completed. The second one-

day user study demonstrated that the system can be effectively used as a long-scale discussion forum and idea board over the course of a smaller, targeted event, helping to both bring attendees together and collect ideas and information for the event's organizers. It is regrettable that the system could not be permanently installed in the original location, as it appeared to have a truly tangible benefit on interactions within the plaza and would have been an excellent topic for extended study. In summary, Your ____ Here is unequivocally successful at engaging members of the local community with each other.

3. Encouraging Personal and Social Reflection: While it is difficult to measure something as subjective as reflection without asking participants outright, the effectiveness of Your ____ Here at generating this interaction can be estimated by analyzing the content of the messages for meaning. In the initial testing, 32% of the accepted messages were either self-referential or contained a form of "status update" like "exhaustion by design". 50% of the messages were related to the School of Design in one-way or another. That a high proportion of participants in the installation chose to use it as a comment on their own status or that of the School community suggests at least some level of introspection and reflection. Study of the exact content submitted reveals musings on job applications, deadlines, life philosophies, and even romantic relationships. These all form part of the greater collective mentality of the area, displayed in Your ____ Here over time to users who are willing to sit and watch for a while. It seems that Your ____ Here is also effective at fulfilling the third tenet of Slow design.

Your ____ Here proved to also be successful in ways beyond the effectiveness of its immediate test installations. During the attempts to have the system installed in a permanent housing on the Design School, the author created a short video depicting and explaining the operation of the system. This video was initially intended to only be used internally, as a method of demonstrating the system's operation; however, on a whim the video was posted on YouTube and linked to from an AME Facebook page. Through Facebook, other

departments on campus discovered the video and expressed interest in using the system for their own events and installations. During the first testing phase, two of the passersby also personally indicated interest in the system, suggesting its use at parties or nightclubs. The system was in a highly experimental form at that point, requiring in-depth knowledge of Ruby and AIR and access to the source code to operate, and was not suitable for public release. However, following the conclusion of the testing protocol attempts began to transition the system into something usable by the "average" person without programming or networking experience.

6.6 — Updates & Future Developments

Given the success of the system, it was decided that the system should be packaged and distributed to the public. It was initially hypothesized that this might be done through a short (3-6 hour) workshop, involving discussion and brainstorming on the topic of Slow design and Slow interactions using Fast media, and distribution of the software to all participants, with instructions and training on how to run and configure the system. This might generate new ideas for future implementations and improvements of Your ____ Here, and simultaneously spread the system around for experimentation and publicity purposes.

Two workshops were scheduled: one three hours long as an "introduction" to the system, where users would be able to install a full chain of Google Voice — Server — Client and run the software with minimal modifications, and one six hours long which would enter into greater depth and introduce users to the concept of making more drastic changes through modification of source code. Using printed posters, a website, email lists and social media, workshops were advertised to a number of schools in the university, to local "maker" collectives and "hackerspaces", and to a general audience via official AME Facebook pages.

Simultaneously, the system co-developers worked to update the software into a simpler, more usable form. The first step was to package the server as efficiently as possible,

a process that proved difficult. While Ruby on Rails is a powerful development environment, there is no reliable way of making an application into a package that could be transferred between multiple computers, and installing the supporting software for a non-packaged application requires extensive experience with command line tools and software compilation, in addition to several hundred megabytes of downloads. After much debate and experimentation, it was decided that the best solution was to create an entire virtual machine running a complete operating system with all the software preinstalled, and distribute this image file. This would still require installation and configuration of the VM host, some willingness to change settings using command-line tools, and a multi-gigabyte download, but it was simpler than any of the alternatives.

The client also had to be modified for ease of use. Since the system was in a constant state of flux, many of the features were built into the software's source code and required extensive programming experience to modify; the preference file was more a matter of convenience than simplicity. After development work, the most important features were exposed outside the source code, such as allowing users to set the details (rate, type, splitting, etc) of the specific animation used by each text block. Allowing the level of configurability afforded by source editing, such as the creation of new animation styles and text processing algorithms, from a GUI would have effectively required the development of an entirely new application. As with the server, the client's state was set by a balance of feasibility and ease-of-use.

The actual response to the workshops was disappointing. In total, only five RSVPs were received, three from outside the author's research group and only two from outside AME. Nevertheless, the first workshop was held with two people in attendance. They were each asked to fill out a demographic survey designed to gauge the types of people who were interested in the workshop. Both attendees were college students, and while they indicated some familiarity with fine arts, design and web development, they both ranked all

programming-related experience as 0 or 1 out of 5. One subject was a very heavy user of social networking and text-messaging, while the other indicated light to very light use of both. Neither student had pre-existing ideas for the software or foresaw themselves using it. One student indicated that she attended to learn new general technical skills, while the other attended only because of a class requirement to attend and write about tech-related events.

Since neither participant was actually particularly interested in Your ____ Here, the brainstorming session took on the form of a general discussion about the concepts behind the system and where it could be useful. Many of the anticipated ideas were generated, such as use of the device as a marketing tool or simply as an art installation. One novel idea was to use the system to give instant feedback at public events, such as commenting on an athlete's performance in the middle of a game or submitting questions to an elected official at a press conference. On demonstrating how to install and use the system, we discovered problems in our software development process: for users with extremely low levels of programming experience, even the simplified structure required far too many steps and was too complex to grasp. Despite the authors' subjective interpretations of the system as just "two applications", one participant asked if the software would ever be an application instead of "code". Clearly the system was not ideally suited for the "average" user.

The failure of this first workshop actually resulted in a number of important results and insights. First, despite the supposed interest in the software, very few people appeared to be interested in the workshop format. This suggests that there is perhaps a better distribution method for a system of this nature. Second, though generalizations cannot be made from a small sample, neither attendee was particularly interested in Slow design or the structure behind the system, so the software itself free of other "constraints" would probably be a bigger draw. Third, the developers' experience bias obviously caused them to misinterpret how difficult the system was to use for a novice user, to the point that it is effectively not useful without some level of programming experience. So, for truly general

dissemination and use by the general public at parties and the like, a great deal more development time is required.

Following these realizations, the second workshop was determined to not be an effective method of accomplishing any of the intended goals, and was cancelled. To address the issues leading to this change of direction, the author proposes a bipartite approach. The low interest and attendance was likely the result of a very small target user group; there must be very few people who are interested in software development, have a use for the system, are interested enough in the theoretical background to attend a workshop, and can attend a physical event. However, the software received a good response online from just the one video. In order to proceed, the software should be divided into two paths: initially, the raw source code and instructions should be posted on a source code repository like GitHub or Google Code, and advertised online to communities of Makers and Hackers who might find the software useful. Potentially our "easy" system could also be uploaded as a somewhat easier path but which still requires some programming knowledge. At the same time, development could proceed on a truly simple-to-use, fully-packaged one-click version for mass distribution. This version would take a significant amount of development time, during which the system could be generating publicity through its open-source "hacker" version. Eventually, the two projects could be merged back together as a single system with options for full customizability, one-click setup, or anything in between, covering as many targets as possible.

