REACH: The Local Social Favor Exchange

A Proximal Messaging System

Boris G. Kizelshteyn

B.A. in Philosophy, Oberlin College, 1996
A.S. in Computer Science, Oberlin College, 1996

Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements for the degree of
Master of Science in Media Arts and Sciences
at the Massachusetts Institute of Technology
February 2012

Author _____

Boris G. Kizelshteyn
Program in Media Arts and Sciences
September 15, 2011

Certified by _____

Andrew B. Lippman
Senior Research Scientist
Associate Director
MIT Media Laboratory

Accepted by _____

Mitchel Resnick
Academic Head
Program in Media Arts and Sciences

REACH: The Local Social Favor Exchange

A Proximal Messaging System

by Boris G. Kizelshteyn

Thesis Reader

Henry Lieberman
Research Scientist
MIT Media Laboratory

REACH: The Local Social Favor Exchange

A Proximal Messaging System

by Boris G. Kizelshteyn

Thesis Reader

Chris Schmandt
Principal Research Scientist
MIT Media Laboratory

REACH: The Local Social Favor Exchange

A Proximal Messaging System

by Boris G. Kizelshteyn

Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements for the degree of
Master of Science in Media Arts and Sciences
at the Massachusetts Institute of Technology
February 2012

ABSTRACT

We define proximal messaging as that category of information transaction that takes into account the physical, social and temporal proximity between the sender and recipient as it relates to the content of the message. We undertake an analysis of the social factors powering the widespread adoption of social, locative and collaborative systems and assert that their evolution is driven by natural human communication instincts that tend towards increasingly personal and real world interactions. We go on to present Reach, a proximal messaging system realized as a local social favor exchange that leverages users' existing social and mobility network activity to match them with people they can help and who can help them. In prototyping this system we explore how best to work with these dimensions of articulated real-time personal information and validate our work by conducting a user study on the experience of requesting favors and being called to serve by Reach.

Thesis Supervisor

Andrew B. Lippman

Senior Research Scientist

Associate Director

MIT Media Laboratory

Acknowledgements

I would like to thank:

My advisor Andrew Lippman for giving me the opportunity to study at the MIT Media Lab and for pushing me out of my comfort zone.

My thesis readers Henry Lieberman and Christopher Schmandt who provided straightforward and expert advice on how to conduct the research that constitutes this document.

My colleagues in the Viral Spaces group Polychronis Ypodimatopoulos, Julia Ma, Matthew Blackshaw, Dawie Shen, Kwan Hong Lee, Grace Woo, Inna Koyrakh and Rick Borovoy for their great advice and inspiration.

And finally my wife Jeanette and the rest of my family who helped me keep everything in perspective.

Table of Contents

1. INTRODUCTION

Western man acquired from the technology of literacy the power to act without reacting. The advantages of fragmenting himself in this way are seen in the case of the surgeon who would be quite helpless if he were to become humanly involved in his operation. We acquired the art of carrying out the most dangerous social operations with complete detachment. But our detachment was a posture of noninvolvement. In the electric age, when our central nervous system is technologically extended to involve us in the whole of mankind and to incorporate the whole of mankind in us, we necessarily participate. In depth, in the consequences of our every action. It is no longer possible to adopt the aloof and dissociated role of the literate Westerner. [1]

This prescient passage was written by literary theorist Marshall McLuhan in 1964 and is a fitting place to start our discussion of proximal messaging, as this technology stands to bring us closer to a "technologically extended" nervous system that enables the incorporation of the "whole of mankind in us" than any preceding technology. We define proximal messaging as that category of information transaction that takes into account the physical, social and temporal proximity between the sender and recipient as it relates to the content of the message. We propose that because of the increasing ubiquity of social networking and location sharing systems this type of information filtering is possible for the first time on a large enough scale to support the rise of truly novel and potentially transformative modes of social interaction. Indeed, we side with existing literature that describes the pervasiveness of communication systems tightly integrated into our sociality

and mobility as a new kind of sense.[2] We believe that the ability to apply the proximal dimension to digital communication is this sense in action; and understand McLuhan's words simultaneously as an aspirational use-case for proximal messaging, as well as an articulation of the responsibility that comes with possessing it.

This paper is structured into three parts:

Part one analyzes the literature and prior work in the areas that motivated this undertaking. These are broadly: 1. *social-network services* - systems that focus on building and reflecting social networks or social relations among people, who, for example, share interests and/or activities;[3] 2. *location-based* services, systems that enable users to share their real-time and/or historical location information online;[4] and 3. *peer production and consumption systems,* the ecosystem of online services that enable an economic model based on sharing, swapping, bartering, trading or renting access to products and services on a previously impossible scale.[5] Our discussion here centers on the social factors driving the adoption of these services and asserts that their evolution is driven by natural human communication instincts and as they become increasingly widespread and invisible they will also become increasingly personal and present in the physical world. We argue that the adoption of this kind of technology is dependant on the rise of trustworthy filtering systems and present a solution for filtering messages along multiple dimensions of proximity.

Part two detail *Reach*, a prototype local social favor exchange that we have built. *Reach* a real-time social exchange aimed at connecting people for face-to-face interaction, filtered by physical, social and temporal proximity. We propose that people are inclined to help each other if it is convenient for them to do so and they can exercise control over who they encounter in the course of the interaction. We argue that a system that provides value on a peer-to-peer basis is necessary in order to motivate people to share increasingly personal details of their mobility and social graphs. As such, a favor exchange is an excellent illustrative instantiation of a proximal communication network. We then proceed to model this problem domain using an attributed, multi-relational properties graph structure[6] and detail its implementation in our protype application.

Part three describes a series of evaluations that were conducted to measure the efficacy of our system and to validate the concept of proximal communication as proposed by this paper. We conducted a qualification survey to reveal users' attitudes towards real-time social exchanges and used these findings to recruit active users of location sharing services for a usuability study of our system. Once selected, users were asked to sign up for *Reach* and complete a survey on their willingness to participate in a real-time favor exchange. Of the qualified population, willingness to participate in the exchange was high. Next, users were asked to request a favor on *Reach* and compare how they would have requested an equivalent favor today. User's equated requesting a favor on *Reach* with requesting a favor from a friend,

suggesting that a sense of intimacy was preserved by the interaction. Finally, we messaged a subset of the qualified users with favor requests and surveyed their experience of being called to serve by *Reach.* We found that most were targeted accurately with the request and were ready to help.

We conclude with remarks on future enquiry, centered specifically on location accuracy, reputation in real-time local social exchanges and the role natural language processing systems could play in enabling systems like *Reach.*

2. MOTIVATION

In his seminal 1991 paper on ubiquitous computing, *The Computer for the 21st Century*, Mark Weiser opined that "[t]he most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."[7] This statement elegantly describes a central motivation for our discussion, namely that when a technology becomes "invisible," and part of the "fabric" of everyday life and when it becomes a "utility" like the delivery of municipal power and water, people build their lives on the expectation of its continuance. Over the past five years we have observed Facebook[8] and Twitter,[9] with their combined usership of over a billion people[10, 11] be promoted to the status of defacto communication utilities.[12] Facebook serving the demand for easy maintenance of user's social networks[3] and Twitter serving the demand for broadcasting peer-to-peer, real-time communication to people outside of it.[13] Additionally over the last two years we have seen the rise of location sharing services, the biggest of which, Foursquare, bolstered by widespread adoption of GPS enabled smartphones,[4] claims nearly a billion checkins,[14] or self reported user location records, illustrating that a demand large enough to support a location sharing utility is gathering. In parallel with these new baselines of networked civilization are emerging as commonplace, nonmarket, nonproprietary, motivations and behaviors.[15] These are most recognizable today as the open-source software movement;

but are now spreading beyond this relative niche to touch potentially every part of society.[5, 15] Our inquiry will discuss the significance of this connected baseline and position the emergence of proximal communication as the next necessary technology to maintain the evolutionary trajectory of the society it has enabled.

2.1 Strong Ties and Weak Ties

As we will be making frequent use of the terms "strong ties" and "weak ties" in the pages ahead to structure our argument, it is important to define their meaning here. When we speak of ties, we mean interpersonal ties and understand their "strength" in the sense used by Mark Granovetter, in his seminal paper entitled *The Strength of Weak Ties*, to mean the combination of time investment, emotional intensity, mutual confiding and reciprocity that characterize the tie.[16] The more of these characteristics define that relationship the stronger the tie.

With this definition in place, we summarize Mark Granovetter's brilliant but initially counter-intuitive observation based on his investigation of the social connections that resulted in his subjects getting jobs: namely that when it comes to social opportunities like finding a job, opening a business or spreading a meme, weak social ties are more important than our long cultivated strong ones.[17] The reason he proposed this is that our close friends move in the same circles we do - that is they are likely to know each other, and as such are exposed to the same information about available

opportunities. In essence to get new information we must activate our *weak ties*,[17] our network of *acquaintances* not our close friends. Our casual connections with people, our weak ties, play a crucial role in our ability to communicate beyond our immediate neighborhood of social links,[18] since by frequenting different social circles than us and our friends they are naturaly exposed to at least some information not available in our circle.[16]

Since it's publication in 1973, the thesis of *The Strength of Weak Ties* has been validated across a number of inter-disciplinary analyses,[17, 19] and as such we accept that the generation of weak ties is an activity people desire to maximize as it leads to increased opportunity.

2.2 Social Systems

The 2003 paper entitled, *Neighboring in Netville*,[20] claims to be the first study to systematically assess the impact of always-on Internet access on the local social ties of a residential community. In 1997, when well below a quarter of the North American population had broadband Internet access at home, the Toronto suburb of Netville was the first-known neighborhood where most of the 109 homes had built in broadband capability.[20] Since this was a planned community, people moved in at the same time and were presumed largely not to know each other previously. Given the opportunity to communicate with anyone, anywhere, about any interest, and at the same

time to message with the neighborhood via an Internet based community bulletin board, the effect of this technology on the formation of neighborhood bonds was surveyed over a two-year period. Reviewed literature agrees that the most significant finding of the study was that the wired population recognized three times as many neighbors by name when seeing them in the neighbothood and regularly talked with twice as many of them than did the non-wired group.[15, 21] In addition to enabling contact with geographically distant others, the Internet demonstrably enhanced the formation and management of weak ties of the sort required to remember a name or stop for a brief chat.[15] While the study concluded that Internet use was neutral to the formation of strong ties, of the sort required for home visits and personally revealing conversations, it demonstrated that it did not dilute them. In fact, when all previous barriers to communication (distance, ability and cost) were removed and people could communicate with anyone, they naturally maintained their normal set of close ties, local and distant, and significantly multiplied their local weak ties. Distant weak ties, ie meeting new people from far away on the Internet did not manifest as a common practice in that community, given the affordances their technology provided.

We take this study as instructive as the routine social software of today has codified many of the emergent behavior patterns exhibited by the residents of Netville. Indeed the two largest online social services, Facebook and

Twitter,[1] have become largely specialized, with strong ties being the provenance of the former and weak ties of the latter. A claim we will now consider in depth.

There exists an extensive literature on Facebook and its uses,[22, 23] so a simple received definition will suffice here. Facebook is a social network service providing users with the ability to: 1. construct a public or semi-public profile within a bounded system, this includes lists of likes, interests and tastes 2. articulate a list of other users with whom they share a connection and 3. view and traverse their list of connections and those made by others within the system.[3] Our interest in it is two-fold; that it is an articulation of people's existing social network and that this has become so valuable a service that it has achieved the status of a utility.

While it is possible to initiate a relationship on Facebook, this is not its frequent purpose,[3] or what marks it as an advance over the basic email and web-browsing functionality available to the early adopters of computer mediated communication,[3] such as the residents of Netville. Instead Facebook is used primarily to maintain relationships between people that share some offline connection.[3] Relationships that may have become extinguished in the face of great distances or as a result of neglect can now survive in perpetuity and thrive with the briefest profile update. This is significant because it marks an evolution pipeline whereby an emergent use

[1] Both of these services have a number of competitors, but as of this writing, they are by far the most popular so they will serve as our illustrative purposes.

for the Internet becomes formalized into an interface a priori adopted by future users. In its relatively raw form as email and web browsing, we found via the Netville study, that the Internet did not interfere with strong ties. Nearly a decade later, Facebook, one of the web's most successful destinations to date, is a dedicated interface adopted by the majority of Internet users for maintaining them.[2]

Facebook has become so successful that its founder's dream of building a social utility[24] has been practically realized. Alongside the fact that people rely on a utility such that everyday life would be significantly impacted in case of a prolonged outage, they also usually don't like it. Facebook is no exception, blogs are abuzz with people threatening to delete their accounts due to frequently flagrant privacy missteps or unhappy encounters with customer service,[25] but as is the hallmark of most utilities people only have a non-choice: if you don't like it, don't use it. So the majority of people stay because they know that if they leave they are likely to become impoverished by that many fewer strong ties.[3] Yochai Benkler, a scholar who is repeatedly cited in this paper, observes that individuals do more of what is easier to do than what requires great exertion.[15] People find enough value in the relationships they maintain via Facebook that they don't want to

---

[2] This is not to say that all declared friends on Facebook are necessarily close ties, research on the topic has demonstrated that many fewer people are actually poked and messaged, an indicator of active relationships, than the user has friends. Nonetheless, those relationships that are active, represent strong ties, and are the primary reason people use Facebook.

[3] Again, there are a number of competitor services, but none have the widespread penetration of Facebook. In order to move from Facebook and still get the same value, all of one's friends would need to move too.

chance losing them to the vagaries that may befall keeping up via email or counting on everyone to switch to another service at once.

The fact that Facebook is used primarily to maintain relationships started over offline connections, or in the parlance of one researcher existing "latent" ties;[3] and that it mirrors and maintains the structure of one's social network, we assert that it is social software for cultivating strong ties. This is further evidenced by the parallel success of Twitter, a service we will now argue is social software for cultivating weak ties, a function different enough to warrant the rise of a separate yet equally necessary utility.

While Twitter has about onefifth the users of Facebook,[10] it is a different interface for supporting a different function of the Internet and in its class as a micro-blogging platform, it is by far the most used.[26] Twitter is also well documented in a wide range of literature, so we again offer a summary received definition: it is a tool that provides users with a light-weight (140 character limit per message), easy form of communication to broadcast and share information about their activities, opinions and current status.[27] But what makes it really unique is the kind of relationships it promotes: Twitter users follow others and are themselves followed.[13] This is different from Facebook and other social network services in that the relationship of following and being followed requires no reciprocation. A user can follow any other user, and the user being followed need not follow that person back.[13] While such relationships can exist on other systems, namely any

that have a "fan" feature, they are overwhelmingly clustered on Twitter, where the architecture of the site allows only these directed relationships.[13] As with Facebook, we are interested in Twitter first because it amplifies people's ability to create and maintain relationships, in this case we argue weak ties, and to formalize and reflect them and their content to the world. And second because users find the service necessary enough to raise the provider to the status of a utility.

Studies of the relationships on Twitter demonstrate that they are primarily established for the exchange of information, rather than for re-enforcing social networks, as the act of following (forming the relationship) represents the desire to receive all the tweets (messages) by that user.[13] People are on Twitter primarily because it affords a social awareness of the world[13] - a way to connect with the knowledge of others without becoming enmeshed in commitment. This is precisely the benefit people get from weak ties; we see the primacy of Twitter's directional social network as enabling this.

At face value, the claim that Twitter is a utility may be considered more speculative than when made about Facebook, as it lacks the numeric dominance of the latter, but when closely analyzed, it readily demonstrates its necessity. While Twitter's founder describes the service as a utility, [28] there isn't nearly the same begrudging participation on it as on Facebook. Many people can simply decide it doesn't bring them value and those people can stop using the service with little likely social consequences. This

property however, can be said to be a special characteristic of a utility whose business is the maintenance of weak social ties. By their nature weak ties are socially optional in situations when strong ties are able to meet all requisite basic needs, however having them is still desirable and beneficial, so much so that a society that has become accustomed to living with an augmented capacity to find and maintain them, will continue to support a system to do so. On Benkler's principle cited previously, that people will on balance do what is easiest to maintain a standard they have become accustomed to, Twitter currently provides the easiest to use and most trafficked source for weak ties, and as such it is the go-to system for that pupose. In situations where weak ties are the only means by which to escape or moderate the constraining effects of strong ties, such as repressive social or political climates, the necessity of a system that is capable of creating low liability social connections becomes even more evident.[15] Twitter's significance in the real-time organization of pro-democracy protests and its use in ferrying accounts of oppression and wrongful detention across heavily censored channels over the last three years,[29] has amply demonstrated this.

In review, we have presented evidence that computer-mediated communication is organically adopted in support of existing strong ties and in the amplification of our capacity to create weak ties. Over the last five years we have observed the codification of these communication patterns into formal interfaces, in the form of Facebook and Twitter, that have taken on the ubiquity of classic utilities and a such large swaths of the world's

population have begun to rely on them for servicing communication needs now seen as fundamental to society. Further, a side effect of the formalization of these previously organic practices has been the creation of a repository of human connection networks whose lasting representation has swung from the impossible to the mundane in less than five years.

Our discussion thus far has centered on virtual connections. While we have demonstrated that virtuality is predicated on physical relationships and that the information gleaned from weak ties is used in the service of real-life advantage, we have been describing a world where people neatly move from online to offline and back as if moving between discreet worlds. And in fact, services like Facebook and Twitter were designed based on this organizing metaphor whether conscious or otherwise. This can be recognized from research that demonstrates that people indicate many more relationships on social media than they actually maintain.[26] The reality is that we come to rely on different kinds of connection, with different people, over time[15] and with our attention being limited can only attend to a fraction of the total network we have built up online. However, these systems continue to treat all connections equally, outside of manual pruning. This is not meant as a criticism or a feature fix suggestion, instead we are simply presenting the current state of the art in widely adopted social systems.

Figure 1: Future social media systems will dynamically assemble ties for us based on situational context[30]

Polychronis Ypodimitopolous, a PhD candidate at the MIT Media Lab, presented Figure 1 as a slide during a talk entitled *We Are The Network,* envisions the state of the art in widely adopted communication technology in the year 2021. We include it here because it serves as a vivid and concise statement of the direction in which we believe social systems are evolving. During the time of the Netville study, social networks were not explicit. Rather cutting edge communication tools amplified the normal patterns of human connection, which independent of technology have long been recognized as having a network topology.[15] As technology evolved it made explicit the connections and software for maintaining the range of human relationships a dominant interface to the Internet. We are now entering the next phase of this continuum. As people use these social systems broadly, they begin to take on the temporal arch of real human life in which relationships are fluid and react to changing events. Building on the existing corpus of our networks, the technology will continue to disappear into the background while amplifying our interconnectedness. The emergence of

dynamic and adaptive systems for the calculation of human social proximity based on situational information will have a profound effect on how we live our lives. We now turn to a discussion of the emerging technologies that are defining this emergence.

2.3 Location Sharing Services

In our discussion of social systems and their principle effect of making explicit human social networks of both strong and weak ties, we highlighted the fact that on the whole the design of these systems reflects a paradigm of online and offline activity as being distinct. Indeed, a decade after the Netville study much inquiry continues on the, both in academic[31], and popular writing.[32] We will now present the rise of systems that are transcending these distinctions as we continue to trace the evolution of social systems from raw tools for computer-mediated communication to an integrated part of human awareness.