Your ____ Here remains in active development. As there is undoubtedly a market for the application, publication of the full source code is anticipated in the weeks following the publication of this thesis, with subsequent enhancements being made to user-friendliness and flexibility of use. A number of external organizations have expressed some interest in using the system or a variation; these opportunities will be followed-up on as they occur.

Chapter 7

CONCLUSIONS

7.1 — Summary of Findings

This thesis presented research into the application of socially reflective, or Slow, design principles to modern, mediated, highly information-dense, or Fast, technologies. The Slow design principles used in this process were extracted from literature detailing the "Slow" movements themselves, beginning with the original Slow food movement of 1989; the history and psychology of "information overload"; historical and contemporary studies into reflective practice; and existing implementations of technology that demonstrate an aspect or sub-aspect of reflective practice in their design, especially those using advanced technology to those ends.

These Slow design principles were synthesized into three main tenets: that a Slow design should increase the depth and richness of an interaction with the product or service, that a Slow design should promote engagement of local community members with each other on an interpersonal level; and that a Slow design should in its operation encourage personal and community reflection. The three tenets were used as guiding principles and evaluation metrics in the development of three major projects, intended to study methods of successfully applying the tenets to Fast media. These three projects were KiteViz, Taskville, and Your ____ Here. The results from multiple user studies carried out on each of these systems were analyzed, and conclusions about the effectiveness of the studied methods were drawn.

Figure 37: Relative effectiveness of each system according to the three tenets of Slow design, graphed on radar plots

Figure 37 graphs the relative success levels of each system at supporting the three tenets of the Slow movements. KiteViz was effective at promoting reflection and deepening interaction through use of the metaphor, and its ability to expose new and unexpected facets of the relationships between system users promoted discussion and socialization, but it was less effective at encouraging local engagement. Interest in the system fell off fairly rapidly. Unexpected facets of personal relationships that created socialization also prompted reflection on their cause, while metaphorical elements with no meaningful drivers prompted reflection on what they could represent.

Taskville successfully exposed the competitive aspect of work in a friendly way and provided an alternate motivation for completing mundane tasks, though users did not indicate that they had any more interest or enjoyment in completing the tasks after the system's introduction. Taskville was particularly effective at engaging users with each other on a local scale; the constantly changing nature of the game gave group members a topic of discussion and a reason to continue checking in. Taskville also proved effective at encouraging users to reflect upon themselves and others through comparison and metaphor. Your ____ Here was successful at transforming text-messaging from a two-person direct communication into a creative, political, introspective act, forming a representation of collective local opinion and attitude at the same time. It was unequivocally effective at engaging the local community, even to the point of being co-opted for its ability to convey content to the public in an attractive way. Over 50% of the content submitted to the system was reflective or introspective in some way, suggesting that people, perhaps encouraged by anonymity, enjoy the ability to contribute their feelings and interpretations to a pool of community zeitgeist.

In this final section of this thesis, the results from each system are distilled into a set of Slow principles to be used specifically in the creation of Slow experiences through Fast technologies.

7.2 — Implications for Slow Design

The Slow movement as a whole has traditionally been somewhat regressive in attempts to accomplish its goals. Seeing Fastness as a product of current society, it attempts to re-examine and re-implement older, traditional methods as an outright replacement of the modern strategies. This research was predicated on the theory that Slow interactions and living and Fast, modern technologies are not mutually exclusive; rather, Slowness is inherent to the *interface* between the technology and the user. The assumed requirement for a an

advanced technology to use exclusively Fast interactions is simply a result of a focus on the tenets of Fast — efficiency, density, compression, speed — as inherently positive characteristics of a man-machine interface, and the concomitant lack of application of thoughtful Slow interaction concepts to modern technology. This research aimed to demonstrate that with careful design, a Fast technology may be caused to behave in a Slow manner, or appear to the user as such, carrying with it the full value that the Slow movement aims to impart to life.

While the level of success of each experimental project in implementing Slow principles varied, the conclusions from all studies confirmed that the projects — which applied computerized technology, social networking, mobile communications, and digital representations of reality — were able to induce and support the central common elements of the Slow movement: richness, engagement and reflection. The key insights from the research process can be summed up in a simple list of guidelines to be applied in the design of any human-technology interaction where a mentally restful, personally valuable and humanly satisfying interaction is desired.

7.3 — A Slow Design / Fast Media Framework

1. **Design for simple, fundamental understanding, not high-level mapping.**

Some types of interaction are more inherently comprehensible than others. In order for people to understand a new interaction, they must compare it to something with which they already have experience, combining existing skills and understandings into a new model. An effective Slow interaction should operate on a level that does not require a great deal of "mapping' to first be understandable, instead basing itself on something universal and intuitive. Notably, humans have years of experience understanding the laws of the physical and natural worlds, so interactions that leverage those concepts are built upon a lifetime of

instinctive knowledge. Where possible, physical or visual metaphors can help users operate through intuition rather than analysis; they might not understand a complex mathematical model, but they certainly understand how gravity or springs work. Furthermore, using basic, immediately graspable concepts as the highest level of an interaction allows one to increase the interaction's depth by placing content where only a user experienced with the concept would notice it. In practice this is simpler than it sounds; for instance, KiteViz users immediately understood the basic metaphor and began searching for further meaning in features like the altitude of the kites. This principle can be related back to John Maeda's "The One" — he suggests "removing the obvious and adding the meaningful." Giving users their KiteViz relationship score as "0.83" is an *obvious* way of indicating that their score has been ranked. However, understanding of the value requires knowledge of the scale's endpoints, what other people scored, what is a "good" value, and so on. On the other hand, displaying the relationship as the physical closeness of people to each other is *meaningful;* people choosing to stand closer to those they are more socially comfortable with than to strangers is a universal reality, and so this aspect of the display allows the user to jump straight to their interpretation of the *knowledge* rather than just the *information*.

2. **Handle complexity gracefully.** A Slow design or interaction does not need to be simplistic. Indeed, a system which only operates on a basic and immediate level has no depth, does not encourage much reflection and quickly bores the user. Complexity in interaction should be embraced, but handled as part of a coherent whole. When a system needs to display advanced options or complex information, it is common for designers to simply add an "advanced" panel, something which frequently could be much more accurately described as "complicated" panel. The complexities of an interaction should not merely be hidden as an option behind an attractive shell; rather, deeper levels of interaction should be incorporated naturally through the paradigms of the display. For instance,

Taskville exposes multiple levels of detail in a single screen without overloading the user with too much information. On the surface level, users can simply compare the relative output of two groups by comparing the size of the cities. Looking more closely at a city, the density of flags of a give color indicates the relative output of a user within that group. The height of buildings attached to those flags begin to indicate the user's working patterns, and the number of multi-tile buildings suggest how often they collaborate with others. In future versions, the state of upkeep will indicate how regularly the user submits tasks to the system. All of this information is available simultaneously to a user, but the system can be interpreted at any level in the chain without requiring the understanding of more detailed content.

3. ***Slow* is a process of evolution and continuous revelation**. While information presented too quickly is tiring, the solution is not to just eliminate temporally-fast interactions. If the interaction does not change over time, users will quickly try everything, come up against the limitations of the system, and find the experience stale. Rather, the experience should evolve over time with the user as they become more capable with the system and examine it more deeply. Greater complexity and depth of information can result when the user is encouraged to explore. In a similar vein, embracing the unexpected and unanticipated can help keep the system new; if users are continually questioning the interaction and guessing what might come next, they are looking for new interpretations and insights. Your ____ Here relies upon this concept to stay consistently interesting: users know that the content will change randomly a few times per minute, and they know that the content is user-submitted and updates immediately so there is always a chance of something entirely new appearing. Coming back a day later will likely result in an entirely new set of comments and statements being shown. There would be little long-term enjoyment in

reading a list of all the comments submitted to date, but by exposing them in a way that does not require constant focus and evolves over time, interest is maintained.

4**. Leverage groups and personal connections to encode meaningful value**. A system which interacts only with a single person is useful, but humans are inherently social beings. Designing a system which intentionally relies on, enhances or exposes connections between users can greatly increase a user's enjoyment of and engagement with the system, and promote secondary interactions between the user and others. The system does not need to be exclusively designed to interact with groups, but should (in the manner of point #2 above) expand in scope and depth as more users engage with it, creating more interesting interactions. If any sub-groups within the system user pool do exist, the pre-existing connections can be leveraged to help those particular users engage with one another. The research in this thesis demonstrated that much of the value in all three experimental systems was in the way that they encouraged users to interact with one another in person, either by their situated nature, their focus on group social structure, or the way that the systems relied upon user-generated content.

5. **Allow for participation along widely distributed and flexible scales.** All users will interact with the system in a different way, with varying levels of engagement. In studies of Taskville, some users became so engaged that they would literally rush out of class to see the latest updates to the game, while others would simply interact with it when they were in the area, and another did only the bare minimum required to play the game. A Slow system should be developed to add value and provide useful and intriguing interactions at all levels, regardless of how much the user is willing to "buy-in" to the system. If the interaction is open-ended enough, its basic nature can be altered by the user to fit better with their goals; if the system allows the user to project their own meaning and life experience into it, they can

then extract from it what is most valuable to them. KiteViz and Taskville allow users to view information about themselves, but make no particular judgments or even arguments for why the information should be displayed as it is. As noted in the relevant sections, one user viewing KiteViz felt encouraged to change the nature of their interpersonal relationships, while others only noticed that some users were more active on Twitter, and still others only commented on the attractiveness of the display. In the Taskville user study, a user interpreted the size of her neighborhood as a sign that she was working too much, while another ignored the reflective aspects of the game and chose to simply try and submit tasks in a way that would build a "wall" of buildings to prevent the other city from expanding. In Your ____ Here, the content is entirely user-generated, so people used it for a wide variety of different purposes, presumably according to their personal interest and engagement in the system.

Proper application of these five principles in the design process of any user-facing system, interaction or product should help leverage the valuable central tenets of the Slow movements. This can aid in the creation of human-technology interfaces that are deep and meaningful, encourage reflection, and help people engage more rewardingly with each other and with their local communities, improving social, cultural and personal sustainability and improving quality of life.

REFERENCES

Amazon.com, Inc. (2011). Amazon Mechanical Turk - Welcome. Retrieved March 31, 2011, from https://www.mturk.com/mturk/welcome

Arduino. (2010). . Retrieved June 28, 2010, from http://arduino.cc/

Berg, D. L. (1993). *A Guide to the Oxford English Dictionary* (2nd ed.). Oxford University Press, USA.

Bernstein, E. (2011, March 8). Reply All Horror Stories: The Button Everyone Loves to Hate. Retrieved April 7, 2011, from http://online.wsj.com/article/SB10001424052748703386704576186520353326558.html

von Bismarck, J. (2008). Image Fulgurator. Retrieved March 31, 2011, from http://www.juliusvonbismarck.com/fulgurator/idee.html

Bissas, C., & Hayashi, T. (2008). Distance Lab / Projects / neuromantic. Retrieved June 27, 2010, from http://www.distancelab.org/projects/neuromantic/

Cheok, A. D., Mustafa, A.-ur-R., Fernando, O. N. N., Barthoff, A.-K., Wijesena, J. P., & Tosa, N. (2007). BlogWall: displaying artistic and poetic messages on public displays via SMS. *Proceedings of the 9th international conference on Human computer interaction with mobile devices and services*, MobileHCI '07, 483–486. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1377999.1378058

Cheverst, K., Dix, A., Fitton, D., Kray, C., Rouncefield, M., Sas, C., Saslis-Lagoudakis, G., et al. (2005). Exploring bluetooth based mobile phone interaction with the hermes photo display. *Proceedings of the 7th international conference on Human computer interaction with mobile devices & services*, MobileHCI '05, 47–54. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1085777.1085786

Connelly, M. (2010, June 6). Your Brain on Computers - More Americans Sense Downside to Being Plugged In - NYTimes.com. *The New York Times*, A12.

Cook, S. (1997). Technological Revolutions and the Gutenberg Myth. *Internet Dreams: Archetypes, Myths, and Metaphors*. MIT Press.

Cortesi, D. (2010). TweetStats :: Graphin' Your Stats. Retrieved March 31, 2011, from http://tweetstats.com/

Dewey, J. (1910). *How we think*. Courier Dover Publications.

Dewey, J. (1916). *Democracy And Education*. Free Press.

Eppler, M. J. (2006). A comparison between concept maps, mind maps, conceptual diagrams, and visual metaphors as complementary tools for knowledge construction

and sharing. *Information Visualization*, *5*(3), 202-210. doi:10.1057/palgrave.ivs.9500131

Facebook. (2011). Statistics | Facebook. Retrieved April 2, 2011, from http://www.facebook.com/press/info.php?statistics

fast-food. (2011). *Merrian-Webster Online Dictionary*. Retrieved from http://www.merriam-webster.com/dictionary/fast-food

Ferris, S. P. (2002). Writing Electronically: The Effects of Computers on Traditional Writing. *The Journal of Electronic Publishing*, *8*(1). doi:10.3998/3336451.0008.104

Fry, B., & Reas, C. (2010). Processing.org. Retrieved June 28, 2010, from http://processing.org/

Gaver, B., Dunne, T., & Pacenti, E. (1999). Design: Cultural probes. *interactions*, *6*, 21–29. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/291224.291235

Goldberg, A., & Flegal, R. (1982). ACM president's letter:Pixel Art. *Commun. ACM*, *25*(12), 861-862.