Location-based services allow users to share their real-time or historical location information online.[4] Just as social systems make explicit a person's social network, location-sharing systems make a person's mobility explicit. At present these services breakdown along two dominant types, ones which offer "check-ins", that is user generated location reports, and a second which offers a continuous stream of location information,[33] similar to sharing traditional GPS data. The former allows users to share the venue they are in, while the latter allows users to simply share their location co-ordinates. While the newest location sharing services hybridize these two modalities,[33] the most successful of these services, Foursquare,[34] has built its success on and continues to offer only the check-in interface. Indeed, we will argue that the check-in is representative of a social act, and that this

is what accounts for the success of a present day location sharing system. As such we note this distinction as we move to discuss Foursquare.

Foursquare describes their service as a "mobile application that makes cities easier to use and more interesting to explore. It is a friend-finder, a social city guide and a game that challenges users to experience new things, and rewards them for doing so. Foursquare lets users "check-in" to a place when they're there, tell friends where they are and track the history of where they've been and who they've been there with".[34] Foursquare has clients for smartphones such as the iPhone, BlackBerry, Palm, and the Android platform.

What interests us about this service is that in adopting the check-in as the primary interface for a user reporting their location, Foursquare has simultaneously discovered a simple enough mechanism for people to bridge their physical and online realities. This mechanism is perceived at once as both safe and socially attractive enough to engage a critical mass of users. The check-in was a breakthrough for location-based services because it challenged a received assumption of location-based system design, namely that it required precise location.[35] In fact by being a "coarse" location indicator, the check-in leveraged the inconsistant precision of underlying technology such as Apple iOS's common location services[36, 37] into an asset by making the final decision to share the resolution of their location a function of the user's choice. In a check-in scenario, the user is presented

with a list of venues in the neighborhood so they can choose to indicate where they are. This self-report serves to quell the major privacy concern that users report having with location-based services, namely that their location will be collected surreptitiously and broadcast to the world.[4] At the same it transforms the user's location report into a social message whereby they can accrue status by virtue of actively sharing their exciting lives. Further, the followers of these feeds gain value by knowing those places frequented by the tastemakers in their network,[38] in addition to the cadre of benefits usually associated with location-based services such as signaling availability to socialize and coordinating activities with friends.[4, 38]

It is fair to ask how the perceived benefits of this sort of sociality really affect people and society in a lasting way. We find the answer articulated by researcher Lee Humphreys in her article entitled *Mobile social networks and urban public space.*[39] Humphreys conducted a yearlong qualitative study on how location based services[4] "allow new kinds of information to flow into public spaces and, as such, can rearrange social and spatial practices".[39] What she reported was that users of a social service rooted in the exchange of sociolocational information can transform a public space into a parochial space where the inhabitants all have a sense of familiarity with each other.[39] Indeed, Humphrey's defines *parochialization* "as the process of

---

[4] It is interesting to note that Humphreys studied the application Dodge Ball, which was the first location sharing service started by the Foursquare founders.

creating, sharing and exchanging information, social and locational, to contribute to a sense of community among a group of people in public space."[39] Accounts collected from users establishing familiarity with venues before arriving there, of taking different commuting routes based on the location of other users and of congregating or avoiding certain venues based on social milieu, can be said to echo the findings of Netville where the wired residents were able to establish and maintain an amplified number of weak social ties around their home based on interactions with neighbors on Internet message boards. What Humphrey's observed is very much the same phenomena only on the go, that is based on the situational location of the users, neighborhood style familiarity can emerge in any public space. The mobile and locational affordance of Foursquare has extended and codified the phenomena of the neighborhood message board to anywhere people go.

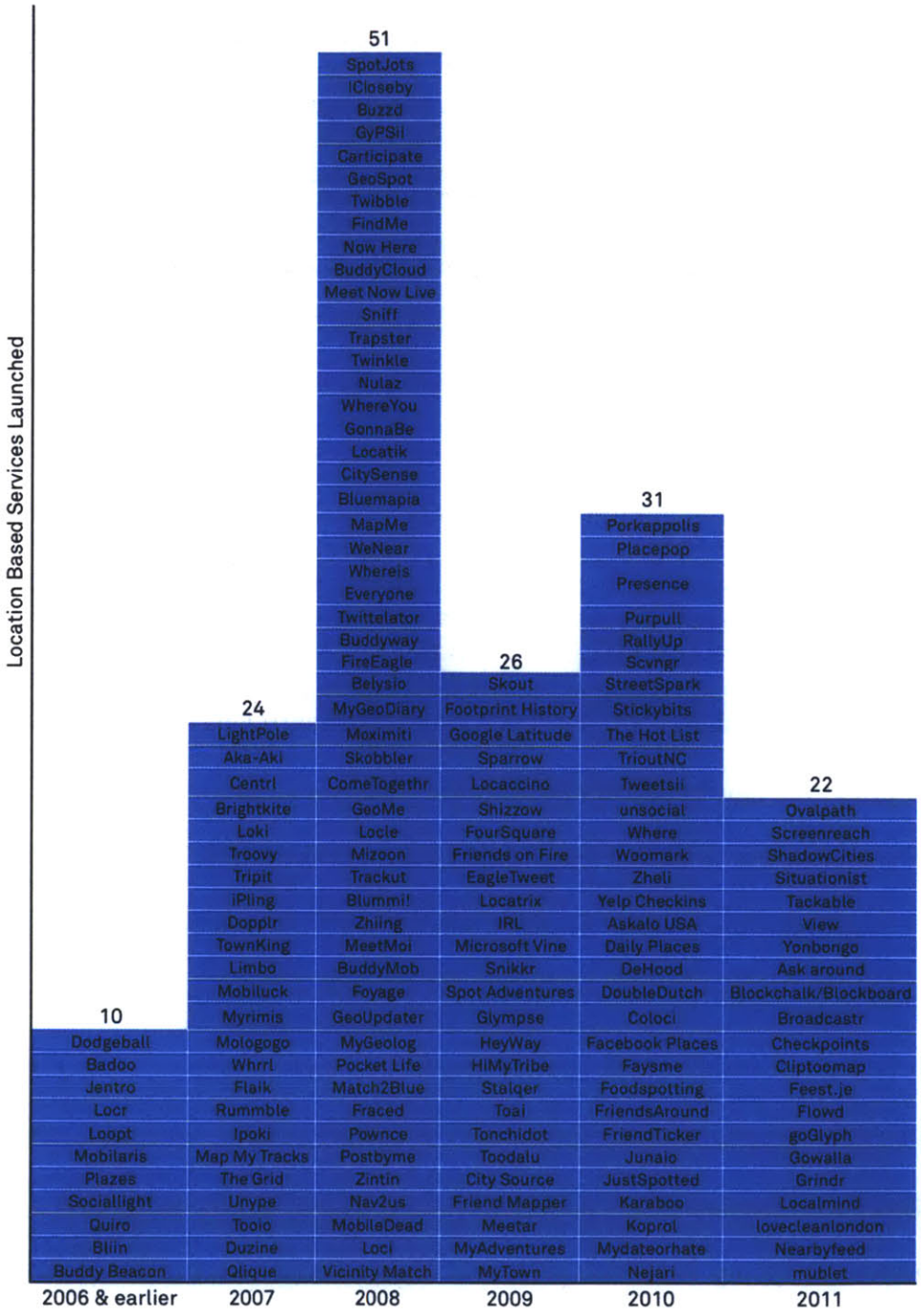


Figure 2: The rise of whereness as a utility? A survey of location based services launched since 2006[40]

Foursquare reports having over 10 million users worldwide, who have shared their location over 750 million times.[14] While these numbers are impressive, they are paltry compared to the usage numbers of Facebook and Twitter. Nonetheless, while the usership of these services is still relatively small, the explosion of services that compete for those users has exploded. Figure 2 charts the staggering emergence of location sharing services since 2006. While it is likely that the interchangeable nature of these services will mean that many will not succeed in attracting a significant usership, it does signal that the act of publically sharing one's location is here to stay. Quoting Benkler again, "connected social beings, such as we are, will take advantage of new capabilities to form connections that were practically infeasible in the past".[15] The amount of services vying for the growing number of users adopting this new capability to be connected by shared location can be said to be giving rise to a whereness utility,[12] that is a utility by which people can share and view other people's whereabouts. We further propose that whereness needs to incorporate more of the social intelligence we see formalized in social systems to continue to increase in popular use. We will unpack this statement in the coming sections, but for now can cite the addition of location-sharing to the core functionality of every major social service, including Facebook,[41] over the last year, as evidence that the operators of these services share this conjecture.

To summarize, we have presented location-sharing service Foursquare as an example of the most popular of these services. We described research that

establishes this communication modality as a method to extend weak ties over any local geography where users find themselves. And we concluded that the technological and business environment is such, represented by the relatively rapid growth of Foursquare and the explosion of nearly 100 similar commercial efforts in less than five years, that it is fair to assert that a whereness utility is emerging to service the demand for sharing location. We can now make the claim that location-sharing services represent the next evolution in the continuum towards increasingly articulated interfaces for maximizing human sociality. We see their proliferation in popular culture as the first massive dissipation of the differentiation between online and offline and the emergence of a communication modality that is increasingly integrated into the fabric of daily life. As this mode of connection becomes more popular, location will become a routine context for electronic communication. And as such the need to filter messages based on physical and social proximity will become essential.

2.4 Attention and Information Overload

In 1971 economist Herbert Simon articulated a key challenge faced by information system designers:

"...in an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it"[42]

Indeed it is clear that attention is the scarce resource in the age of the web, [26] an social proximity is a natural lens by which we spend it. We continue to use the newly feasible lines of communication primarily to maintain pre-existing strong ties and amplify our ability to make weak ties.[15] As such we imbue our social network with an agency that can serve to help us identify opportunities, friends and experiences. However, as our discussion has unfolded we noted that a vestige of the online/offline divide manifests itself in the structure of online social systems is their inability to gauge the subset of the articulated social network a user should pay attention to at any given time. Facebook and Twitter both become very noisy channels even with significant manual pruning. [43]

We see systems rooted in location as adding a second filter: they give preference to people who are proximate to the geography the user occupies or is interested in. While this is an advance, it continues to rely on the user's ability to manage the cognitive load of deciphering the meaning of certain

people being at certain places, a task that becomes no small feat as one's list of friends grows along with the mainstream user-ship of the application. We observe that the current satisfactory experience of a service like Foursquare may well be attributed to the fact that like-minded, early adopters are its primary users, and that what they find useful about it is the ties it supports within their population.[38] As usage by a broader population grows, new filters will need to be added in order to keep the service useful. For example, if a location-sharing service reaches Facebook scale and over 60% of all Internet users become active on it, will knowing that people are at a particular venue, really still be of value? Will even knowing that those people are on one's friends list be of particular use if it cannot also be filtered by other criteria?

Pattie Maes in her seminal paper entitled *Agents that Reduce Work and Information Overload*, characterized this problem as being one of systems design based on the metaphor of *direct manipulation*, that is one where the user is personally responsible for initiating and monitoring all events explicitly.[44] Maes proposes agents, or semi-autonomous computer processes, that mimic a user's behavior and work in collaboration with them, taking over some of the mundane aspects of computing such that a user is freed up to interact *indirectly* with the machine, presumably engaging only in creative or generative tasks.[44] Since the publication of her paper there has been a rich body of literature proposing various solutions to this problem in the areas of email prioritization,[45] search,[42] direct marketing,[46] online

dating,[47] and various recommendation support systems.[48] Gauging success by adoption, algorithms that effectively filter and rank information have become the solution of choice for simplifying people's interactions with computers.

We can make the claim that the computer's greatest contribution to human intelligence is its amplification of it. Information increase inevitably brings about discoverability issues, as the necessity to locate and filter desired information arises.[49] As the world becomes increasingly technologically rich, algorithm based augmentation becomes necessary to make sense of it. We can reframe Maes' remark that computer interaction requires an upgrade from direct user to user directed (indirect) manipulation as interfaces becomes more complex, to state that information discovery and retrieval in a society where the amount of data available dwarfs many times over any individual's ability to comprehend it, requires a change from direct user to user directed comprehension. Researchers Marko Rodriguez and Alberto Pepe contrast early with present day web search to make this point:

The early Web maintained rudimentary indexes in the form of Web "yellow pages" that provided short descriptions of web pages. With the explosive growth of the Web, such directory services fell by the wayside as no human operator (or operators) could keep up with the amount of information being published, nor could such rudimentary lists provide the end user a representation of the quality of web pages ... a commercialized Web industry was born and continues to thrive around solving the problem of search ... The development of the simple mechanism of ranking web pages by means of their eigenvector component within the web citation graph has proved the most successful [solution] to date.[49]

Otherwise stated, when webpages lexically matching user queries and having the most incoming links were isolated and ranked by the PageRank[50] algorithm, the top results usually correlated accurately with what the user was looking for. What makes this remarkable is that computers doing what they do well, namely quickly calculating the distance between large vectors of numbers and keeping lossless representations of information in memory[49] coupled with people doing what they do well, namely being creative and seeking information, formed a symbiosis in step with the challenges posed by the modern information landscape.

The large datasets being generated by our social and commercial footprint on the Internet lend themselves not only to novel ways of ranking resources, but also of recommending them. Once again, a relintuitive family of algorithms called collaborative filtering, that work by comparing an individual's online activity with that of others and by way of the resulting similarities recommend resources that may be of interest to the user, leverage the computer's ability of quickly processing large datasets with the human's desire to gain value from that dataset.[49]

Coupled with the self-explanatory friends-of-friends algorithm, these three algorithms inform the majority of our interaction with the Internet today. Yet the dataset they compute is so large-scale that to integrate its results into our decisions is in a sense an act of faith. We trust them increasingly in the

same way we trust our own senses and cognitive resources.[49] Just as we have abandoned the "yellow pages" format of the early Internet to find information algorithmically, we are increasingly relying on algorithmic recommendations for anything from entertainment to dating. While this faith in algorithms is by no means blind, as we have all experienced woefully inaccurate web search results, product and friend recommendations, we do on the whole believe that the large datasets they are able to traverse will result in matches and connections we would not be capable of making without them.

In this chapter's discussion we have covered how social proximity, physical proximity and algorithms that take advantage of the massive datasets articulated by our social, commercial and knowledge producing activities allow us to fit our networked lives into our human attention spans. This describes the "how" of managing information, with the "why" following on it's heels: people have a fixed amount of attention to devote to social pursuits and that as the attention cost of these pursuits decreases their volume increases. While research bears out this observation, we assert that the more interesting consequences of this technology are the uses these connections are being put to.

Social scientists often understand the notion of "too much information" as "too much to do,"[51] they equate consequential information with action and overload with a volume of information that causes paralysis, even though the

information is potentially useful.[52] That is, a substantive amount of the information we seek and share requires some form of action and the most valuable helps us get what we want. We see Facebook as a vehicle for maintaining strong ties, Twitter as a vehicle for maintaining weak ties and Foursquare as a vehicle for turning public into parochial space. The common denominator of all of these services is that they amplify users' connections with people and places. We turn now to a discussion of the value emerging out of the articulated, personal and place aware social networks technology is empowering us to expand.

2.5 The Wealth of Networks

This section is titled after Yochai Benkler's seminal book on the economic and social effects of network communications. His thesis states that the shift of advanced societies from industry (factories) to information (banking, communications, advertising) centered economies and the simultaneous move to a communications environment built on cheap and powerful computers interconnected in a pervasive network (the Internet), have the ability to fundamentally transform market-based production.[15] Quoting Benkler:

> [The Internet] *allows for an increasing role for nonmarket production in the information and cultural production sector, organized in a radically more decentralized pattern than was true of this sector in the twentieth century ...* [while the economic centrality of the products of] *these new patterns of production - nonmarket and radically decentralized - will emerge ... at the core, rather than the periphery of the most advanced economies.[15, 40]*

His research demonstrates that economic, social and technological factors are ripe for a shift that will remove received barriers to individual autonomy and enable people to make, exchange and prosper on value derived from previously impossible, non-market activities. Quoting Benkler again:

We act for material gain, but also for psychological well-being and gratification, and for social connectedness ... In the industrial economy ... most opportunities to make things that were valuable and important to many people were constrained by the physical capital requirements of making them ... In the networked information economy ... a good deal more that human beings value can now be done by individuals, who interact with each other socially, as human beings and as social beings, rather than as market actors through the price system ... As the material barriers that drove much of our [motivations] *are lifted, these basic nonmarket, nonproprietary, motivations and organizational forms should in principle become even more important [15]*

Benkler's analysis takes him through examples of peer-production innovations in traditionally centralized endeavors such as software development, information production, research and governance, which have the potential of being disrupters at a societal scale. Our discussion will key off of these concepts and trace them to interactions that are now becoming possible on a real-time, local, interpersonal basis.

By grounding our discussion around the interpersonal actions of people against the backdrop of a networked society, we can avoid some of the potentially dogmatic overtones in high-level concepts such as "non-market" and "non-proprietary" interactions. We are interested in systems where the technology enables people to create value for and/or with each other. Such systems may be agnostic to who benefits from their operation, so long as they enable generative value relationships between individual users. An illustrative and well known example in this regard is the peer-to-peer hospitality site CouchSurfing.[53]

CouchSurfing is an online hospitality exchange that helps people find a "couch" to sleep on when traveling away from home. People willing to host a guest offer thier space online and travelers find them and connect via the site to arrange the visit. Normally, no money other than expenses is exchanged. Instead the motivation to host comes out of an interest to meet new people and a desire to raise in the social ranking on the site. CouchSurfing is exteremly popular with over three million members in 230 countries.[54] Research compiled in 2009[55] indicated that over 25% of the site's users have either stayed with a member or offered a place to stay and that between 12% and 18% of these visits were recipricol following a first meeting through CouchSurfering. The researchers go on to say :

> [W]e find CouchSurfing to be a community rife with generalized reciprocity: active participants take on the role of both hosts and surfers, in roughly equal proportion. About a third of those who hosted or surfed are in the giant strongly connected component, such that one couch can be reached from any other by following previous surfs across the globe.[55]

While few situations require more trust than letting a stranger stay in your home or vice-versa,[55] the reputation system employed by CouchSurfer appears to both satisfy user's concerns and based on the very low rate of reported crime during CouchSurfer exchanges to actually keep users safe.[56] The reputation system employed is multi-tiered, at the most basic level users provide detailed profiles to describe themselves. In addition they can pay for physical verification of their identity through their credit card. Once a user has started to use the system they can accumulate positive

ratings from members they meet. Very popular users can have other members vouch for them personally.

CouchSurfing embodies the qualities we have attributed to the wealth of networks. It is a platform that allows users to get direct value from each other and it uses an articulated social network as the basis for a reputation system that has been validated at scale.[5]

Another hospitality site, called airBnB,[57] offers a similar platform for connecting people who want to rent their extra space on a short term basis. We note it here briefly to highlight that this model works whether the shred resource is free or pay.

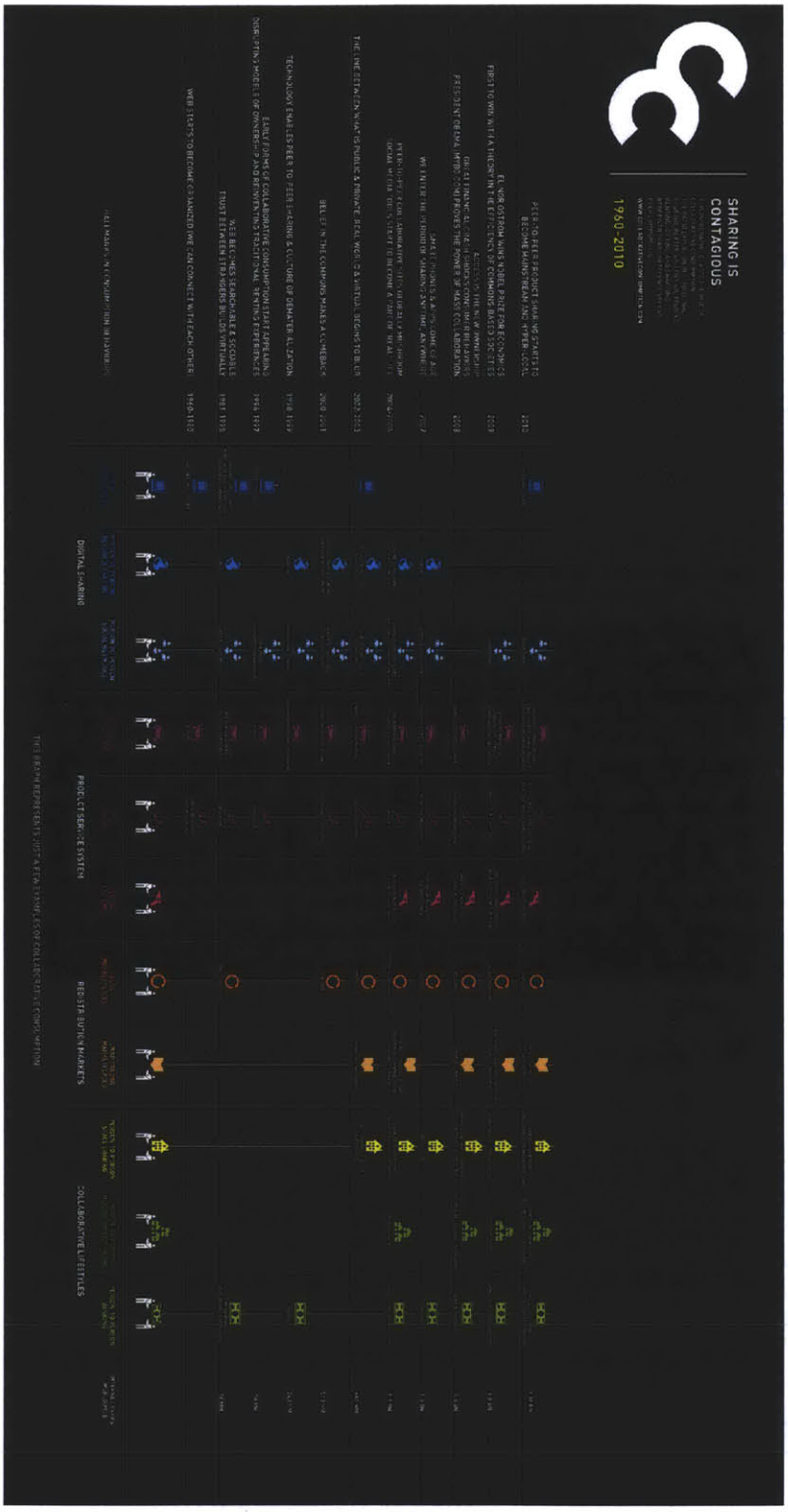


Figure 3: Infographic charting the rise in technology empowered "Collaborative Consumption" over the last 40 years.[5]

We formulate the notion of the wealth of networks, as that the value which emerges when communication technology is used to create direct value between people. Zipcar is a simple and mostly conventional business, but it is illustrative of tremendous new opportunities that are possible around empowering people to communicate generatively with each other.

CouchSurfing and airbnb are just two examples of the emergence of networks built to generate value for their users. To get a sense of the scale of this emergence, we turn to research conducted by Rachel Botsman and Roo Rogers and published in their recent book *What's Mine is Yours: The Rise of Collaborative Consumption.[5]* Figure 3 shows a summary of their catalog of thousands of examples of systems varying in scale, maturity and purpose with the common underlying trait of increasing the ease with which users can cooperate in the acquisition, use and disposal of common products and services outside of the current norm of market culture.[5] Echoing Benkler, they found that users increasingly trust distributed systems (namely each-other) more than they do centralized entities,[58] and that this trust results from a reframing of the debate often described as the "tragedy of the commons".[5]

The Tragedy of the Commons is the title of an often-cited article published by microbiologist Garrett Hardin in 1968. In it he parables an account of a cattle pasture open to all, a common resource, as follows: "a herdsman grazing his animals on the land will have an incentive to add another animal to the herd.

And another; and another ... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy ... Freedom in a commons brings ruin to all." That is, doing what's rational on an individual basis results in a negative outcome for the collective interest.[5] This is how the tension between individual and group interest is commonly understood and our societies and markets have set up to mediating mechanisms to mediate this dynamic, that is mechanisms that limit the autonomy of individuals to act.

While this has worked historically, it is seemingly less necessary in the networked society. In a real-time marketplace for direct peer-to-peer exchange, different dynamics are at work. Botsman and Reynolds describe the phenomenon this way:

> *A single phone is useless, but the more people who own telephones, the more valuable the telephone is to each owner as the total number of people on the network increases. Similarly, the more people who participate in* [peer-to-peer exchanges]*, the better* [they] *work for everyone – there is a "network effect". Every person who joins ... creates value for another person, even if this was not the intention.[5]*

The assertion is that a network increases in utility the more people use it. This network organization need not be limited to non-rival goods like the carrying of voice, rather it can further the use of materiel and even scarce resources, as functional networks can distribute utility in a way that's equitable for the users and the resource. They accomplish this by making people explicitly connected. That is they empower people with the right tools not just to coordinate projects or specific needs, but also to monitor each

other.[5] While the former is increasingly visible in systems that share resources like cars, tools, farmland and parking spaces;[59] the latter is well established in the self-managed, peer-policed, online reputation system familiar to the users of eBay.[60]

Detailed research into people's motivations for leaving feedback on eBay has been conducted[61] and is an instructive note on which to conclude this chapter. The well-known online auction site has nearly 100 million active users transacting in over $62 billion worth of goods in 2010.[62] The site has a well-established rating system that allows partners invlved in a trade to rate one-another on various parameters. Research we surveyed considered the online feedback itself as a public good, in that its submission incurs cost to the provider but a benefit to the entire trading community. Behavior on eBay was tested against received economic theory predictions that when many people share public goods, there is incentive to overuse, whereas when people share an obligation to provide them, they tend to undersupply.[61] The experimental findings determined that on eBay, participation in the rating system was significantly higher than predicted. This was attributed to the observation that in the eBay's reputation system users tend to exhibit reciprocity towards partners who have rated them first, this creates a self-interested motivation to rate one's trading partner in order to increase the probability of eliciting reciprocal feedback. The combined effect strengthens the propensity of users to participate in the feedback mechanism.[61] This

exemplifies how self-interest mediated through a network can be channeled in support of a public good.

In this section we introduced the wealth of networks, the idea that as communication becomes decentralized and ubiquitous people are able to generate value directly for each other. We then introduced the rise of companies that, in the words of Etsy founder, Rob Kalin, are "acting as curators and ambassadors, creating platforms that facilitate self-managed exchanges and contributions."[5] These platforms invert the received notion of the "tragedy of the commons" by leveraging interfaces that augment the user's ability to provide value to the community and thereby expand the value they get from it.[5] Our thesis is that this kind of explicit community value is just beginning to be recognized by popular culture and as such assert that it will become increasingly formalized into the emerging communication landscape.

2.6 Proximal Messaging

We are now ready to situate the intended contribution of this paper in our discussion, namely a communication interface for enabling real-time, physical-world centric, collaboration between people in physical and social proximity. We postulate that as social and mobility systems evolve, they will take on more situationaly adaptive features, these will include adhoc prioritization of messaging by physical and social proximity. Further, these

systems will facilitate the direct exchange of value between users, being capable of acquainting them in real-time with people in the vicinity who can help them accomplish their goals.

We take as point of departure research conducted in Finland between 2009 and 2010 on a local online gift exchange called *Kassi.[63]* This system was designed to support the generalized exchange of goods and services in geographically local contexts.[63] The authors were interested in the motivations and system design attributes that governed user participation (or lack thereof) in the Internet mediated exchange of everyday favors such as borrowing items, sharing information, and helping other local community members in the course of daily life. Their reciprocity based motivation model is described as a "network-generalized exchange,"[63] characterized by expectation that "a gift received does not imply an expectation of reciprocity with the same person in the future".[63] The idea being that a long chain of unilateral gift giving will result in everyone deriving value. Kassi focuses on exchanges that span the "online-offline dichotomy,"[63] that is they are aimed at transactions that need to be completed in person. Users list items and services they can provide on a profile page, while a listings section describes items not found in profiles or of an especially specific nature. They then communicate via direct messages, phone or on the public listings forum to express interest and arrange the completion of a transaction. The trade is considered complete when the listing is removed.

A number of interesting findings came out of the Kassi research. Of the 894 user listings logged on the system, 64% of profile offerings and 79% of listings were for tangible items rather than favors. Frequent users, those that used the system for eight or more transactions, of which there were 21 out of 104 users who completed 1 or more transactions, indicated overwhelmingly that they participated because either "it was nice to help" (10) or because of "reciprocity" (5). All users were surveyed about why they did not participate more or at all, the single most frequent answer, given by 40% of respondents, was that they "had difficulty figuring out what items and favors to list." In summary, out of 894 listings, 104 transactions took place of which 34 where for favors. While most people reported that they thought Kassi was a good idea and reflected their personal ethos, a much smaller group of people actually used the system, with major reason why being that they did not know what they could offer that would be of use.[63] Further, the researchers postulate that the reason significantly fewer favors were transacted on the system than goods, can be attributed to the observation that advertising a skill implies more ongoing, relational interaction between the users. It requires a more significant involvement with the other person, namely doing the task "correctly," and therefore carries additional social risk.

We take these findings as instructive and postulate that the recent emergence of neighborhood area exchanges such as Neighborgoods,[64] thefreeconomy[65] and icancanu.com,[66] similar to Kassi, will specialize between systems for sharing and trading things and systems to facilitate skill

and favor swaps. Further, we observe that Kassi has no explicit temporal or locative component making the exchange of time and place sensitive favors impossible. Finally, while the system is a social exchange that was deployed across a university campus, so users had some sense of who they were exchanging with, it did not leverage the existing social networks that were certainly already articulated by its users on systems like Facebook. As with remarks we made about Facebook and Twitter, we are not critical of Kassi, we are simply pointing out the current state of the art in this space and creating a clearing for the prototype we will describe and test in the coming pages.

We assert that a system capable of connecting people locally based on social proximity "just in time" with an expressed need is the next evolution for systems such as Kassi. Further, we assert that the next evolution of social software will have hyper-local capabilities largely used to enable interactions the include those imagined by the creators of Kassi and expanding out to more immediate and time sensitive interactions. These applications require a messaging paradigm allows users to specify recipients based on time, location and intention. In the final section of this part we will describe some existing systems that are making inroads into realizing this paradigm, and in the next part we will present our own.

2.7 Other Related Work

This section is dedicated to enumerating a list of recent work that has capitalized on the phenomena described in the preceding pages for their emergence. These systems, in various states of maturity, represent the current cutting edge of computer-mediated peer-to-peer value exchange. As such they are not presented based on a record of adoption, instead because they serve as instructive for the system we propose in the next part of this paper.

Aardvark

Aardvark[67] is a social search engine. This means when a user makes a request for information, Aardvark routes it to someone in their extended social network who is likely to be able to answer it. Aardvark's challenge lies in finding the right person to satisfy a user's request.[67] Horowitz and Kamvar contrast this challenge with that of providing document based search results as follows: when attempting to connect people with other people as apposed to documents, intimacy rather than centrality determines the quality of the match.[67] While centrality is a measure of how popular something is within a given relevance trajectory, intimacy is predicated on connectedness to the requester. The Aardvark ranking algorithm is an aspect model equation meant to identify the person most suitable to answer a specific requester's query. The main factors in this equation are topic expertise (the probability that user is knowledgeable about the question),

connectedness (the probability that the users have enough in common that the requester will value the responder's advice) and availability (only people who are online can respond).[67] As reported in the findings of the cited paper, this model is very effective in providing quality matches between people who understand each other's needs.

Aardvark is a key reference for the system we built.

Friendsensing

Friendsensing[68] is a system to make it easy to find and confirm friends on social network sites by way of the close range sensing technology, Bluetooth, built into phones. The idea is that based on one's frequency and duration of interaction with others (based on phone detection), algorithmic powered predictions can be made about who is a friend or should be. The system is fairly sophisticated in that it will recommend people who associate with you directly as well as with your friends. It presented as advantageous over systems that do lexical matching on profiles to recommend friends with common interests because those require fairly detailed profiles to achieve acceptable accuracy.[68]

Groundcrew

Groundcrew[69] is a system that aims to massively scale community action organizing, it is a real-time, geoaware, mobile dispatch system that allows "organizers" to manage "crews" via a web or smartphone interface. When

agents enter a specified area they can be messaged by the organizers or scripts they have setup and mobilized for missions that can range from neighborhood assistance to pick-up sports games. What's really intriguing about this system is that it exposes a scripting language called the Coordinated Event Mark Up Language (CEML), a scripting language for coordinating groups of people. Instructions about activities can be prescripted in CEML and then deployed as a geofence to be triggered when the requisite number of people show up in the area.

Inneract & Situationist

Inneract[70] and Situationist[71] are iPhone applications that allow users to broadcast a picture and text message from their location. The idea is that people will see the request, recognize the user by their picture and approach them when they see them to action the message. The creator of Inneract puts it this way:

> Inneract is for your practical needs and your most obscure desires. Invite others to interact with you in any way you like, or open yourself to others' invitations. Experience moments of newness woven into the familiar patterns of your everyday life.[70]

Localmind

Localmind[72] is a location-based system that allows users to send questions to people at specific venues. When a user is at a venue they may receive a question like, "is the bar crowded?" and because they are there, they can

answer the question. Localmind allows you to sign in using one of several existing services like Facebook or Foursquare, but only lists users as available to answer questions when they are logged into the service. This system is an interesting instantiation of distributed intelligence,[73] whereby users are able to ask for information of others who are more physically proximal to the information.

Meet Gatsby

Meet Gatsby[74] allows users to sign up with their Foursquare accounts and enter keywords representing interests they would like to be connected with others over. When they get in proximity with another user who has specified the same keyword, they are both alerted and can opt into a mediated chat which is intended to lead to a real-life meeting. In addition users can add their Facebook accounts and be alerted when friends of friends with whom they are not yet friends are in proximity, this is intended to be a form of new friend discovery.

This system is clearly interesting for our review because it has a rational architecture that attempts a form of intentional routing based on proximity and social matching based on social proximity. Meet Gatsby maintains a static list of interests that it matches with anyone else who has them, making no affordances for the fact that a user's interests may change throughout the day or that given scale every word that denotes an "interest" will be claimed quickly and user's would get inundated with messages. Nonetheless, it is an

early entrant into this field and as we asserted about location-based services, serves as a form of social proofing.

Message Party & Ask Around

Message Party[75] and Ask Around[76] are location-proximal chat applications. When users come into a specified proximity of each other they can text chat on their mobile devices. The concept is that this kind of communication is useful for adhoc group creation, for example messaging with other people at the same sporting event.

MeetMoi & Grindr

MeetMoi[77] and Grindr[78] are location based dating systems catering to heterosexual and homosexual users, respectively. They use the user's location to show them profiles of other users in the local vicinity. The MeetMoi website explains the functionality this way: "By leveraging location awareness and the real time communication channels available on mobile devices, MeetMoi makes it easy for members to connect in person".

Dating systems have historically been at the forefront of matching users algorithmically[47] and it is logical that should be the among the earliest adopters of peer to peer location based exchanges.

Sonar

Sonar[79] is an iPhone application that allows a user to input their Facebook, Twitter and/or Foursquare accounts and alerts them when someone from their social networks is nearby. It allows messaging through Twitter.

Submate

Submate[80] is designed as a social network for public transportation commuters. Users input their commute routes into the system and are then given the profiles of other commuters on that route. The idea is that users can strike up a conversation with another commuter they know through Submate.

Zaarly

Zaarly[81] is a location based buyer's market place. Users enter products and services that they would like to buy, for how much when and where. Sellers can then find buyers who need something and attempt to satisfy that need for the stated price. When we investigated the site buyers wanted diverse products and services ranging from lawn-care to rides to iPads.

3. Reach: a local social favor exchange

Reach is a system that amplifies people's ability to do good for each other. Inspired by the models of the user-to-user marketplaces reviewed in the prior work section, we seek to build a scalable exchange that targets people intelligently and thereby shows a way of designing systems which are considerate of people's time and effort.[82] We hope our system illustrates a means by which we can make helping others addictive, but also generalizes to the development of other exchanges that engage users based on similar proximal criteria.

We understand "favors" to be timely acts of service that fulfill a need that, while not life and death, is greatly appreciated by the recipient. We note that in social science, a favor is defined as a voluntary and often unsolicited act of good-will.[83] We queue off this definition as Reach allows user's to make a request of the system and allows any individual capable of servicing the request to respond without direct prompting from the requester. At the same time, the responders volunteer in one of two modes. They are either called to serve if they match the criteria of the request particularly well or they "volunteer" to take on a request that is proximal to them, these are presented as a ranked list based on the likelihood that the user can service the request.

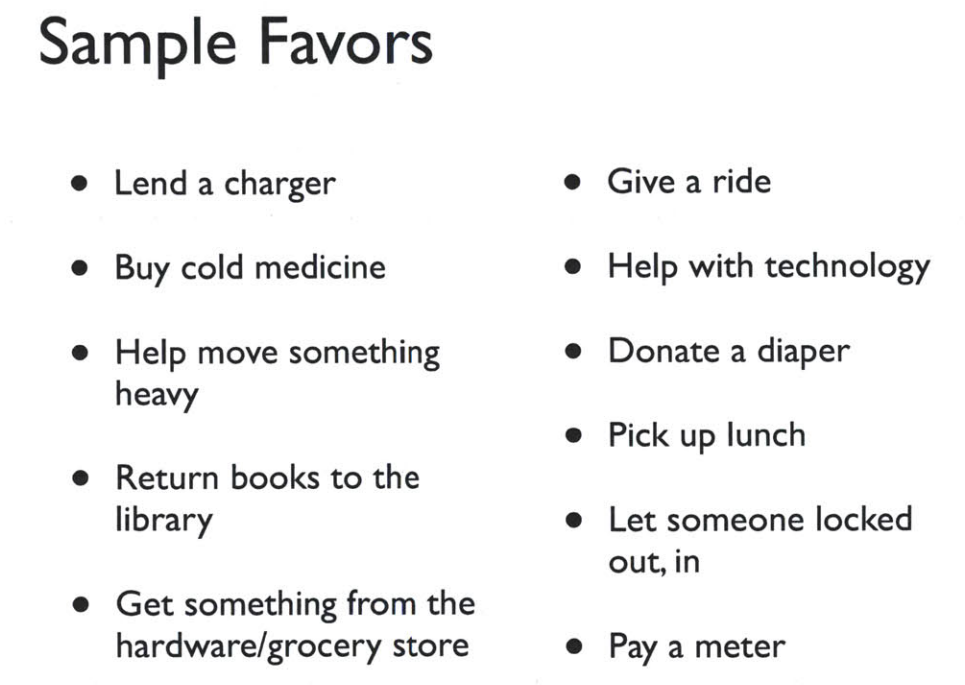


Figure 4: A sample list of favors that can be requested through Reach

Based on an request ontology, users request favors of the type described in Figure 4 through Reach, specifying the time window in which they are to be completed. This serves to add the favor to a queue that is looped through until the favor is either initiated or expires. Each favor has a plan consistent with how it is to be serviced, this includes what the nature (e.g. borrow) and object (e.g. laptop charger) of the favor is, how to meet up with the requester (e.g. go to their location) and when it is required (e.g. ASAP). This information is used to first determine who is in the vicinity of the favor location (e.g. within .5 miles of the user), screening based on registered availability (e.g. available from 2pm – 5pm weekdays) and determining

through a taste profile if the user can help with common tasks (e.g. only ask Mac laptop owners for Mac chargers). From the remaining pool of users we rank them based on if they have interacted with the user before (e.g. did or received a favor) and by their social proximity (e.g. are they friends on Facebook?). Assuming there is a high value connection, like a favor history or social connection the favor is routed to that match. The matching user can at that point either accept or decline the call to serve. If they accept, the requester is then sent a message indicating who has accepted the favor and must either acknowledge the helper or withdraw the request. Assuming the request is acknowledged the two users can now communicate via their indicated primary communication modality (e.g. SMS) and coordinate a face-to-face meeting to complete the favor. Once a favor has been completed the users are now linked on Reach and will be given greater match priority for future requests. Also, the favor type is used to prioritize future matches; if for example, a user is known to loan things, they are likely to be asked for more loans in the future.