Google Inc. (2011). Google Voice - One phone number, online voicemail, and enhanced call features. Retrieved March 31, 2011, from https://www.google.com/accounts/ServiceLogin?service=grandcentral&passive=1209600&continue=https://www.google.com/voice&followup=https://www.google.com/voice&ltmpl=open

Govindarajan, V., & McCreary, L. (2010, November 16). How U.S. Businesses Can Really Win in India. Retrieved April 26, 2011, from http://www.businessweek.com/managing/content/nov2010/ca20101115_713170.htm

Graffiti Research Lab. (2007). Graffiti Research Lab » L.A.S.E.R. Tag. Retrieved March 31, 2011, from http://graffitiresearchlab.com/projects/laser-tag/

Gronbæk, K., Rohde, A., Sundararajah, B., & Bech-Petersen, S. (2006). InfoGallery: informative art services for physical library spaces. *Proceedings of the 6th ACM/IEEE-CS joint conference on Digital libraries*, JCDL '06, 21–30. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1141753.1141757

Gronewold, N. (2009, November 24). One-Quarter of World's Population Lacks Electricity: Scientific American. Retrieved April 26, 2011, from http://www.scientificamerican.com/article.cfm?id=electricity-gap-developing-countries-energy-wood-charcoal

Hallnäs, L., & Redström, J. (2001). Slow Technology: Designing for Reflection. *Personal Ubiquitous Comput.*, *5*(3), 201-212.

Hampton, K. N. (2010). Internet Use and the Concentration of Disadvantage: Glocalization and the Urban Underclass. *American Behavioral Scientist*, *53*(8), 1111 -1132. doi:10.1177/0002764209356244

Hancock, T. (2010). Social Sustainability. Retrieved June 27, 2010, from http://newcity.ca/Pages/social_sustainability.html

Honeycutt, C., & Herring, S. C. (2009). Beyond Microblogging: Conversation and Collaboration via Twitter. *Proceedings of the 42nd Hawaii International Conference on System Sciences* (pp. 1-10). IEEE Computer Society. Retrieved from http://portal.acm.org/citation.cfm?id=1488734.1489848&coll=Portal&dl=GUIDE&CFID=83519874&CFTOKEN=94833448

Howe, J. (2006). The Rise of Crowdsourcing. *Wired*, *14*(6).

Hulkko, S., Mattelmäki, T., Virtanen, K., & Keinonen, T. (2004). Mobile probes. *Proceedings of the third Nordic conference on Human-computer interaction*, NordiCHI '04, 43–51. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1028014.1028020

International Telecommunications Union. (2010). Free statistics - International Telecommunications Union. *Free statistics - International Telecommunications Union*. Retrieved October 12, 2010, from http://www.itu.int/ITU-D/ict/statistics/

Ishii, H., & Ullmer, B. (1997). Tangible bits: towards seamless interfaces between people, bits and atoms. *Proceedings of the SIGCHI conference on Human factors in computing systems*, CHI '97, 234–241. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/258549.258715

Itō, M., Baumer, S., & Bittanti, M. (2009). *Hanging out, messing around, and geeking out: kids living and learning with new media*. MIT Press.

Jackson, S. E. (1996). The consequences of diversity in multidisciplinary work teams.

Java, A., Song, X., Finin, T., & Tseng, B. (2007). Why we twitter: understanding microblogging usage and communities. *Proceedings of the 9th WebKDD and 1st SNA-KDD 2007 workshop on Web mining and social network analysis* (pp. 56-65). San Jose, California: ACM. doi:10.1145/1348549.1348556

Kern, S. (2003). *The Culture of Time and Space, 1880-1918*. Harvard University Press.

King, S., & Forlizzi, J. (2007). Slow messaging: intimate communication for couples living at a distance. *Proceedings of the 2007 conference on Designing pleasurable products and interfaces*, DPPI '07, 451–454. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1314161.1314204

Kjeldskov, J., Paay, J., O'Hara, K., Smith, R., & Thomas, B. (2009). FrostWall: a dual-sided situated display for informal collaboration in the corridor. *Proceedings of the 21st Annual Conference of the Australian Computer-Human Interaction Special Interest Group:*

Design: Open 24/7, OZCHI '09, 369–372. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1738826.1738900

Linn, S., & Kelliher, A. (2010). Speak More Slowly! Developing better community awareness through localized reflective media systems. *IDSA DIY 2010*. Retrieved from http://www.idsa.org/content/content1/speak-more-slowly

Linn, S., Spicer, R., & Kelliher, A. (2011). Discursive Architecture: integrating buildings, displays and text messages. Retrieved from http://www.silvanlinn.com/msd/

Lohr, S. (2007, December 20). Is Information Overload a $650 Billion Drag on the Economy? - NYTimes.com. Retrieved March 30, 2011, from http://bits.blogs.nytimes.com/2007/12/20/is-information-overload-a-650-billion-drag-on-the-economy/

Lozano-Hemmer, R. (2011). Rafael Lozano-Hemmer. Retrieved April 8, 2011, from http://www.lozano-hemmer.com/index.php

Maeda, J. (2006). *The Laws of Simplicity*. Cambridge, MA: MIT Press.

Mankoff, J., Dey, A. K., Hsieh, G., Kientz, J., Lederer, S., & Ames, M. (2003). Heuristic evaluation of ambient displays. *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 169-176). Ft. Lauderdale, Florida, USA: ACM. Retrieved from http://portal.acm.org.ezproxy1.lib.asu.edu/citation.cfm?id=642642

Mann, M. (2010). Inbox Zero. Retrieved June 27, 2010, from http://inboxzero.com/

McLuhan, M. (1964). *Understanding media: the extensions of man*. McGraw-Hill.