For a clearer picture of how this system operates we illustrate with a simple use case narrative:

Gabe is working on his Mac laptop in a coffee shop when his laptop alerts him that it is about to run out of power. Not having a charger on him, Gabe enters his request into Reach. The system routes the request to Tanya one of Gabe's Facebook friends who has indicated that she is a Mac user in her taste profile and happens to be in a store just a few doors away. Luck would have it that she has her laptop on her and agrees to help. Gabe receives a notification that Tanya is nearby and has a charger and accepts her help. Tanya can now see where Gabe is on a map and brings him the charger. They both indicate that the favor was competed satisfactorily and Gabe can charge his laptop while Tanya shops in the area.

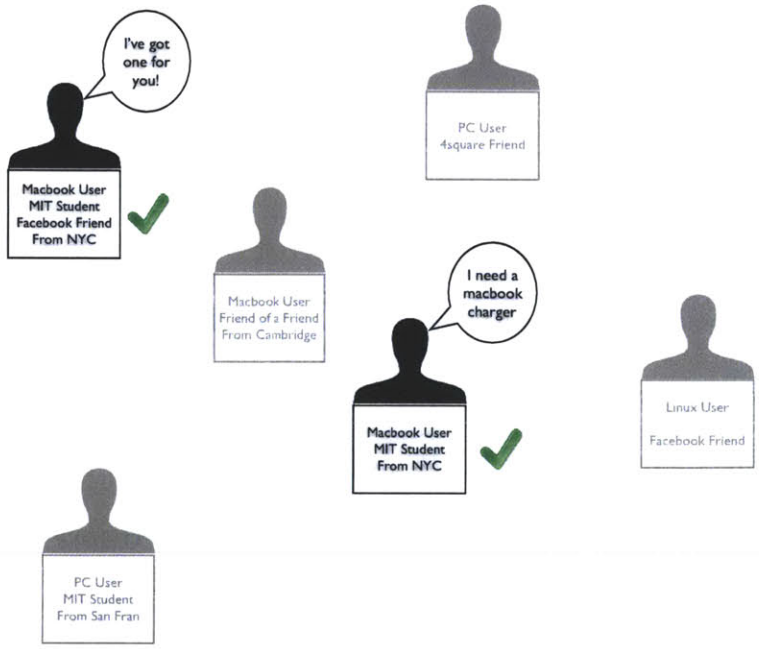


Figure 5: The favor request is routed to the most physically and socially proximate person

In what follows we will present the design principles and system architecture that enables this functionality.

3.1 Principles

Reach is essentially a matching engine predicated on prevailing theories of social balance via homophily and the norm of reciprocity. Social balance is ascribed to the observation that on balance people prefer to be in the company of people they get along with.[84] Homophily, or "the love of like," is the idea that on balance people get along best with people who are similar.[85] The norm of reciprocity, for our purpose, is meant in the sense of Robert Axelrod's *"tit for tat"*,[86] that is behavior we associate with cooperation and goodwill towards others motivated by exogenous and endogenous factors. We will unpack these concepts now.

Social psychologist, Fritz Heider,[87] asserted a tendency towards balance between three things: the observer, another person and a third object which may be another person, a thing, or even an idea. This balance is described in terms of agreeing sentiment that is usually categorized as either positive or negative. What has become known as Heider's Balance Theory is that human relations tend towards sentiment agreement between interacting pairs and groups. Subsequent research qualifies this as being reported balance,[84]

that is, the feeling of seeing eye-to-eye with someone. For our purpose, we accept this theory and operate from the notion that it is better to match people with others who have report similar perspectives.

The seminal paper *BIRDS OF A FEATHER: Homophily in Social Networks* catalogs in detail how the principle that similarity breeds connection is borne out across the majority of human relationships; including marriage, friendship, work, advice, support, information transfer, exchange and comembership.[85] The focus of the paper is on bringing explicit awareness to how this phenomenon shapes our social networks. For our purpose we make use of it's substantiation that similarity leads to propinquity[85] in order to substantiate the matching logic we use to route our messages. It is also noteworthy that the majority of online dating systems substantiate their matching algorithms on this same phenomenon.[88]

Finally, the norm of reciprocation is covered by a vast social science literature. In general there is consensus that people will often ignore their selfish tendencies when dealing with people with whom they feel a connection and that they will go out of their way to help such people about half the time.[21] We want to bring to light two particular theories relevant to the functionality we are proposing in Reach. The first: *"Tit for tat"*, as articulated by Robert Axelrod, demonstrates that tempered cooperation is a better strategy for getting the desired result than dogmatic cooperation or

selfishness. The theory states that when meeting a new person one is to be cooperative at first and then follow the other person's lead. If they are cooperative, cooperate again; if they are selfish, be selfish back.[86] We can extrapolate from the documented success of this strategy that the act of helping someone makes it more likely that they will help in return since they garnered value in advance.[21] Second is an account of mathematician Chris Hauert's evolutionary model by Nicholas A. Christakis in his book *Connected.*[21] Hauert's model describes a world where, by default, people choose not to interact with each other at all. It demonstrates that in such a world, cooperation will almost certainly emerge, because if the norm is noninvolvement, then those individuals that join forces will immediately be more successful. By highlighting these two theories of reciprocity we seek to present substantial received research demonstrating that many people will both help and ask for help when given the opportunity and that helping others is on some level a necessary part of the human experience.

The system we are building builds upon these three principles in order both match people with tasks and each other, as well as re-enforcing the cooperation inherent in the system. Matching preference is given to people who already share social space over those that don't, to people who have something in common over those who don't, and people who have helped before are more likely to be asked again then those who have never helped. The latter is hoped to be both a catalyst for people to help as well as a re-enforcement against free riders, the idea being that if someone has been

helped significantly more than they have helped, then within the context of Reach's favor ontology, people should be less inclined to help them.

3.2 Graph Data Structure

We chose Neo4j,[89] a graph database, and Gremlin,[90] a domain specific language for traversing property graphs, to store and manipulate the data in Reach. The graph database is NOSQL technology for storing data natively in graph form. Instead of separate tables connected by join queries as in a traditional RDBMS, a graph database has only one data structure that is already joined by its defined edges. This property of the graph database is called index free adjacency, [91] meaning that every vertex and edge has a direct reference to its adjacent vertex or edge. This provides two benefits, the first being that there is a constant time cost for retrieving an adjacent vertex or edge. Regardless of the size of the graph as a whole, the cost of a local read operation at a vertex or edge remains constant. This means that data can be modeled and queried predictably at scale and defines the primary means by which users interact with that data, namely traversals.[6] The second benefit is that a graph representation significantly reduces the complexity involved in searching the hybrid network data that is at the heart of Reach. Graphs offer a unique vantage point on data, where abstract traversals over the

vertices and edges of the graph can dynamically reveal patterns that would have to be meticulously modeled in a relational structure.[6]

The Reach datastore is modeled as a multi-relational, property graph. In the parlance of graphs, a property graph is a directed, edge-labeled, attributed multi-graph.[6] This means that nodes in our graph can have heterogeneous relationships such that when one set of relationships is traversed a different sub graph emerges than if a different pair was selected. In addition, indices are employed to find the root node of an intended subgraph. Once an index identifies a node that matches certain criteria, then a traversal can be executed through the graph.

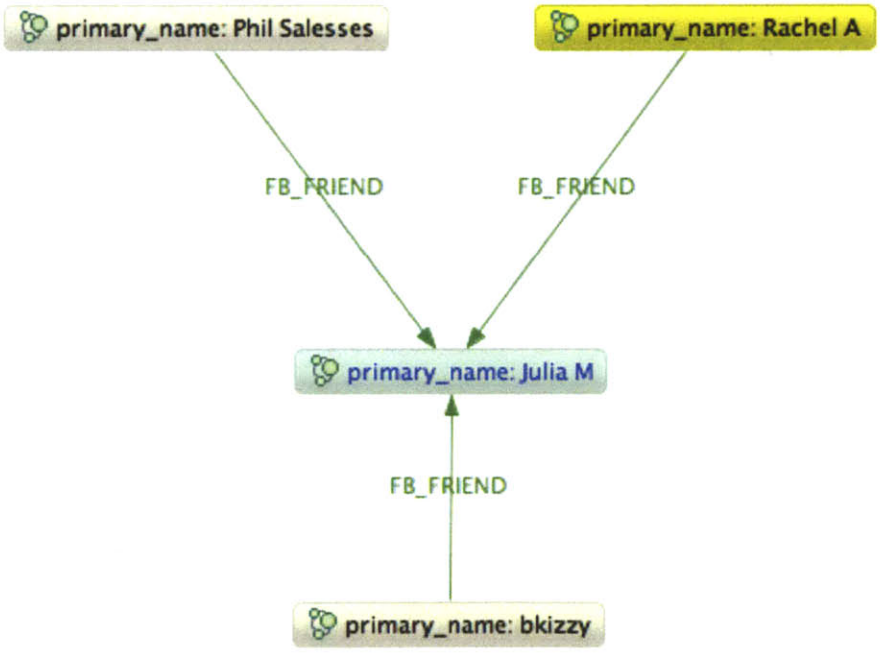


Figure 6: A subgraph showing all of Julia M's Facebook friends who are users of Reach

Figure 5 illustrates a subgraph that is the product of the index/traversal pattern at the root of how data is represented in Reach. We want to see all of Julia M's Facebook friends who are users of Reach, so we retrieve Julia M's node by looking up here unique id in an index and then traverse all incoming FB_FRIEND relationships. In Reach, direction of friend relationships denote membership order, so in this case, Julia M. joined before her other Facebook friends. Note that the Julia M node has many different relationships that constitute her subgraph, any of these can be used to query connections to other users, locations, etc. The real power of graph databases is revealed when traversing multiple steps in order to unite vertices that are not directly connected.[6] Figure 6 illustrates this with a basic friend of a friend topology. We see that Devittles is the connecter between Jen F. and her other friends as none of them are friends with Jen F. directly, but are rather connected through Devittles. Traversals based on abstractly defined paths is the core of what is called the graph traversal pattern.[6]

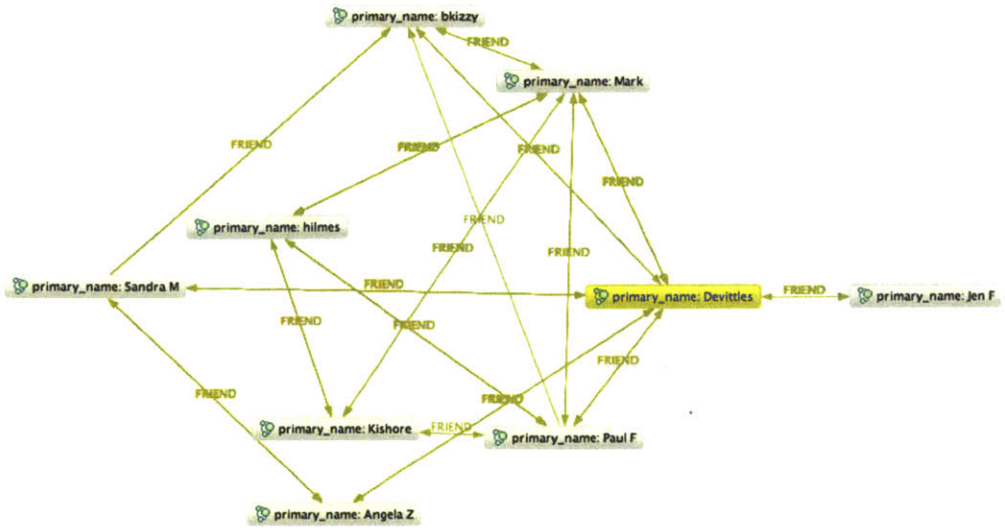


Figure 7: A simple Friend of a Friend pattern with Devittles as the connecter

Pattern is the term given to a data modeling/processing approach that has defined benefits in terms of efficiency and/or expressibility.[6] The graph traversal pattern when implemented in a graph database and queried with a property graph centered query language has demonstrated both of these benefits in our building of Reach. In the section that follows we will present the domain specific graph traversals that make the accurate routing of favors possible. In order to efficiently express the tensors that constitute our queries, in addition to representing them programmatically, we will illustrate them using single step traversal notation defined by graph database researchers Marko A. Rodriguez and Peter Neubauer in their papers titled *The Graph Traversal Pattern* [6] and *A Path Algebra for Multi-Relational Graphs.*[92] These are presented in Figure 6. We believe that this notation will make our queries more readable and portable to other implementations.

- $e_{\text{out}} : \hat{\mathcal{P}}(V) \rightarrow \hat{\mathcal{P}}(E)$: traverse to the outgoing edges of the vertices.
- $e_{\text{in}} : \hat{\mathcal{P}}(V) \rightarrow \hat{\mathcal{P}}(E)$: traverse to the incoming edges to the vertices.
- $v_{\text{out}} : \hat{\mathcal{P}}(E) \rightarrow \hat{\mathcal{P}}(V)$: traverse to the outgoing (i.e. tail) vertices of the edges.
- $v_{\text{in}} : \hat{\mathcal{P}}(E) \rightarrow \hat{\mathcal{P}}(V)$: traverse the incoming (i.e. head) vertices of the edges.
- $\epsilon : \hat{\mathcal{P}}(V \cup E) \times R \rightarrow \hat{\mathcal{P}}(S)$: get the element property values for key $r \in R$.

- $e_{\text{lab}\pm} : \hat{\mathcal{P}}(E) \times \Sigma \rightarrow \hat{\mathcal{P}}(E)$: allow (or filter) all edges with the label $\sigma \in \Sigma$.
- $\epsilon_{\text{p}\pm} : \hat{\mathcal{P}}(V \cup E) \times R \times S \rightarrow \hat{\mathcal{P}}(V \cup E)$: allow (or filter) all elements with the property $s \in S$ for key $r \in R$.
- $\epsilon_{\epsilon\pm} : \hat{\mathcal{P}}(V \cup E) \times (V \cup E) \rightarrow \hat{\mathcal{P}}(V \cup E)$: allow (or filter) all elements that are the provided element.

Figure 8: Single Step Graph Traversals[6]

3.3 System

This section covers the logical components that constitute Reach.

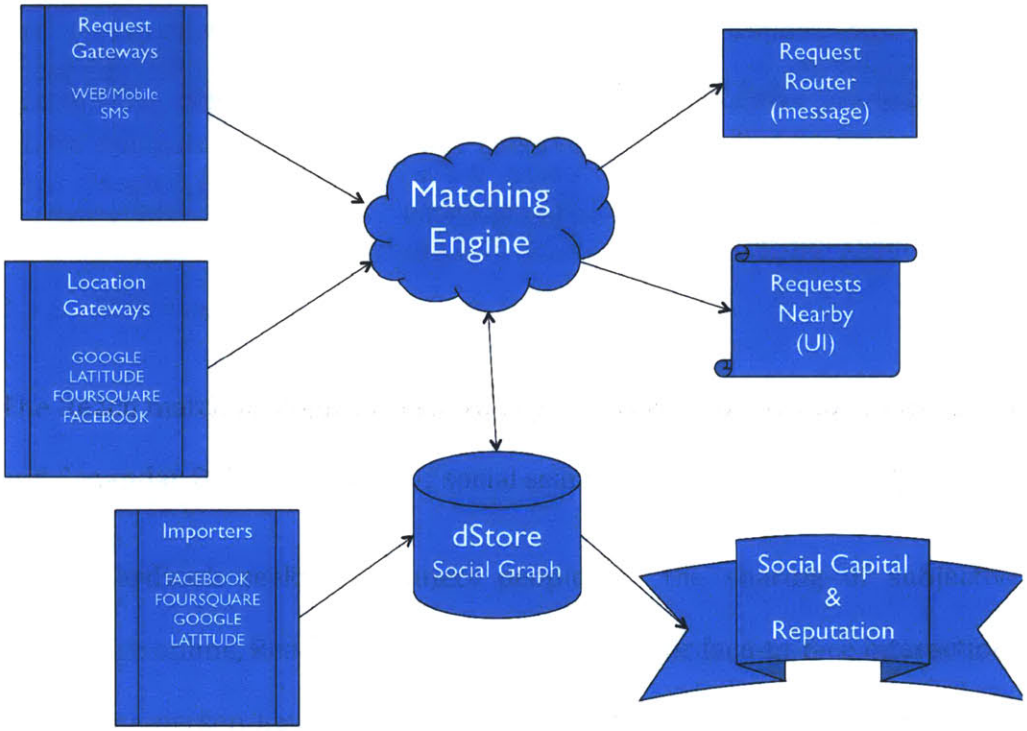


Figure 9: Reach Logical Components

3.3.1 Matching Engine

The Reach matching engine is inspired by the work done by Damon Horowitz and Sepandar D. Kamvar on their social search engine, Aardvark.[67]

While Aardvark seeks to connect people for the sharing of subjective knowledge online, Reach seeks to connect people for face-to-face interactions where one person helps the other. This requires a similar domain model as Aardvark with the addition of location and an explicit articulation of how the

person asking for help and the person providing the health are connected to each other. That is, we are making explicit the physical and social proximity. The factors important to our search are physical proximity to the request as well as the requester, availability (at the time of the request) and connectedness, which in our case is denoted by both social distance and past favors exchanged between the users. We will now present each of these factors illustrated with graph algebra, Gremlin syntax and visualization.

1. Who is nearby and available to perform favor?

With this index/traversal query we will determine who is nearby to the favor location and if they have indicated that they are available to receive requests and finally depending on the request plan, we may filter the users based on their taste profile.