Myers, B., Hudson, S. E., & Pausch, R. (2000). Past, present, and future of user interface software tools. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *7*, 3–28. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/344949.344959

Neuro Productions. (2009). Twitter Friends Network Browser. Retrieved March 31, 2011, from http://www.neuroproductions.be/twitter_friends_network_browser/

Nielsen, J. (2003). Information Pollution (Jakob Nielsen's Alertbox). Retrieved March 30, 2011, from http://www.useit.com/alertbox/20030811.html

Nikkila, S., Linn, S., Sundaram, H., & Kelliher, A. (2011). Playing in Taskville: Designing a Social Game for the Workplace. Retrieved from http://www.silvanlinn.com/msd/

O'Hara, K., Harper, R., Unger, A., Wilkes, J., Sharpe, B., & Jansen, M. (2005). TxtBoard: from text-to-person to text-to-home. *CHI '05 extended abstracts on Human factors in computing systems*, CHI EA '05, 1705–1708. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1056808.1057002

Rauch, J. (2010). Slow Media Blog. Retrieved June 27, 2010, from http://slowmedia.typepad.com/

Redhead, F., Dekker, A., & Brereton, M. (2010). NNUB: the neighbourhood nub digital noticeboard system. *Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction*, OZCHI '10, 418–419. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1952222.1952324

Sale, K. (1995). *Rebels against the future: the Luddites and their war on the Industrial Revolution : lessons for the computer age*. Basic Books.

Shirky, C. (2008, September 16). *It's not information overload. It's filter failure.* Keynote presented at the Web 2.0 Expo, New York, NY. Retrieved from http://blip.tv/file/1277460

Slow Food International. (2010). . Retrieved June 27, 2010, from http://www.slowfood.com/

Strauss, C., & Fuad-Luke, A. (2008). The Slow Design Principles. *Proceedings of "Changing the Change."*

Stross, R. (2008, April 20). Struggling to Evade the E-Mail Tsunami. *The New York Times*. Retrieved from http://www.nytimes.com/2008/04/20/technology/20digi.html?_r=4&oref=slogin&oref=slogin

Terrell, G. B., & McCrickard, D. S. (2006). Enlightening a co-located community with a semi-public notification system. *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work* (pp. 21-24). Banff, Alberta, Canada: ACM. doi:10.1145/1180875.1180879

Thoreau, H. D. (1995). *Walden: an annotated edition*. Houghton Mifflin Harcourt.

Toffler, A. (1970). *Future shock*. New York, NY: Random House.

Toups, Z. O., Kerne, A., & Hamilton, W. (2009). Game design principles for engaging cooperative play: core mechanics and interfaces for non-mimetic simulation of fire emergency response. *Proceedings of the 2009 ACM SIGGRAPH Symposium on Video Games*, Sandbox '09, 71–78. doi:http://doi.acm.org.ezproxy1.lib.asu.edu/10.1145/1581073.1581085

Troy, D. (2010). twittervision. Retrieved March 31, 2011, from http://twittervision.com/

Twitter. (2010). Twitter Blog: Measuring Tweets. Retrieved March 31, 2011, from http://blog.twitter.com/2010/02/measuring-tweets.html

Twitter. (2011). API Documentation | dev.twitter.com. Retrieved March 31, 2011, from http://dev.twitter.com/doc

VR/URBAN. (2010). VR/URBAN | reclaim the screens | Interactive Media Installation |. Retrieved March 30, 2011, from http://www.vrurban.org/smslingshot.html

Walther, J. (1996). Computer-Mediated Communication. *Communication Research*, *23*(1), 3 -43. doi:10.1177/009365096023001001

Weinberger, D. (2007). *Everything Is Miscellaneous: The Power of the New Digital Disorder* (First Edition.). Times Books.

Weiser, M., & Brown, J. (1995). Designing Calm Technology. Retrieved June 27, 2010, from http://www.ubiq.com/weiser/calmtech/calmtech.htm

Wellman, B. (2002). Little Boxes, Glocalization, and Networked Individualism. In M. Tanabe, P. Besselaar, & T. Ishida (Eds.), *Digital Cities II: Computational and Sociological Approaches* (Vol. 2362, pp. 10-25). Berlin, Heidelberg: Springer Berlin Heidelberg. Retrieved from http://www.springerlink.com/content/5gwnj5p8j293qlua/

Wurman, R. S., Leifer, L., Sume, D., & Whitehouse, K. (2001). *Information anxiety 2*. Que.

YouTube LLC. (2011). YouTube - Broadcast Yourself. Retrieved March 31, 2011, from http://www.youtube.com/

Zhao, D., & Rosson, M. B. (2009). How and why people Twitter: the role that micro-blogging plays in informal communication at work. *Proceedings of the ACM 2009 international conference on Supporting group work* (pp. 243-252). Sanibel Island, Florida, USA: ACM. doi:10.1145/1531674.1531710

APPENDIX A

SURVEY DOCUMENTS

Twitter Usage Patterns Survey

Thank you for participating in this user study. You are helping develop a new generation of social media displays to enhance and support group-based work interactions. This survey should take less than 15 minutes to complete all together.
* Required

Anonymous identifier *Please enter the anonymous identification number you received with the link to this survey.

Demographics

What is your gender? *

- Male
- Female

In what year were you born? *Four digits -- eg., "1981".

Twitter Use

This section deals with your regular Twitter use and communication with members of the reflective living research group.

When did you first start using Twitter? *Month and year -- for instance, for October 2008, write "10-2008
"

How many hours per week would you estimate you typically spend using Twitter? *Reading, posting, answering, retweeting messages.

- Less than one hour
- 1-2 hours
- 2-5 hours
- 5-10 hours
- 10-20 hours
- 20 or more hours

What would you say is your primary reason for using Twitter? *Check all that apply.

- Keep in touch with friends
- Keep notes for myself about my daily experiences
- Comment about things I read online

- ☐ Communicate with colleagues
- ☐ Meet new people
- ☐ Keep notes related to my research interests
- ☐ Other: _____

What percentage of your Twitter messages would you say are about personal matters? *

What percentage of your Twitter messages would you say are about the news, current events, or things you think are newsworthy? *

What percentage of your Twitter messages would you say are related to the research activities and interests of the Reflective Living Research Group? *

In comparison to other Reflective Living Group members, how would you classify your Twitter activity? *

- ● Very active
- ● Active
- ● Reasonably Active
- ● Not very active
- ● Not active

How often do you use a Twitter web application? *

What is the name, if any, of your preferred Twitter web application?

How often do you use a Twitter desktop application? *

What is the name, if any, of your preferred Twitter desktop application?

How often do you use a Twitter mobile application? *

What is the name, if any, of your preferred Twitter mobile application?

KiteViz Heuristic Evaluation

Now that you've taken a look at the KiteViz display, please fill out this form with your opinions on its aesthetics and effectiveness. Thanks very much!
* Required

What is your gender? *

- ● Male
- ● Female

In what year were you born? Four digits, eg. "1981" *

Approximately how many years' experience do you have in a design-, art-, or user-interaction-related field? Please include university or college education, and time working. *

Do you currently have a Twitter account? *

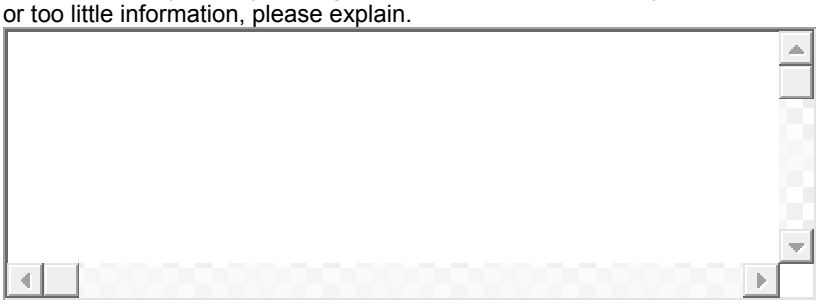
- ● Yes
- ● No

How many hours per week would you estimate you typically spend using Twitter (posting, commenting and reading others' posts), even if you don't have a Twitter account? *

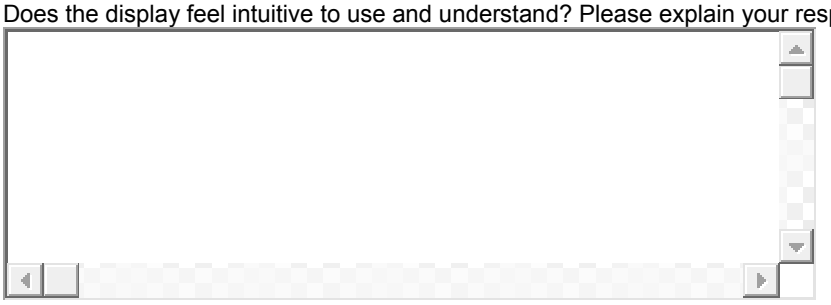
- ● None
- ● Less than one hour
- ● 1-2 hours
- ● 2-5 hours
- ● 5-10 hours
- ● 10-20 hours
- ● 20 or more hours

Heuristic Evaluation

Sufficient Information Design
Does the display convey “the right amount” of information? If you feel the display conveys too much or too little information, please explain.



Consistent and Intuitive Mapping
Does the display feel intuitive to use and understand? Please explain your response.

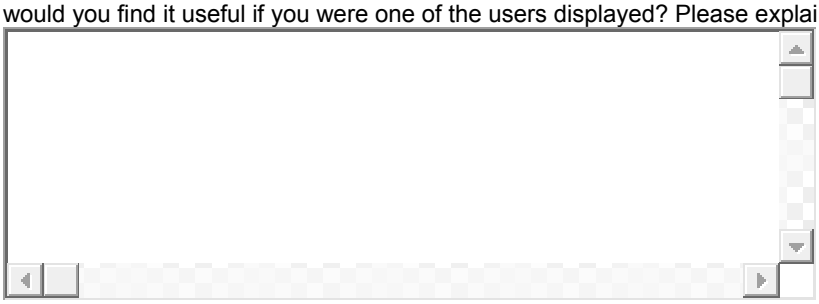


Match Between System and Real World
Do you believe the concepts, graphics and terms understandable, natural and logical? Please explain your response.

Visibility of State
Is it obvious what state the display is in, and when it changes to another state? Please explain your response.

Aesthetic and Pleasing Design
Do you find the display visually attractive? Please explain your response.

Useful and Relevant Information
Do you think that the information conveyed is useful and relevant to users of Twitter? In particular, would you find it useful if you were one of the users displayed? Please explain your response.

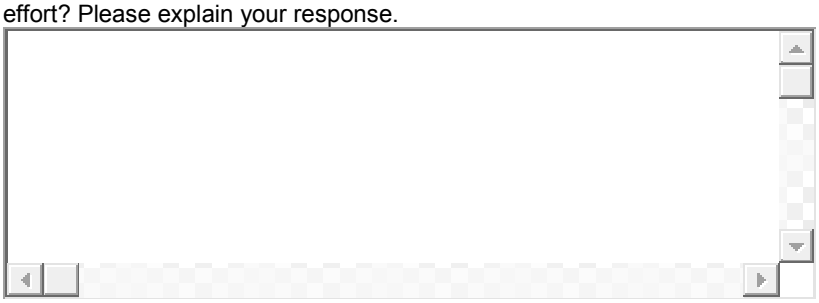


Visibility of System Status
Is it obvious from the display what kinds of actions the Twitter users are engaging in? Please explain your response.

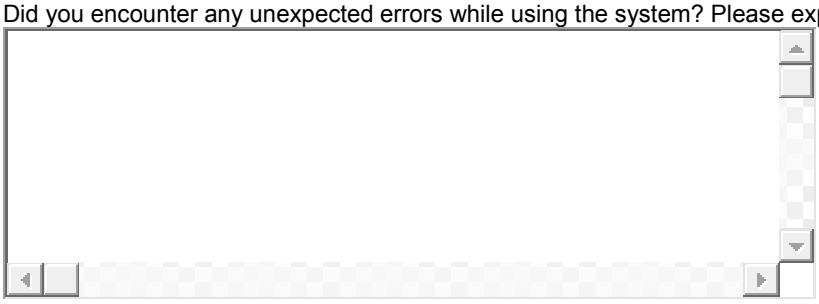
User Control and Freedom
Do you feel that the system provides a reasonable level of user control over the display? Please explain your response.

Easy Transition to More In-Depth Information
Do you feel that it is easy to view deeper levels of information on the display? Please explain your response.

"Peripherality" of Display
Do you think the display is unobtrusive? Do you feel it is easily monitored, without a great deal of effort? Please explain your response.



Error Prevention
Did you encounter any unexpected errors while using the system? Please explain your response.



Taskville Post-Study Questionnaire

Thank you for participating in this user study. You are helping in the development of a fun, interactive visualization that facilitates individual, group, and organizational awareness of work related tasks being performed. This survey should take approximately 6 minutes to complete.
* Required

Secret Number

0. Please enter the secret number that you chose when you submitted your consent form (the last three digits of your ASU ID). This is solely for the purpose of linking your pre and post questionnaires and will not be used to identify you in any way. *

Work Methods I

For the purpose of this survey, a task can be any activity that you partake in that you view as productive and is focused on work. For example, reading a research paper can be considered a task as well as calibrating software for a demonstration.