We assume that there is a favor queue from which a favor is retrieved that needs to be done at a certain latitude and longitude or a user specified location. We create a bounding box around the address of ½ mile (this is a good default baseline for densely populated urban areas) and identify all the Reach users in this proximity with the following spatial index query expressed in Gremlin:

```
gremlin>peeps=[]; g.idx('UsersWorld').get('bbox','[-71.070231297681, \
42.351920260159","-71.091167203206, 42.375030765981]')>>peeps;
==> v[3867]
==> v[6098]
==> v[11579]
==> v[8585]
```

Expression 1: Query of a spatial index in the Reach Neo4j database expressed in Gremlin

The resultant list of users is then fed through this property filter:

$$f(i) = (\varepsilon_{p+}^{avail\_end>now} \circ \varepsilon_{p+}^{avail\_start<now} \circ \varepsilon_{p+}^{weekday \in avail\_days})(i)$$

Expression 2: User availability property filter

Reading from right to left, function f states that for user vertex i evaluate their available days of the week property by seeing if today is a day in their set of available days, next evaluate if the specified available to start time is earlier and if the availability end time is later than now.

$$f(i,q) = (\varepsilon^{name=q} \circ v_{in} \circ e_{lab+}^{INTERVIEW} \circ e_{out} \circ \varepsilon_{p+}^{avail\_end>now} \circ \varepsilon_{p+}^{avail\_start<now} \circ \varepsilon_{p+}^{weekday \in avail\_days})(i)$$

Expression 3: User availability properties filter and graph traversal

```
gremlin>long t=(System.currentTimeMillis()/1000);\
peeps.filter{it.avail_start[0] <= t && it.avail_end[0]>=t} \
.outE("INTERVIEW").inV.filter{it.name == "mac"}})
```

Expression 4: User availability properties filter and graph traversal express in Gremlin

In some cases a favor may be common enough to warrant mapping to a taste profile, e.g. a mac user. In Figure 3 we add another variable to f, q which represents the name of an entity that is mapped to the given favor plan. In addition to the availability operations, we traverse out from user vertex i via the relationship labeled INTERVIEW and evaluate if any of the vertices on the incoming end have a name that matches q.

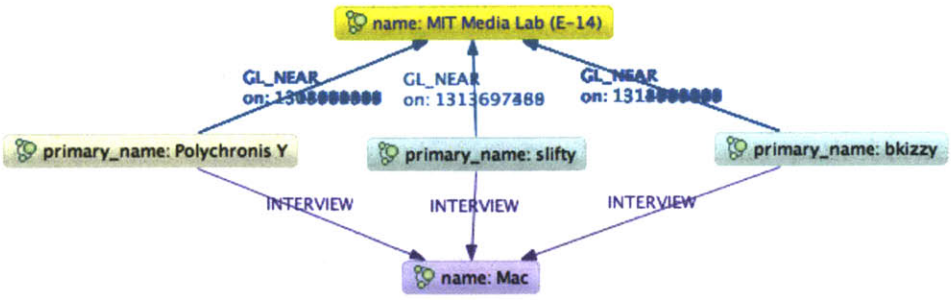


Figure 10: A graph of Mac users near the MIT Media Lab available to perform a favor

2. What is the shortest path between the requester and the responders?

Here we are looking for any relationship that connects the requester and the responder other than INTERVIEW.

$$f(i,q) = \prod_{i}^{q}(v^{q}_{both} e^{INTERVIEW}_{lab-} \circ e_{both})(i)$$

Expression 5: Shortest path between two nodes, excluding INTERVIEW

```
gremlin>peeps.bothE.filter{it.label != 'INTERVIEW'}.bothV.loop(3) \
{it.loops <=2 && it.object.id != 6098}.paths >>1;
```

Expression 6: Shortest path excluding INTERVIEW expressed in Gremlin[5]

f states that for requester vertex i traverse edges in both directions which are not labeled INTERVIEW, determine if either vertex is the requester q, loop until q is found. In Gremlin we add a break condition since this query would otherwise walk the graph forever if there is no path between requester i and responder q.

---

[5] This Gremlin query is presented for illustrative purposes only, because calculating shortest path on large graphs is a very resource intensive operation, neo4j offers a double sided Djikstra algorithm implemented in Java for performing this operation.

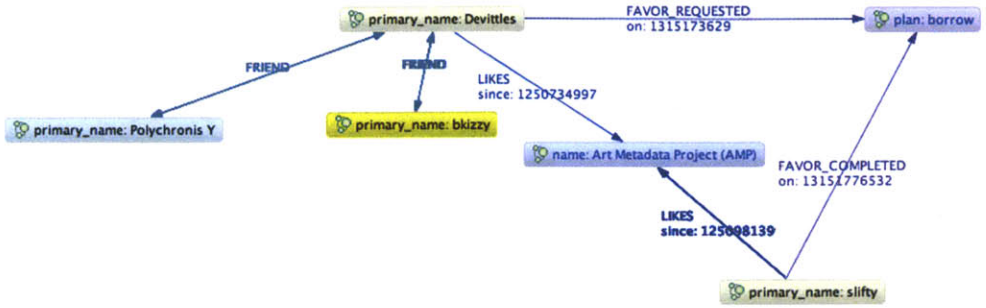


Figure 11: Shows direct and indirect paths between users. One of the requesters is connected only by indirect paths.

Note that even though the user *slifty* is not connected to *Devittles* by a direct path, the fact that they are connected by an exchanged favor makes them as close or closer than had they been connected by a direct link.

3. Which responders are likely to travel to the meet location?

This is necessary in all cases except when the requester will come to meet the responder.

```
gremlin>locs=[]; uuid = g.v(6098).UUID; g.idx(uuid + '_world').get('bbox',\
'[-71.070231297681, 42.351920260159","-71.091167203206,\
42.375030765981]')>>peeps;
```

Expression 7: Gremlin index lookup for all the places this user has been inside the specified bounding box.

We query each responder's spatial index within a .5m bounding box around the meeting location, this returns all of their mobility information in that area.

We can then make a location point list and see how the users compare.

$$f(i,q[]) = (\varepsilon_{\varepsilon+}^{q[]} \circ \varepsilon_{p+}^{on>=now-604800} \circ e_{lab+}^{FS\_VISITED||FB\_VISITED||GL\_NEAR} \circ e_{out})(i)$$

Expression 8: Traverses out from user to list of locations, filtering visits older than a week

```
gremlin> g.v(6098).outE.filter{it.label in ["FS_VISITED","FB_VISITED",\
"GL_NEAR"] && it.on > (((long)System.currentTimeMillis()/1000) - \
604800)}.inV.filter{it.id in (locs as Long[])}.name.groupCount(m); \
m.sort{a,b -> b.value <=> a.value}
```

Expression 9: Travereses out from user to list of locations visited in the last week expressed in Gremlin. Returns locations sorted by count.

f states that for user vertex i traverse outgoing edges labeled "FS_VISITED","FB_VISITED","GL_NEAR", created in the last week, to incoming location vertex in list q[]. Return matched location.

Location	Visits
Cambridge Brewing Company	6
Starbucks	6
Third Square	5
MIT Media Lab (E-14)	4
Cambridge Innovation Center	3
Cosi - Kendall Square	3
The Friendly Toast	2
Metaversal Studios	2
Voltage Coffee & Art	2
Boca Grande Cambridge	1
Meadhall	1

Table 1: Shows the last week of a responder's visited location clusters near the requested favor meeting location

We should note that we are following a simplified version of the location prediction methodology based on GPS data clustering proposed by Ashbrook and Starner.[93] That is we are creating clusters of reported locations and therefore are able to identify hotspots where the user usually travels. The next step would be to implement the full predictive model based on the probability that user moves from one hotspot to another based on all the hotspots they have previously

traveled to from that hotspot. Because we did not have a very high density of reported locations, relative to that provided by a continuous GPS stream, we were able to get satisfactory results in our evaluation by guessing the user's likelihood of being able to pass by a certain location for the purpose of doing a favor by simply grouping their reported locations into time ordered clusters as per the stated query.

3.3.2 Importers and Location Gateways

Importers allow us to leverage users' current usage of social and mobility networking and sharing systems in order to supply Reach with data for conducting matches and sending messages. In this way, the minimal usage scenario for Reach, allows users to sign up and then continue with their current social and mobility sharing habits, being alerted by message when they are called to serve. In this section we will detail importers we use and the data we receive from them. We will then describe the Reach datagraph and how the imported data fits in.

Facebook	Foursquare	Google Latitude & Places
Identity	Identity	Identity

Likes	Friends	History of visited places derived from coordinate data
Friends	History of visited places via checkin history	
History of visited places via checkin history	Realtime Updates of Friends likes	
Realtime Updates of Friends, likes and new checkins	Update of friends on new login	
Places detail	Places detail	Places detail

Table 2: Shows the data Reach imports from each of the supported providers

Table 2 provides an overview of the data we collect from each importer. Since we consume identity and location history from every provider, linking any of these accounts is sufficient to allow a user to start using Reach. However, during the sign up process we encourage users to connect at least two of the three accounts since they provide fairly unique information based on the nature of the service and how it is traditionally used. Namely, Facebook is usually the richest source of viable relationship data and the only provider of a user's taste profile of the three (via "likes"). On the other hand a minority of users use Facebook as their primary location sharing service.[41]

This is where Foursquare is strongest, providing the highest value user initiated location reports along with a basic articulated social graph. Google Latitude can provide passive location tracking (if the user enables this) and therefore the most time accurate position density of the three. We are able to infer from the position clustering when the user is near a trending place (as per the Foursquare and Google Places APIs) and in our prototype use this information to establish both availability and connectedness between people who visit similar places. This however would not scale if there were many users who did not know each other on the system, as per our prior critique of location sharing services, so if Google Latitude is to be accepted as the sole provider in a production system like Reach a profile that provides connectedness informing information must be collected from the user. In the current prototype, we ask for a very minimal amount of data from the user, instead relying on the data they have previously shared online.

3.3.3 Data Graph

The Reach data graph consists of nodes (vertices), relationships (edges) and indices that provide shortcuts to specific vertices in the graph. Tables 3 – 5 provide entity level detail for each of these graph components. It is the organization of these entities that represent the Reach data model and their traversal the application logic.

Nodes

USER	Contains properties associated with identity, Geo Coordinates, communications preferences and time availability
VENUE/PLACE	Contains properties associated with any place that can be meaningfully geocoded
FAVORITE	Any concept or institution that may be favorited that does not have a meaningful address. This would include for example sports teams and philosophies.
FAVOR	Contains properties about a specific requested favor
INTERVIEW RESPONSE	These nodes are a sort of "Cache" which represents users' responses to a Reach administered taste profile. Relationships with certain responses may increase or decrease a user's suitability for a task
JOB/POSITION	This describes the employment that a user may have.

Table 3: Node entity types that make up the vertices of the Reach domain property graph

Relationships

FRIEND	Someone on the system that either has an existing latent tie or has established one through Reach.
FB_FRIEND	A friend on facebook
FB_VISITED	A checkin from Facebook

FS_FRIEND	A friend on Foursquare
FS_VISITED	A checkin from Foursquare
GL_NEAR	Indicates a ternding Foursquare location near a user's reported Latitude Coordinates
APP_NEAR	Indicates a trending Foursqaure location near the last place the user registered their location through the Reach Application.
LAST_SEEN	A relationship with a shifting incoming vertex of the most recent location where the user is known to be
FAVOR_REQUESTED	Denotes that a user has requested a favor
FAVOR_COMPLETED	Denotes that a user has completed a favor
FAVOR_REJECTED	Denotes that a user has rejected a favor that was routed to them
FAVOR_WITHDRAWN	Denotes that a user canceled a favor after submitting it.
FAVOR_IN_PROGRESS	A relationship with a shifting incoming vertex representing a favor the user is doing

	right now
FAVOR_REQUEST_IN_PROGRESS	A relationship with a shifting incoming vertex representing a favor the user is doing right now
LIKES	Indicates a positive sentiment towards something
INTERVIEW	Denotes a particular choice in the taste survey
WORK	Indicates where a user works or has worked
POSITION	Indicates that a position the user holds or has help
EMPLOYS	Indicates a relationship between an entity and position
HOMETOWN	Indicates where the geographical region the user indicates they are from
LIVES	Indicates the geographical region where the user lives or has lived

Table 4: Relationships that constitute the edges of the Reach domain property graph

Indices

UNIQUEINDEX	member_id	Uniquely identify a user by Reach id
	FB_id	Uniquely identify an entity imported from Facebook by their id
	FS_id	Uniquely identify an entity imported from Foursquare by their id
	GL_id	Uniquely identify an entity imported from Google Latitude by their id
	email	Uniquely identify a user by email address
	ActiveFavors	Identify favors that need helpers
TIMELINE	joined	A timestamp of when a user has joined
USERSWORLD	*Spatial*	A geo-queriable map of all the user visited locations stored in Reach
FAVORSWORLD	*Spatial*	A geo-queriable map of all the favors in Reach
<member_id>_WORLD	*Spatial*	One index per user indicating all the locations recorded for them
INTERVIEW	Category	An index of answers by question

Table 5: Indices and their keys that provide "short cuts" to specific vertices in the Reach property graph

3.3.4 Requests

Favor requests are at the heart of Reach. While in principle any request that can be modeled by a property graph can be included in the Reach ontology, for the alpha stage of the application detailed in this document we propose the six detailed in Table 6 – Table 12.[6] The delineation of requests into these separate categories is meant to make the synthesis and routing of the favors expressible in code and distinct enough as to infer future behavior based on the type of favors people are willing and unwilling to do. In practice this means that some favors are very specific, like *Putting Money in a Meter*, while some may have very similar execution plans, such as *buying food* and *buying something* (other than food). The semantics of the task guide how it is modeled and presented in the user interface. We postulate that our categorizations provide actionable information for users and coherent representations in data.

Need to borrow something...

What	iPhone/iPad/iPod Charger	Preset items matched to taste profile
	Android Cable/Charger	
	Apple Macbook Charger	

[6] In addition to these six, two other favors are proposed *Taxi Share* and *Give,* however these have not been implemented in the application at this time.

	$20 or less	Money
	Something else ...	User provided input
Where	Can you bring it to me?	Requester's location shared with responder
	I'll pick it up	Responder's location is shared with requester
	Let's meet at ...	Meeting place is selected
When	ASAP (next 2 hours or less)	Favor is active in the system for 2 hours
	Today	Favor is active in the system until midnight
	Anytime (never expires)	Favor never expires
	At ...	Needed at or by a specific time, favor expires after this.
Plan	borrow	This plan searches for responders near the established meeting place or near the requester's location at the time the favor was requested

Table 6: Detail of *borrow* favor

Need something from ...

What?		Requester enters free text.

Where sold?	Look for it wherever you are	Ask the responder to find the item.
	Let me pick a specific store	Requester chooses a specific business
	List of business types (e.g. convenience store, hardware store, etc) from Google Places	This list is used as input for a search against the Google Places api to determine where to send the responder
Where?	Can you bring it to me?	Requester's location shared with responder
	I'll pick it up	Responder's location is shared with requester
	Let's meet at ...	Meeting place is specified by the requester
When?	ASAP (next 2 hours or less)	Favor is active in the system for 2 hours
	Today	Favor is active in the system until midnight
	Anytime (never expires)	Favor never expires
	At ...	Needed at or by a specific time, favor expires after this.
Maxprice		Responder enters the amount of money they want to spend on this item

Plan	buy	This plan searches for responders near the established meeting place or near the requester's location at the time the favor was requested. The search range is dynamic as it is informed by a Google Places search (e.g. Users near the closest convenience store to the meeting place)

Table 7: Detail of *buy* favor

Food pickup ...

What?	Surprise me!	Buy anything
	Choose a specific place	Requester chooses a specific business
	Specify something else	The responder enters free text
Where?	Can you bring it to me?	Requester's location shared with responder
	I'll pick it up	Responder's location is shared with requester
	Let's meet at ...	Meeting place is selected
When?	ASAP (next 2 hours or less)	Favor is active in the system for 2 hours
	Today	Favor is active in the

		system until midnight
	Anytime (never expires)	Favor never expires
	At ...	Needed at or by a specific time, favor expires after this.
Maxprice		Responder enters the amount of money they want to spend on this item
Plan	buyfood	This plan searches for responders near the established meeting place or near the requester's location at the time the favor was requested.

Table 8: Detail of *buyfood* favor

Move something heavy ...

What?	What are we moving?	Requester enters free text.
Where?	Meet where I am	Requester's location shared with responder
	Let's meet at ...	Meeting place is selected
When?	ASAP (next 2 hours or less)	Favor is active in the system for 2 hours
	Today	Favor is active in the system until midnight

	Anytime (never expires)	Favor never expires
	At ...	Needed at or by a specific time, favor expires after this.
Plan	move	This plan searches for responders near the established meeting place or near the requester's location at the time the favor was requested

Table 9: Detail of *move* favor

Pay my meter ...

Where?	Dude, where's your car?	User enters their car location on a map or via address
When?	ASAP (next 15 minutes)	Favor is active in the system for 15 minutes
	before ...	favor expires after this time.
Plan	meter	small search radius around the car location is searched.

Table 10: Detail of *meter* favor

Tech Support ...

What?	Brief problem description	Requester enters free text.
Where?	Meet where I am	Requester's location

		shared with responder
	Let's meet at ...	Meeting place is selected
When?	ASAP (next 2 hours or less)	Favor is active in the system for 2 hours
	Today	Favor is active in the system until midnight
	Anytime (never expires)	Favor never expires
	At ...	Needed at or by a specific time, favor expires after this.
Plan	techsupport	This plan searches for responders near the established meeting place or near the requester's location at the time the favor was requested

Table 11: Detail of *techsupport* favor

Need a lift?

Where to?	Where are you going?	User enters the destination on a map or via geosearch
Where?	Can you pick me up?	Requester's location shared with responder
	I'll meet you	Responder's location is shared with requester
	Let's meet at ...	Meeting place is

		selected
When?	ASAP (next 2 hours or less)	Favor is active in the system for 2 hours
	Today	Favor is active in the system until midnight
	Anytime (never expires)	Favor never expires
	At ...	Needed at or by a specific time, favor expires after this.
Plan	rideshare	Search for drivers (known via taste profile) near the meet location. Always exclude responders who have never been to the destination area.

Table 12: Detail of *rideshare* favor

In addition to the inputs detailed in the preceding tables each favor type allows a requester to offer a "bounty" on the favor. This is meant to encourage and reward responders who help. While there is no restriction on what can be offered as a bounty, we draw inspiration from the crowdfunding website, kickstarter.com, and allow for a non-monetary reward system to emerge in our exchange (along side of monetary rewards). Kickstarter facilitates the gathering of investment from the general public to fund creative endeavors ranging from Indie films to new products, and while it encourages posters to offer rewards to funders, it does not allow financial

compensation. Instead users are motivated by personalized gifts from the funder and recognition of their participation in the project in the community.[94] We anticipate that users of Reach will be creative with the bounty feature and that it's open-ended nature will attract a diverse set of motivations for participation.

Finally, all favors allow the requester to send a note providing more detail about the favor. In the case of paying the meter it is required as the requester must provide the vehicle description and optimally the license plate number for the favor to be completed.

3.3.5 Reputation and Social Capital

The alpha version of Reach implements a simple reputation model based on the number of favors a user has requested and the number of favors they have done. Every message sent requesting a favor indicates the number of favors the user has done and the number they have done specifically for the potential responder. In this way we hope to both encourage people to help those that have helped them as well as to create a social capital whereby people who are generous with their time are recognized as such by people who they have not yet done a favor for and may not even know.

We discussed the concept of reciprocity in the *Principles* section of this chapter and based on the ideas presented therein we can assert that on the whole people will be more likely to reciprocate favors to people who have

helped them before. We are however also interested in providing a reputation capital[5] to users so that they can attract the help of people with whom they have not connected before. We see the global number of favors they have done to be the beginnings of this type of capital. In addition personal endorsements of the type used by CouchSurfing[55] would be another way to allow people to identify themselves as trust and help-worthy.

From ratings and endorsements on eBay, Etsy and CouchSurfing to recommendations on LinkedIn or even simple Google searches, a person's online reputation is becoming an increasingly consequential part of their identity.[5] Similarly, Reach seeks to reward people's good deeds with a "permanent" online record. Indeed systems for making online reputation portable, by aggregating all of a person's reputation data, have been widely proposed.[95] In future we would like to see the Reach reputation model exchange data with reputation management systems as well as pull data in for display to users.