1. On average, how many work related tasks do you complete in a week?

- 0
- 1 - 3
- 4 - 6
- 7 - 9
- 10 - 12
- More than 12
- Other:

2. What percentage of these tasks are short tasks that take less than 2 hours to complete?

- 0 - 25%
- 26 - 50%
- 51 - 75%
- 76 - 100%

3. How many hours per day do you spend on work related tasks?

- Less than 1 hour
- 1 - 2 hours
- 3 - 4 hours
- 5 - 6 hours

- ● 7 - 8 hours
- ● 9 - 10 hours
- ● 11 - 12 hours
- ● More than 12 hours

4. During what times of the day do you feel that you are the most productive at work?

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Late night (After 11:00 PM)

5. On which day(s) do you feel that you have the largest number of work related tasks to complete?

- ☐ Sunday
- ☐ Monday
- ☐ Tuesday
- ☐ Wednesday
- ☐ Thursday
- ☐ Friday
- ☐ Saturday

6. Do you have any days in the week that you take off regularly from work? If so, what days?

- ☐ Sunday
- ☐ Monday
- ☐ Tuesday
- ☐ Wednesday
- ☐ Thursday
- ☐ Friday
- ☐ Saturday
- ☐ I normally do not take any days off from work

Work Methods II

Please rate how much you agree with the following statements with 1 indicating that you strongly disagree and 7 indicating that you strongly agree.

7. I am aware of the number of tasks that I complete every day.

	1	2	3	4	5	6	7	
Strongly disagree	●	●	●	●	●	●	●	Strongly agree

8. I am aware of the number of tasks that my colleagues in my group work on every day.

	1	2	3	4	5	6	7	
Strongly disagree	●	●	●	●	●	●	●	Strongly agree

9. I am aware of the number of tasks that my AME colleagues in other groups are working on every day.

	1	2	3	4	5	6	7	
Strongly disagree	●	●	●	●	●	●	●	Strongly agree

10. I enjoy working on work related tasks.

	1	2	3	4	5	6	7	
Strongly disagree	●	●	●	●	●	●	●	Strongly agree

11. I am motivated when working on work related tasks.

	1	2	3	4	5	6	7	
Strongly disagree	●	●	●	●	●	●	●	Strongly agree

12. My work-related tasks frequently involve collaboration with other members of my group

	1	2	3	4	5	6	7	
Strongly disagree	●	●	●	●	●	●	●	Strongly agree

13. The task-management tools that I use make it easy to collaborate with others

	1	2	3	4	5	6	7	
Strongly disagree	●	●	●	●	●	●	●	Strongly agree

14. The task management tools that I use allow me to easily see what tasks others in my group are currently working on.

1	2	3	4	5	6	7

Strongly disagree ● ● ● ● ● ● ● Strongly agree

15. I tend to work on the same schedule as the other members of my group.

1 2 3 4 5 6 7

Strongly disagree ● ● ● ● ● ● ● Strongly agree

16. I feel that I perform an above-average amount of work compared to others in my group.

1 2 3 4 5 6 7

Strongly disagree ● ● ● ● ● ● ● Strongly agree

17. I feel that I perform an above-average amount of work compared to others outside of my group.

1 2 3 4 5 6 7

Strongly disagree ● ● ● ● ● ● ● Strongly agree

APPENDIX B

YOUR ____ HERE SUBMISSIONS

Study 1: Design School		
Content	**Approved ?**	**Rejection reason?**
Fernando is the design man	approved	
Ethiopiastudio presentation Monday	denied	no-design
this is design, not an ad	approved	
cool Design!	approved	
Emily and Alex love graphic design!	approved	
Ahhhhhh graphic design	approved	
Designer message	approved	
Designer jeans? What about designer life.	approved	
We are all designed	approved	
sleepy designers	approved	
Designgised	approved	
We are the ASU design monkeys!	approved	
Make it work, designers.	approved	
Design, just design	approved	
I love interior designers!	approved	
what a neat design	denied	testing phrase
see our junior industrial design show this Friday!	approved	
Make it work, designers.	approved	
industrial design is killing me	denied	Auto-reject: killing
hella design bro!	approved	
edouard u. is the best design er	approved	
Steve is a mean designer!	approved	
steve is	denied	no-design
Sorry but Kenia C. is the Best designer!!!	approved	
Architecture students are the best	denied	no-design
I like your design on the design building. it was very well designed	approved	
Edy is a bomb designer	denied	Auto-reject: bomb
Interior design is not a major	approved	
Design is as design does	approved	
Design me a sammich woman	denied	inappropriate
jenny chang is a design queen	approved	
Design us a new design building	approved	
im sorry but i dont see the word design in architechture.	approved	
im sorry but i dont see the word design in architechture.	denied	duplicate
design? LOL	approved	
It's interior decorating not interior design	denied	inappropriate
gjfvngjfurikcnvfhd design	denied	junk
im sorry but i dont see the word design in	denied	duplicate

architechture.		
87D	denied	no-design
interior architecture not interior design	approved	
INDUSTRIAL DESIGNERS DESIGNED U! Vv Kc	approved	
In Russia, school design you!	approved	
wish i was as cool as a designer	approved	
87D	denied	no-design
Why?	denied	no-design
Sorry, we can't accept your submission. Here's why:	denied	(system bug)
I don't understand the point of this design	denied	inappropriate
Design is planned	approved	
what's going on in the design building tonight?	approved	
Design blows my mind!	approved	
Design makes me tired.	approved	
Design	approved	
I like turtles and design	approved	
Design life.	approved	
Design es de chet	approved	
design the future.	approved	
there's no design in the word architecture	approved	
Yoomin is a good design er	approved	
design esBird habitats	denied	duplicate
design Bird habitats	approved	
jenny and eddy: cutest design couple ever	approved	
	denied	testing blank phrase
Design > business	approved	
Making design happen	approved	
I don't complain I design	approved	
I love Indesign	approved	
Design is bomb diggity	denied	Auto-reject: bomb
everything is the divine design of the Holy Creator	denied	inappropriate
Design turns me on	approved	
Don't cry, design.	approved	
Design stand	approved	
Design: Never Stop Dancing!	approved	
Design makes the world go round	approved	
All Your Design Are Belong To Us	approved	
Design -Dave makes it happen	approved	
Ruben p is the best designer	approved	
Hogwarts School of Design and Wizardry	approved	
t(' . ' t) Design	denied	inappropriate
I Can Haz Designz Pleez?	approved	
Sallie designs the world of our mind brains eyeball	approved	

Team figment effect rocks!	denied	no-design
School of art and Design	approved	
Show me your boobs (Design)	denied	Auto-reject: boobs
Gregory Sale Designs Dreams	approved	
The designator has spoken!	approved	
Doctors design the best chests	denied	inappropriate
Design-Nation	approved	
Art > Design	approved	
Art + Design = <3	approved	
Building full of zombies design	approved	
8====Design===D	denied	inappropriate
(.) (.) Design good ones	denied	inappropriate
My Design Goes Pew Pew	approved	
Intermedia designs the world	approved	
Design happens <3	approved	
	denied	no-design
ZGVzaWduIGVuIGZyYW7nYWlzDQoNCi0tDQpTZW50IHVzaW5nIFNNUy10by1IbWFpbC4gIFJlcGx5	denied	junk
i design audrey's pubic hair sculptures	denied	inappropriate
audrey is a cool designer	approved	
Design SMASH!!!	approved	
DC is a dope designer	denied	Auto-reject: dope
Como de designo	approved	
If youre to design for school	approved	
I once open mouth designed a horse...	denied	inappropriate
Dont deisgn me baby!	denied	no-design
Dc is dope 'design'	denied	Auto-reject: dope
No sir, Santa is teh best deisgner!	denied	no-design
No sir, Santa is teh best designer!	approved	
I design ppl for fun mayn	approved	
Design SMASH!!!	approved	
I once open mouth designed a horse...	denied	inappropriate
I design ppl for fun mayn	denied	inappropriate
Hogwarts school of design and wizardry	denied	bug
Senior design studio rocks	approved	
Word to your mother	denied	no-design
Your mother was born on a pirate ship of design	approved	
Word to your design	approved	
People do dirty things in the design building at night.	denied	inappropriate
Barnies, for design	approved	
Graduate Design Show	approved	
VV master's of science in design posters inside NOW! VV	approved	

I'm so done with Design for this semester!	approved	
Hello	denied	no-design
Exhaustion by desing	denied	no-design
I can design anything give me a job	approved	
Design is for everyone	approved	
Let's Go Hyde industrial Design solutions	approved	
Live, laugh, design	approved	
Hello design world	approved	
Design Break Dance Party!	approved	
Exhaustion by design	approved	
Design-o-rama!	approved	
Muschi is mushy	denied	no-design
Design with intent.	approved	
The design show tonight was rasierte muschi!!!!	approved	
Design a better sign	approved	
	denied	no-design
Mark will design one day!	approved	
I dnooo jneeed designated driveeerr	approved	
Fantasticly sleep-deprived designers	approved	
Dployd design	approved	
Joe sucks balls in design studio lol	denied	Auto-reject: sucks, balls
Son gay joe and john designer	denied	Auto-reject: gay
Joe mama bolas in design studiol	denied	inappropriate
Why I coooo an u not, why I drive nice caaa an u don't, cuz I design zats	denied	
Joe es Joto y chupa mucho in design	denied	inappropriate
Ninas son designadoras tambien	denied	inappropriate

Study 2: Digital Culture Open House		
Content	**Approved?**	**Rejection reason?**
I <3 Digital culture	approved	
Everything here in digital culture is fantastic!	approved	
A bit of Digital culture	approved	
Digital culture is about networks	approved	
digital culture open house rehearsal!	approved	
it's the digital culture open house rehearsal!	approved	
This is freakin awesome	denied	no “digital culture”
Digital culture contains no profanity	approved	
Analog is pre- digital culture yo!	approved	
Digital culture is about the remix	approved	
digidigidigidigital culture	approved	
how do you say digital culture in Latin?	approved	
Turd	denied	Auto-reject: turd
Digital culture smells like turd	denied	Auto-reject: turd
Digital culture is our baby	approved	
We love digital culture ... I think?	approved	
young 'uns love digital culture!	approved	
Digital culture is evolution in action.	approved	
Is Totally Awesome!!!	denied	no “digital culture”
Digital Culture is Totally Awesome!!!	approved	
Can one have digital culture shock?	approved	
Professor Keliher is the best professor in digital culture!	approved	
Digital Culture :-)	approved	
digital culture / kebudayan digital	approved	
Digital Culture is the wave of the future!!!	approved	
Digital Culture is Digital Culture!	approved	
I'm confused about what digital culture isss!!!!!!!!!!	approved	
I though DESIGN was a part of digital culture???	approved	
I thought DESIGN was a part of digital culture???	approved	
Digital culture gives me a case of the happy pants!	approved	
Digital culture is about reflection	approved	
does digital culture have a parser? /;;\\t{}}{!	approved	
No sleep 'till digital culture (digital culture!)	approved	
digital culture is danced	approved	
Does digital culture?	approved	
We built this city on digital culture!	approved	
digital culture walks into a bar . . .	approved	
	denied	no “digital culture”
oops, digital culture did it again	approved	

Digital culture lights my pants on fire.	denied	inappropriate
Warning: late night digital culture fab may contain profanity.	approved	
digital culture is virtually ephemeral.	approved	
I am lucky to be a digital culture student.	approved	
I will use my digital culture degree to change the face of the gaming	approved	
Y aren't u @ digital culture ?	approved	
digital culture = Aeron Chair ethnograpy	approved	
EVA LOVES DIGITAL CULTURE AND RAFAEL	approved	
digital culture is better than regular culture	approved	
Rafael wants to study digital culture yaaaaay	approved	
Someone needs to apply a digital culture project to World of Warcraft. Go	approved	
Digital culture and loren olson rock	approved	
Djertyuikwshertyujnw digital culture hhertyujnwszdxgvedw	denied	junk
In Soviet Russia, digital culture learns you.	approved	
Creating community	denied	no “digital culture”
Digital culture is about breaking things.	approved	
I think that digital culture is hard to spell.	approved	
Do the digital culture dance!	approved	
Digital Culture digital culture digital culture digital culture.	denied	junk
We in digital culture, we fear an unmatched {	denied	Auto-reject: fear
Digital culture consumes lots of caffeine	approved	
Digital Culture > Analog Culture.	approved	
These aren't the digital culture droids you were looking for	approved	
Thanks for inviting us to digital culture, dad :) grace an ellie	approved	
We in digital culture fear an unmatched {	denied	Auto-reject: fear
We in digital culture fear an unmatched{	denied	Auto-reject: fear
We in digital culture fear an unmatched open bracket.	denied	Auto-reject: fear
	denied	Auto-reject: fear
We in digital culture fear an unmatched open bracket.	denied	Auto-reject: fear
Digital Culture can outrun Superman.	approved	
CAPS LOCK MAKES digital culture LOUDER.	approved	
Texting while in digital culture classes makes you a cool guy.	approved	
Be proud your digital culture is showing	approved	
Windows has a place in digital culture just as much as anything from Apple.	approved	
Windows started the digital culture revolution.	approved	
PC PC PC PC PC PC PC PC PC digital culture MAC MAC MAC MAC MAC MAC	approved	
LEFT <- digital culture -> RIGHT	approved	

Digital culture	approved	
What is Digital culture?	approved	
Jessica does Digital culture	approved	
Nathan breathes Digital culture	approved	
Jessicas life consists of digital culture	approved	
Digital makes the world go round.	denied	no “digital culture”
Digital culture Burt Reynolds was here	approved	
Digital culture is fully buzzword compliant.	approved	
Digital culture	denied	no content
Digital culture will be the death and rebirth of us all.	denied	Auto-reject: death
Digital culture creates excellence	approved	
Digital culture requires engagement	approved	
Digital culture is transformation	approved	
Digital culture welcomes the Council for Excellence	approved	