3.3.6 User Interface

The user interface to the Reach alpha consists of a web based sign up processes and a mobile application for requesting and responding to favors. The website was created using HTML5 with CSS media queries so that it provides a satisfactory experience when accessed with a mobile browser, while the mobile application was created with jQuery mobile so it could provide a satisfactory experience on a larger screen device, however the design conventions are recognizably different between the two. The distinct interfaces were deemed necessary because the signup process required a textual introduction and some interactions that are more commonly done on larger screens. In this early prototype, this user interface serves largely to provide a "feel" for the kind of interaction possible with a system like Reach.

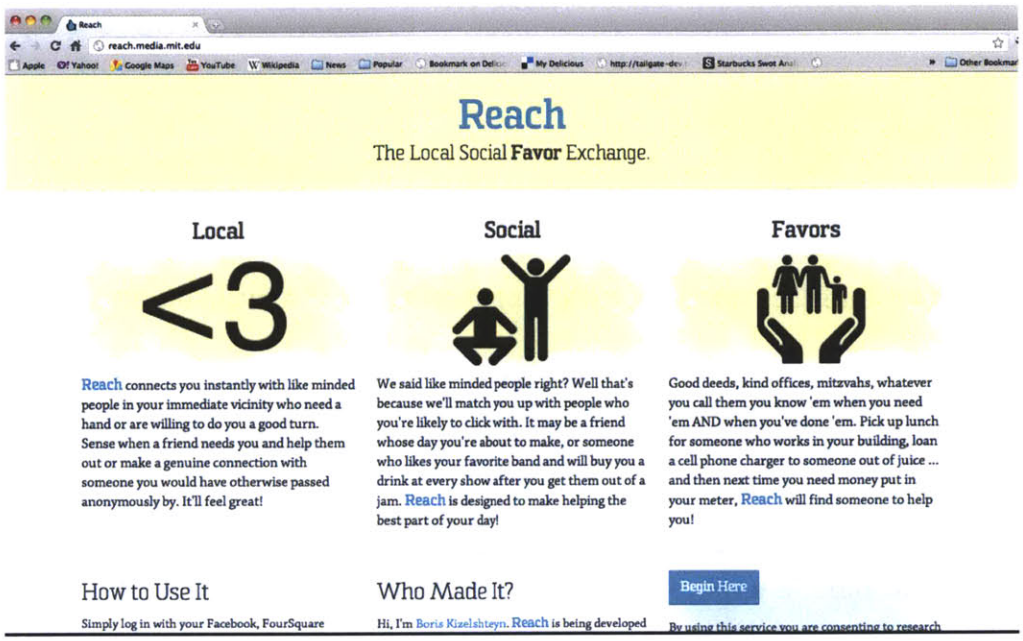


Figure 12: Reach Homepage

Figure 11 shows the Reach homepage, which provides a context for the application and explains the concept.

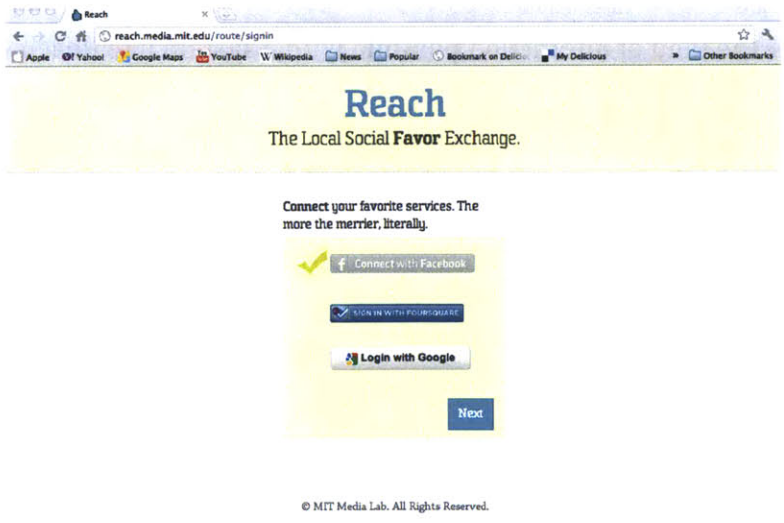


Figure 13: Sign up for Reach via an existing identity provider

Figure 12 shows the interface for adding identity providers. Click the named buttons takes the user to the grant permission screens of the corresponding service and then redirects them back here were a successful import and connection is denoted by a check mark.

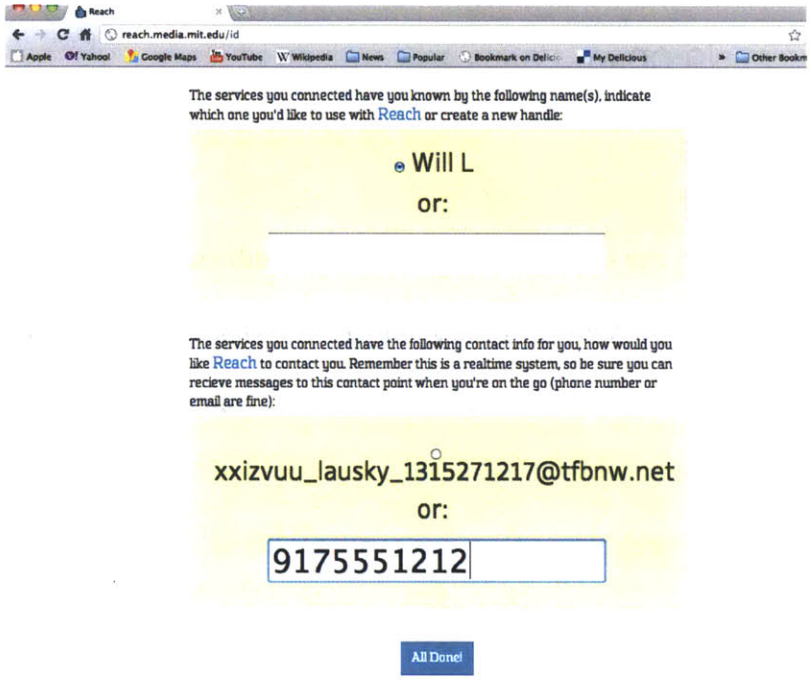


Figure 14: Reach sign up and identity process

Figure 13 shows the identity page where users are prompted to either accept information gathered from the identity providers the connected or provide custom name and contact information for Reach.

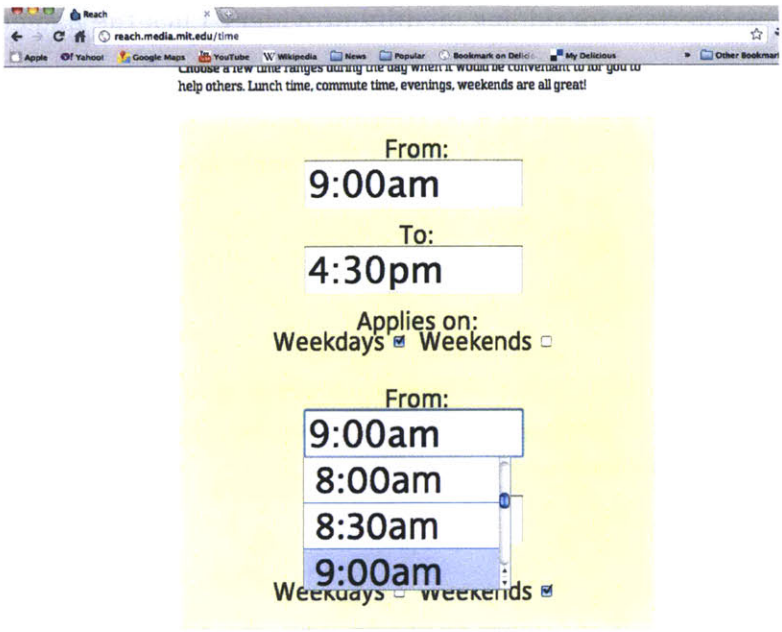


Figure 15: User provides their availability

Figure 14 shows the user availability page. Here users can specify times of the day and days of the week when they are available to help others, these times are honored by the Reach matching algorithms.

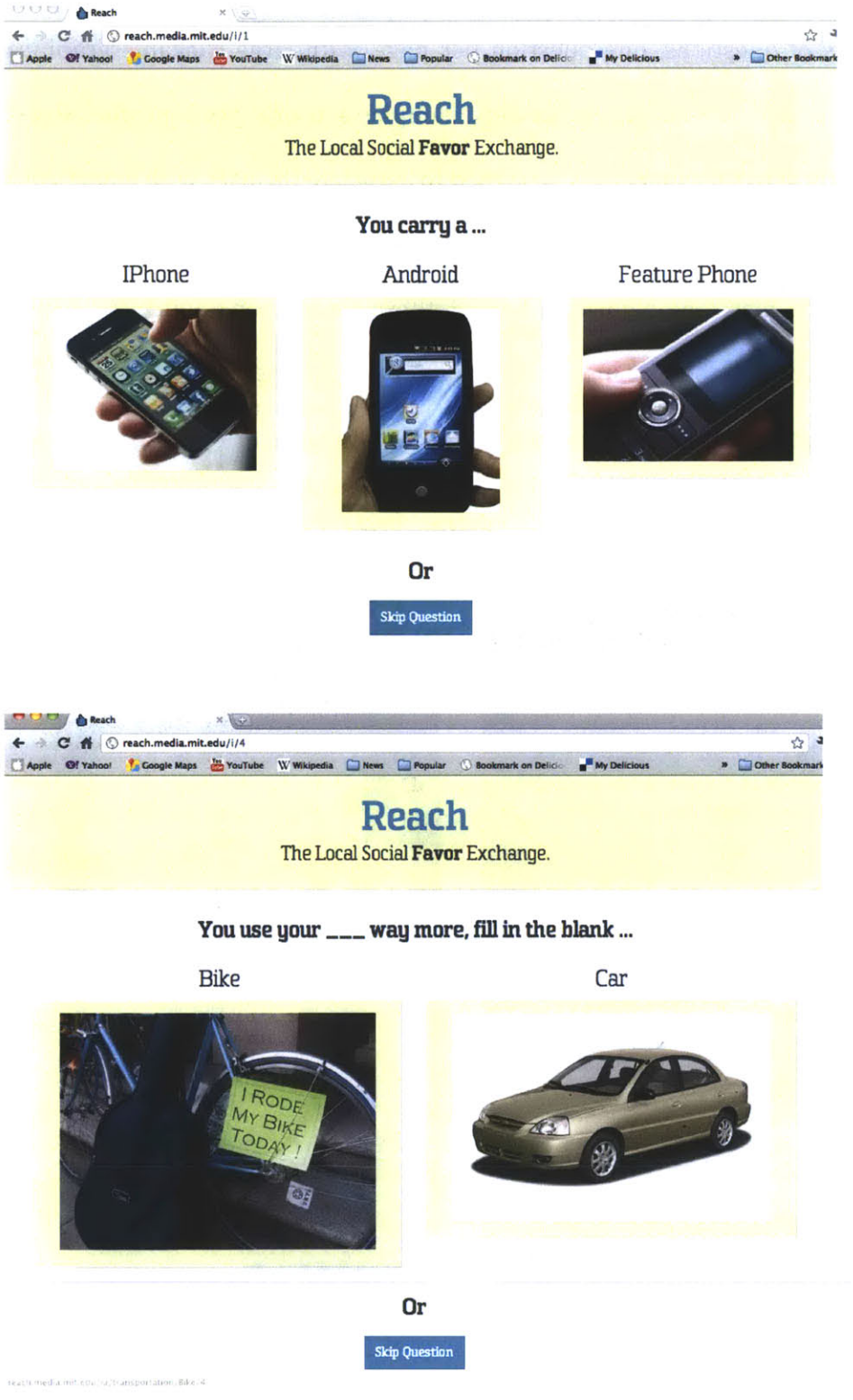


Figure 16: User provides a taste profile in Reach

Figure 15 presents two pages from the user interview. The user interview is a series of questions, one question per page, with large clickable graphical answers, that are meant to quickly compile a user's taste profile. Reach currently asks four questions, designed to associate the user with a particular mobile device, operating system, computing form factor and transportation mode. The matching algorithm honors these associations and more can be added easily, enabling a more robust picture of the user. Once the interview is complete the user can start using Reach on mobile to request favors and help others.

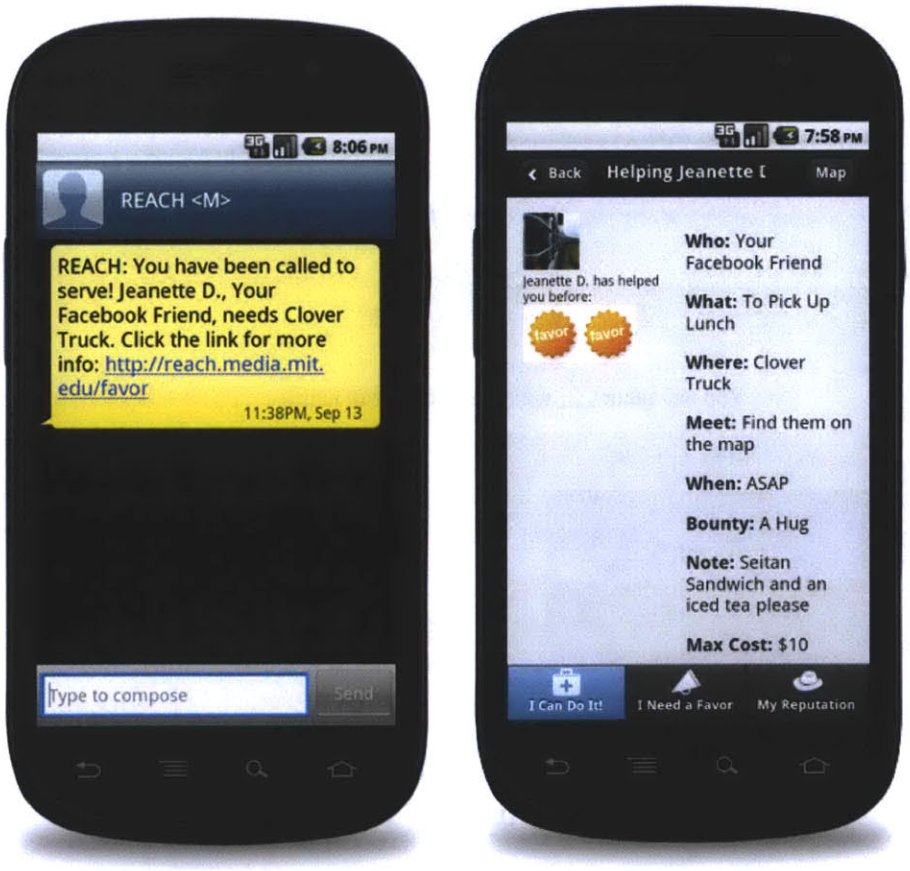


Figure 17: Reach call to serve and favor detail

Figure 18: Reach favor list by proximity

Even if criteria for a match between a request and a responder is lacking, or if the user turns off favor request messages, they are still able to browse favors to be done in their proximal area. Figure 18 pictures a list of open favors. In the summary, we present a picture of the requester if available through one of the services they connected as well as their name and how they are connected to the potential responder. The favor is also briefly stated as well as how many favors they have done overall and for the perspective responder. The detail screen in Figure 17 provides more specific information about the task as well as a button to accept the task. The detail screen serves

as a landing page for links from favor request messages that are sent to perspective responders.

Figure 19: Reach Favor Request Ontology

Figure 19 shows the user interface for the favor ontology described in detail earlier in this chapter.

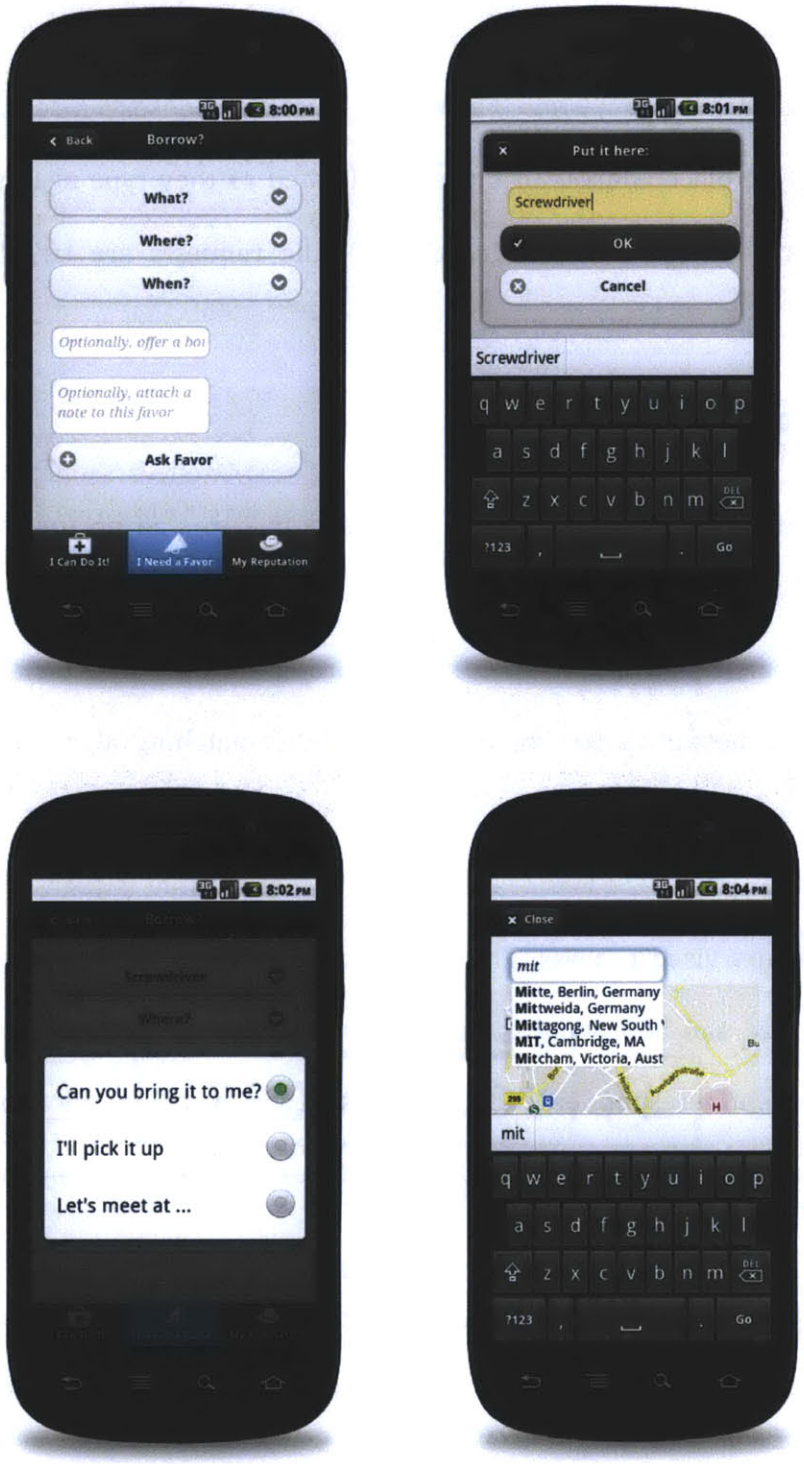


Figure 20: Requesting a favor

Figure 2 illustrates the steps involved in requesting a *borrow* plan favor. The user indicates what they want, when they want it and then chooses a meeting place. The meeting place address or place is validated as they type against the Google Places database so the locations in the requests are largely accurate.

3.4 Current State of Reach

Reach is currently early alpha software. Users are able to sign up for the service by connecting one or more of the social and mobility sharing networks they participate in and then specify profile options that dictate some parameters necessary for the operation of the matching algorithm. Users can then use the Reach mobile application to request one of the seven implemented favor plans. The favors are saved into a queue that is currently actioned via a supervised process. This involves an administrator running through the queue and approving the responder matches. Once these are approved the potential responders receive a message via the communication channel specified during signup that they have been called to serve. They can then click through and view a detail of the task with an opportunity to accept it. On the back end, the Reach data graph is updated in real-time with the user's location and participation in the system, this data informs the match runs.

The system has been tested with a density of 11 users who were surveyed at every interaction point with the system. This provided useful insights into the practicality and "feel" of Reach. While the application requires significant additional, practical, development before it can run autonomously and support a high density of users, the user evaluation we conducted and analyzed as part of this research confirms that a local social favor exchange is a feasible and desirable endeavor that will appeal to current day users of social and mobility sharing networks. We now present this evaluation.

4. Evaluation

4.1 User Study

We evaluated the feasibility and potential for adoption of Reach as we have formulated the system's matching algorithm and feel of the user interface through a series of user surveys. The first survey served as a qualifier to find a population of users already accustomed to sharing their mobility information online and to create a baseline psychographic profile of their attitudes towards location sharing services and online reputation. Once we recruited our user population we invited them to sign up for Reach, request and then subsequently perform a favor. At each of these steps the users were surveyed regarding their sentiment towards the action they had just performed. Study participants were incentivised with one chance to win an $100 American Express gift certificate in a raffle for participating in the qualification survey and in a second raffle for signing up for Reach and participating in the subsequent surveys. All surveys and survey recruitment literature was reviewed and approved by the MIT Committee On the Use of Humans as Experimental Subjects.[7]

---

[7] COUHES # 1105004467

4.1.1 Qualification Survey

We put out a broad call for participation in our qualification survey entitled *Usage of location-based services, attitudes towards online reputation and serendipitous encounters.* The survey was advertised on Twitter, mailing lists and by word of mouth. The goal of this survey was primarily to recruit people who were already heavy users of location based services and would therefore be comfortable with an application that uses their location as part of its central functionality. In addition we were interested to create a psychographic baseline of participants' views regarding their inclination towards helping others, uses for location based service and online reputation and how and if this informed their participation in Reach.

The 36 question survey had 97 out of 99 respondents agree to participate in the research. Of the 97 we determined that 36 were "power users" of location sharing services. We designated a power user as someone who shared their location on Google Latitude, Foursquare, Facebook Places, Gowalla or Twitter once a month or more. The invitation to participate in the survey did not reveal that users were being qualified for participation in an application alpha. Figure 21 shows the questions used to determine the qualified pool of users as they were posed and the total respondent pool.

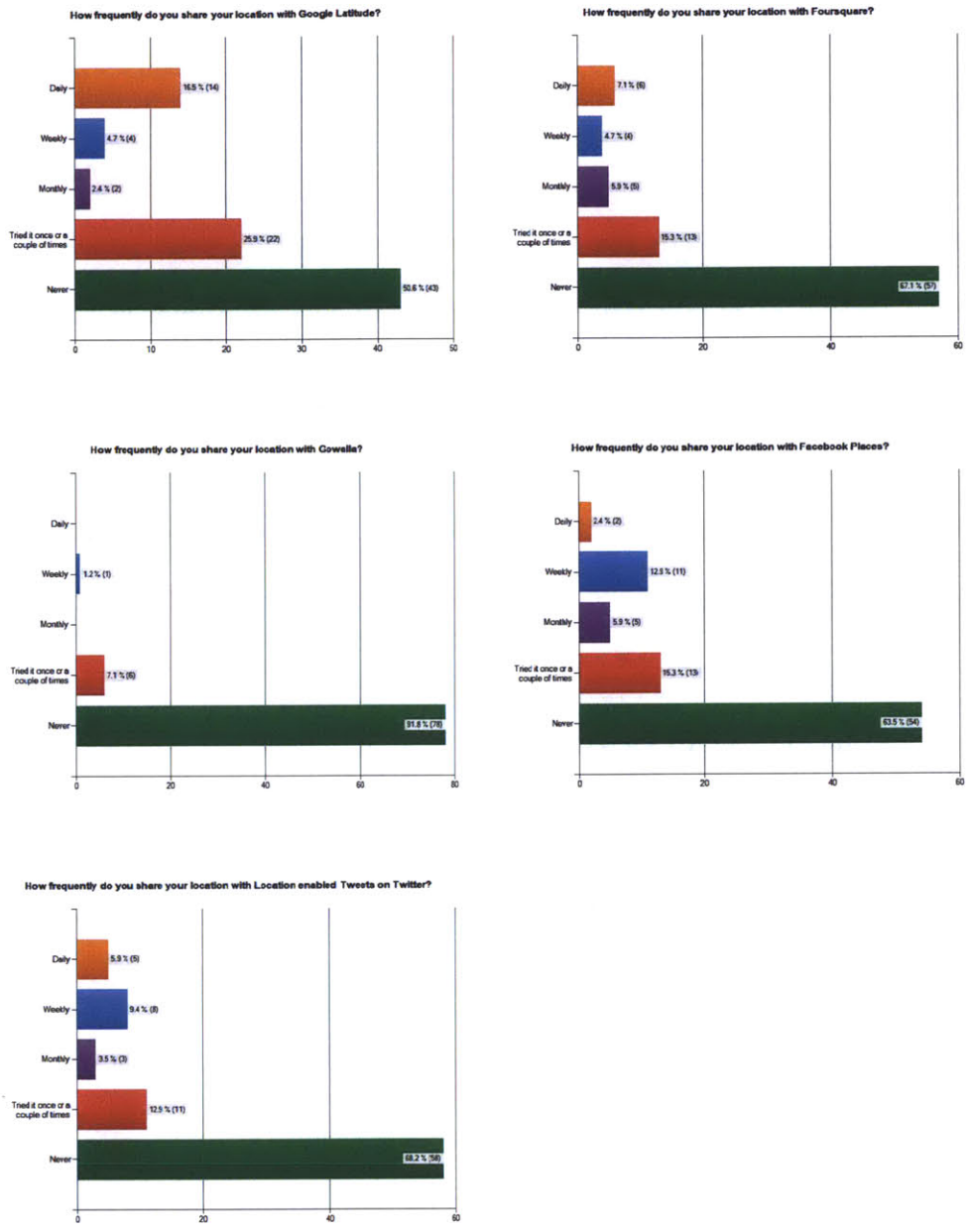
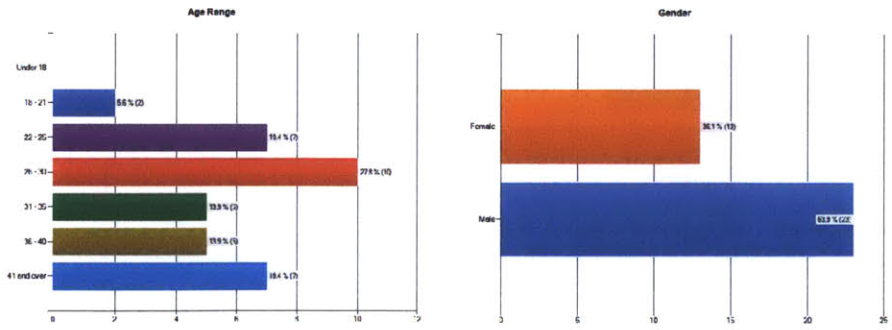


Figure 21: Location sharing on Google Latitude, Foursquare, Facebook Places, Gowalla and Twitter by all qualification survey respondents.

We will now present this group's answers to the remaining qualification questions to in order to reveal their reported attitude towards issues we

assert are important for the adoption and evaluation of a system like Reach. For readers interested in the total population's responses to these questions, the complete survey is provided in the Appendix of this document.

We acknowledge that the participants in this survey self selected to participate, therefore making it only an accurate description of the population that actually participated and that more rigorous surveys are needed in order to extrapolate any conclusions to a more general population. Nonetheless, among the acknowledged best practices of attracting a community to participate in an electronically mediated exchange, is being selective of its initial audience and expending significant effort getting to know them and making the system work for their needs.[96] It is with this motivation in mind that we present the survey responses of the users invited to participate in evaluating Reach.



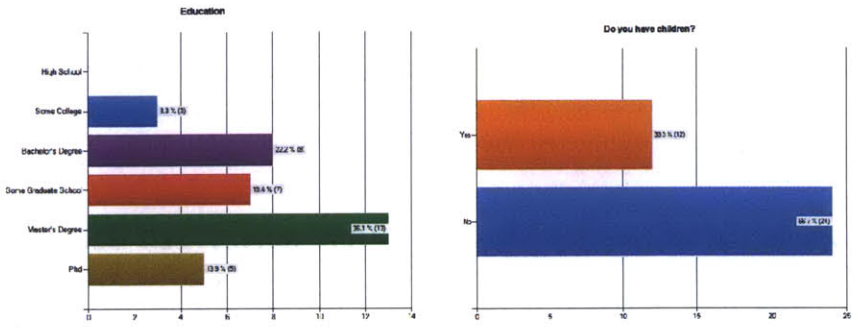


Figure 22: Age, sex, education and parental status of the qualified population

In addition to basic demographics, we requested survey respondents to disclose parental status. With this information it would be possible to evaluate how having children impacts participation in favor exchange.

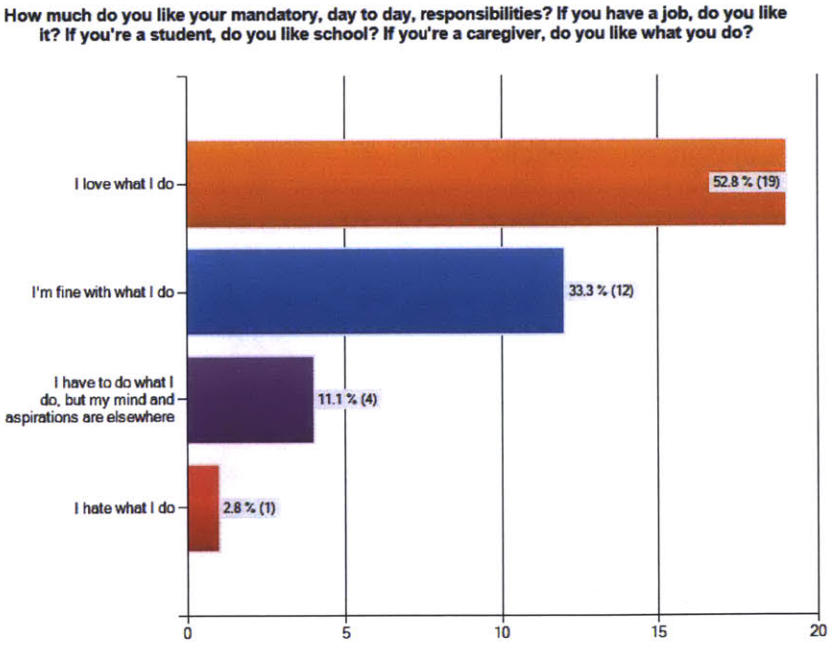


Figure 23: Overall satisfaction with primary daily activity of the qualified population

Figure 23 represents an attempt to gauge if users are satisfied with what they do on a daily basis. Similar to the parental status question, it would be of interest to determine if any correlation exists between participant's ongoing satisfaction with their daily activities and their participation in Reach.

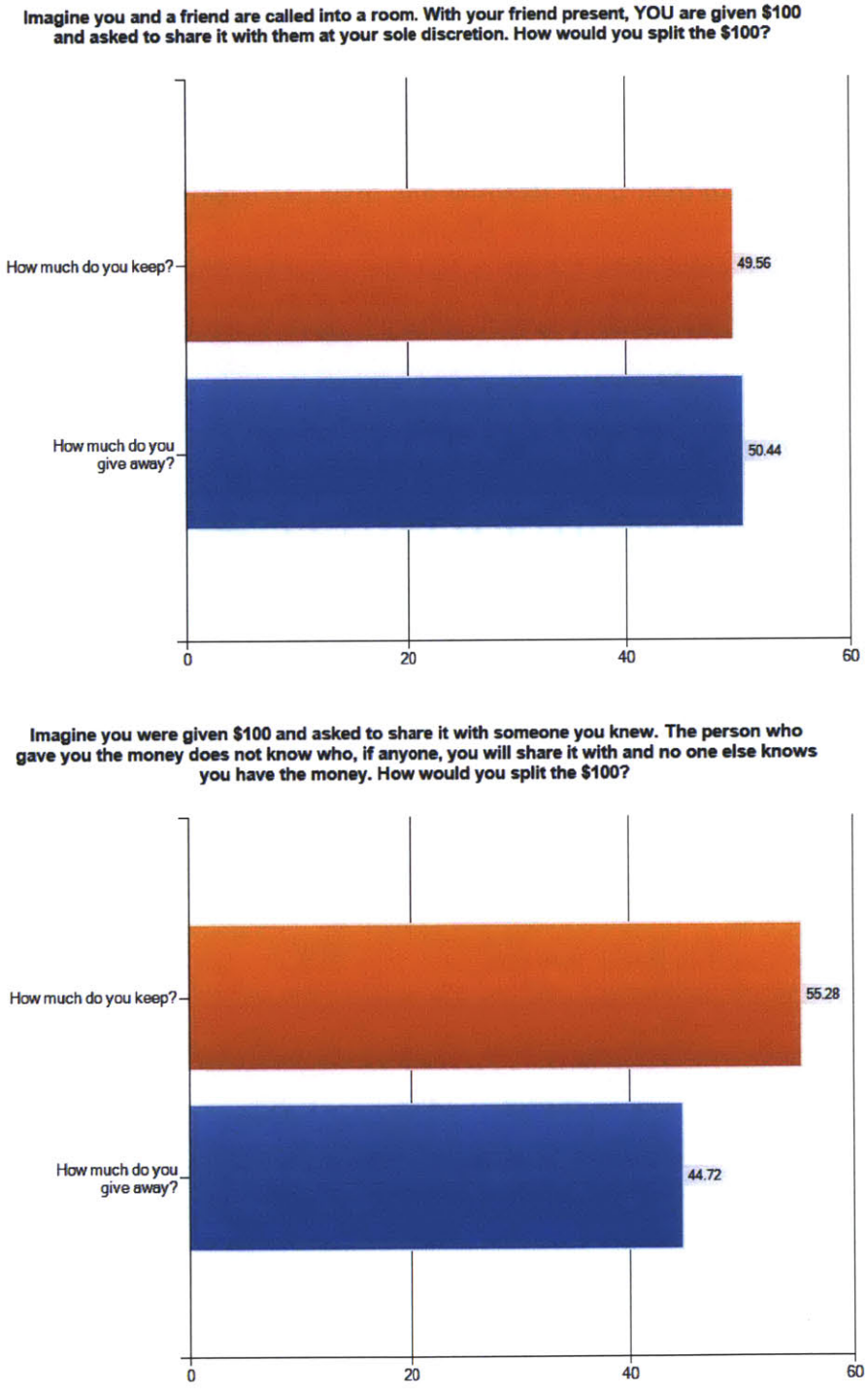


Figure 24: Outcomes of "The Dictator Game" as reported by the qualified population

Figure 24 shows the outcome of a simplified version of the widely conducted economics experiment called the "dictator game." In this game, a user is asked to divide money unilaterally between themselves and another person. Repeated independent experiments have revealed that in the majority of cases the "dictator" will give some or even half the money to the other party, even though they don't have to. This holds even in extreme cases where the "dictator's" actions are completely unobserved. This experimental outcome is problematic for the prevailing theory that people are self-interested, rational, economic actors; as the most economically "rational" action for the "dictator" to take is to keep all the money.[97] Our interest in this experiment is to provide a "moral barometer" of our population, namely do they report themselves to be morally consistent with the participants of this experiment done elsewhere. Based on the collected responses, our population self reports as being is inline or more moral than other recorded respondents to this experiment.

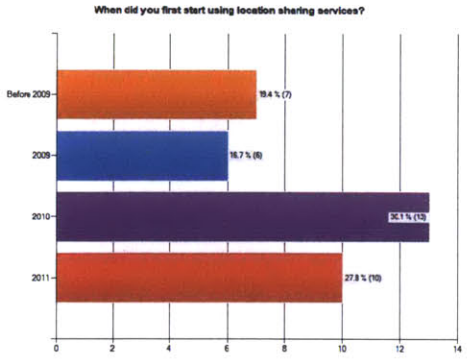


Figure 25: When the qualified population first started using location based services

Figure 25 points to the fact that most of our population has been sharing their location for a year or more, indicating that we can expect a history of user locations for many of the users and that they will continue to use the service throughout our study.

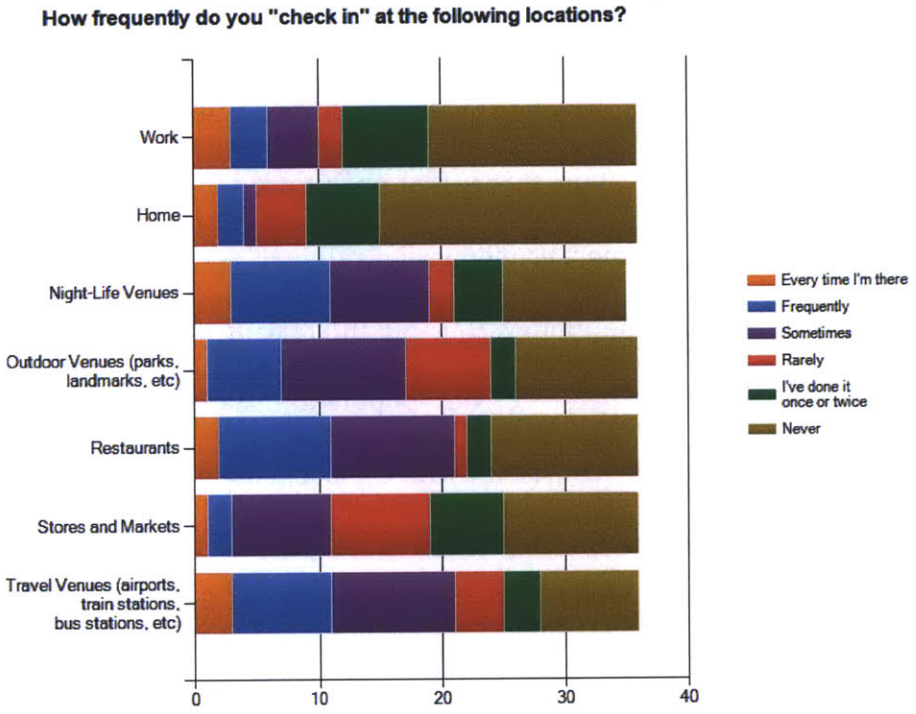


Figure 26: Check-in habits of the qualified population

Figure 26 illustrates where the qualified population normally checks in, with at least some participants checking in at every enumerated venue type.

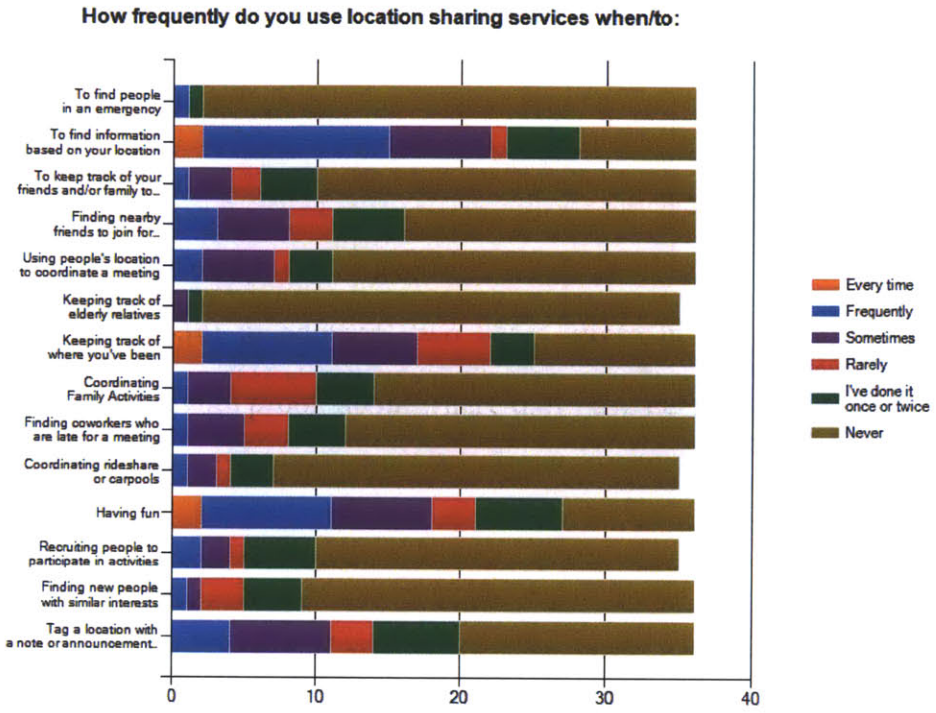


Figure 27: Uses for location sharing services reported by the qualified population

Figure 27 illustrates the ways in which our qualified population uses location sharing services.[4] In addition, two users wrote in that they use these services to "brag with proof" about where they have been.

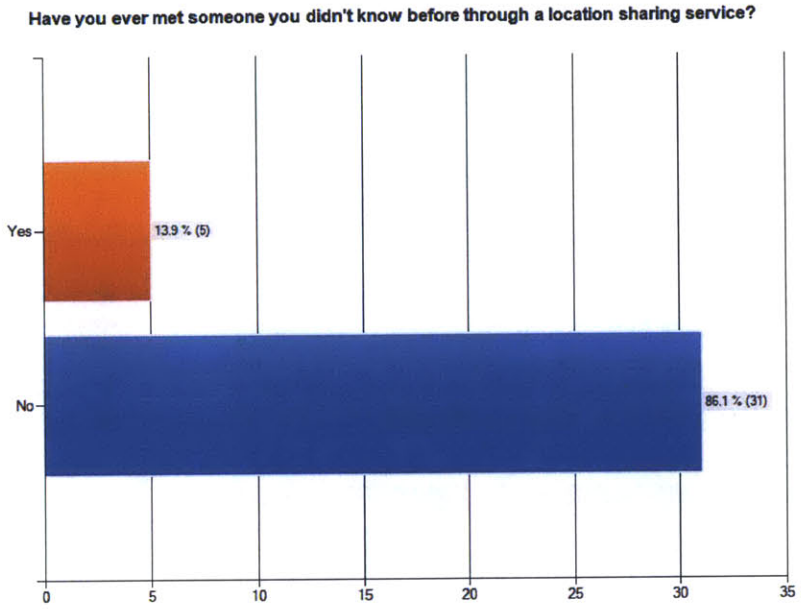
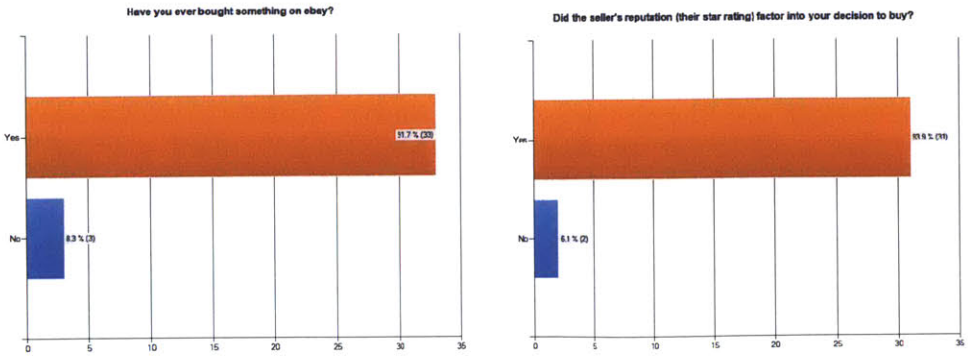


Figure 28: New friends made through location sharing reported by the qualified population

Figure 28 shows that members of our population already have experience with meeting new people via locative media.

We now turn to a series of questions regarding our qualified population's views on online reputation.



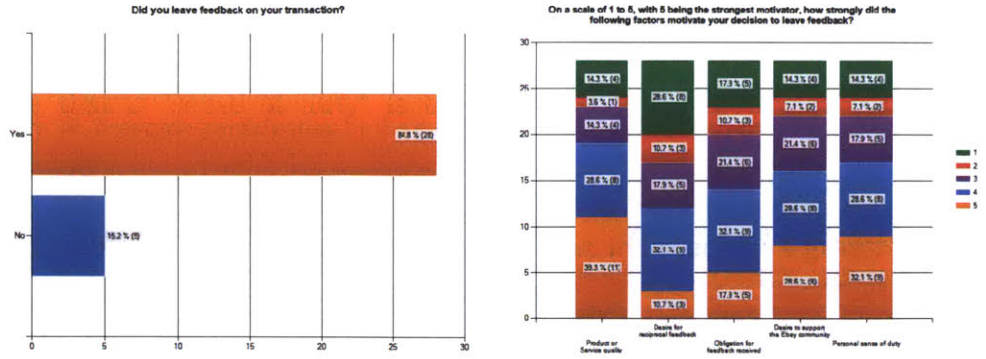


Figure 29: Experience buying on eBay

Figure 29 presents our population's experience as buyers on eBay and their motivation for leaving feedback. The vast majority of users had experience as buyers on eBay and used the reputation system as part of the transaction. Note that a "sense of duty" is the second highest motivator for leaving feedback.

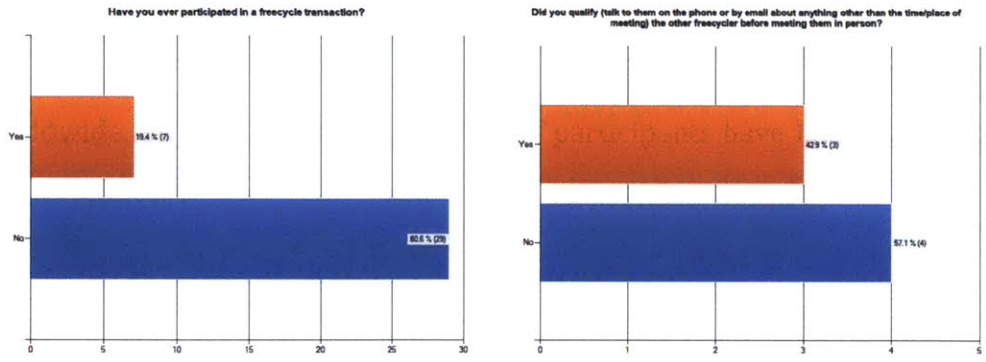


Figure 30: Freecycle participation by the qualified population

Figure 30 shows our population's participation in Freecycle, a grassroots and nonprofit reuse community, with nearly five thousand local chapters worldwide.[98] We note that a number of participants have had experience

trading reuse items face to face and qualifying people in advance of these meetings.

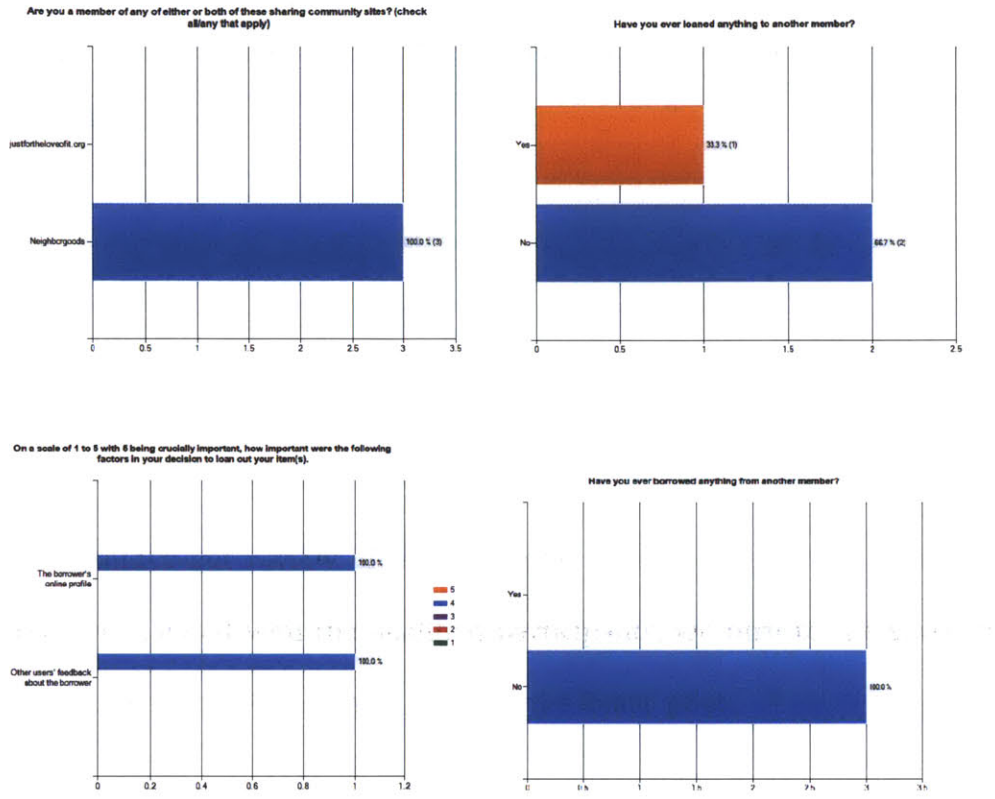


Figure 31: Members of resource sharing communities Neighborgoods and justfortheloveofit.com in the qualified population.

Figure 31 shows that a small number of people in our population already have experience coordinating real-life resource sharing using online systems.

This concludes our review of the qualification survey. Now that we have become acquainted with the qualified participants, we turn to the surveys administered during their participation in the Reach pilot.

4.1.2 Qualified Users' Survey

The qualified user's survey was administered after invited users signed up for Reach by connecting their Facebook, Foursquare and/or Google Latitude accounts and completing the identity and taste profile. Of the 36 users who qualified and were invited, 19 completed the registration and participated in the *Qualified User Exit Survey.*

Upon being invited to participate in this phase of the research users were informed that they would be testing a local social favor exchange and were introduced to Reach. After registration they were asked the following questions to assess their feelings towards trading favors of the type Reach is designed to broker.

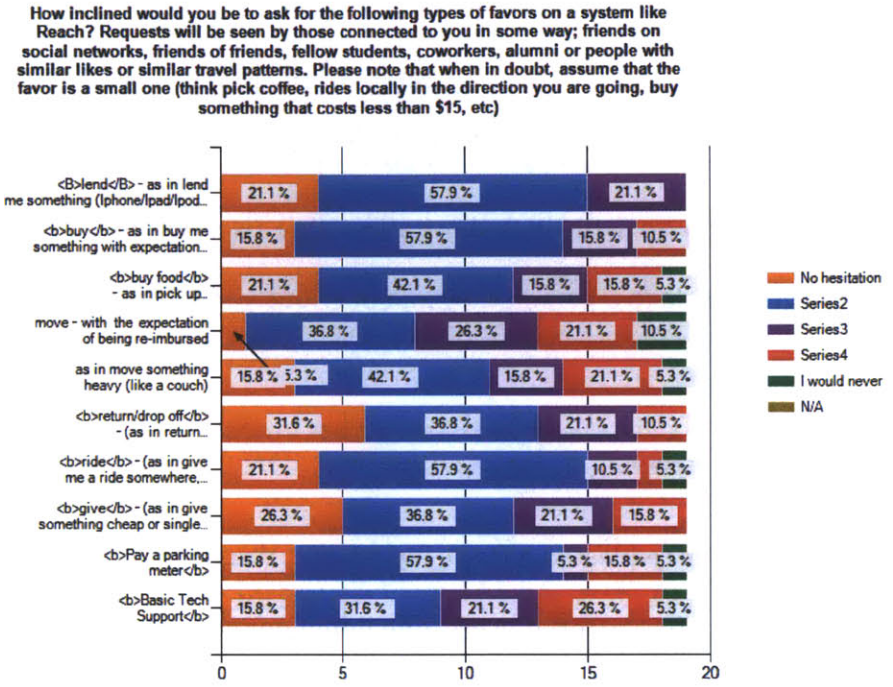


Figure 32: The sentiment of registered Reach users regarding asking for a favor

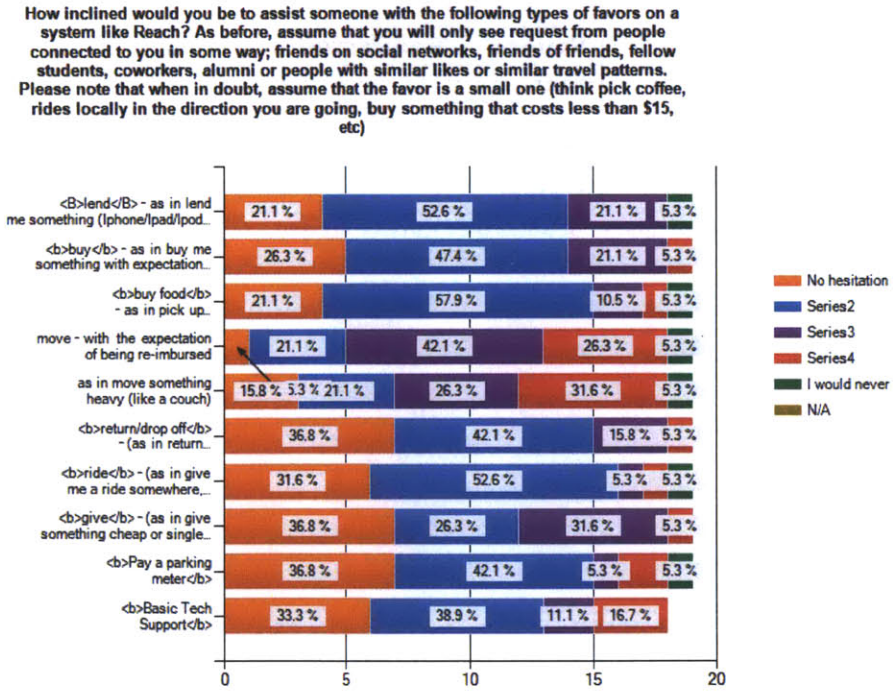


Figure 33: Sentiment of registered Reach users regarding doing favors

Figures 32 and 33 present Reach users' sentiments towards asking for and performing the favors in the specified ontology. Over 90% of users indicated that they would ask for and/or perform the favors listed. Over 50% indicated that they would do so with little hesitation. One user wrote in that they would only give a ride to a person they had previously met.

4.1.3 Favors Requested

The first time a user requested a favor they were presented with the *Request Exit Survey.* Of the 19 registered users, one opted out of future surveys, so of the 18 people who could have requested favors, 12 did. The favor plans requested are presented in Table 13.

Favor	Requested
Buy	1
Buyfood	2
Borrow	8
Meter	1

Table 13: Favor plans and number of times they were requested

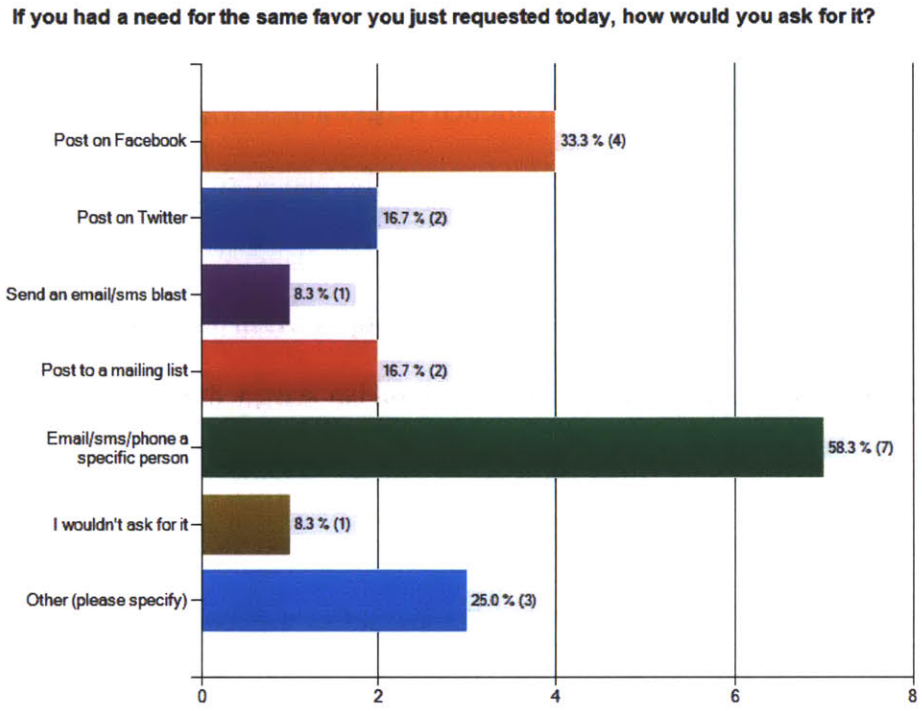


Figure 34: Shows how users would have asked for the same favor before Reach

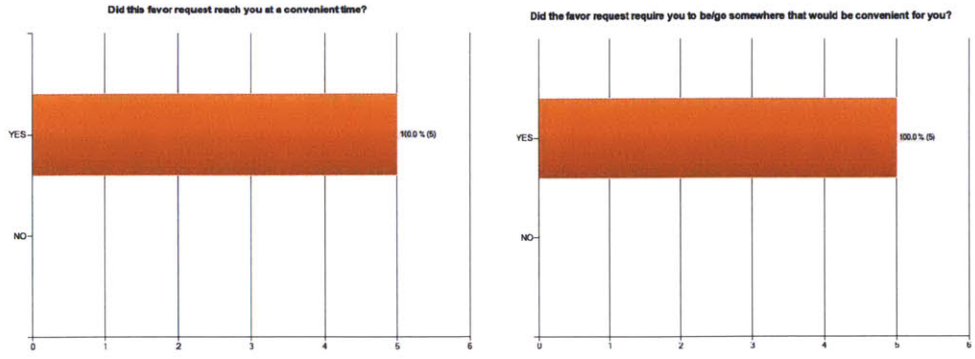
Figure 34 shows that users requesting favors overwhelmingly equated the request on Reach with a personal favor they would ask someone they knew.

4.1.4 Favors Assigned

The final user evaluation was conducted after a user was called to serve. Out of the 12 favors requested, five were actually relayed to users. Because of the low density of users during our alpha and the disparate times of day people indicated they were available it was difficult to match the actual requester with the respondent during a time frame in which a favor was valid. So instead favors were time shifted to the availability of users. Would be respondents were asked to focus on the experience of being called to serve and to answer the survey as if the favor request was real, but not to actually perform the favor. Table 14 shows the favors that were relayed to responders. The complete calls to serve are included in the Appendix.

Favor	Requested by
buyfood	Foursquare Friend
buyfood	User who frequently checked in from the same location as requester
borrow	Facebook Friend
meter	Friend of a Facebook Friend

Table 14: Favor plans sent to potential responders



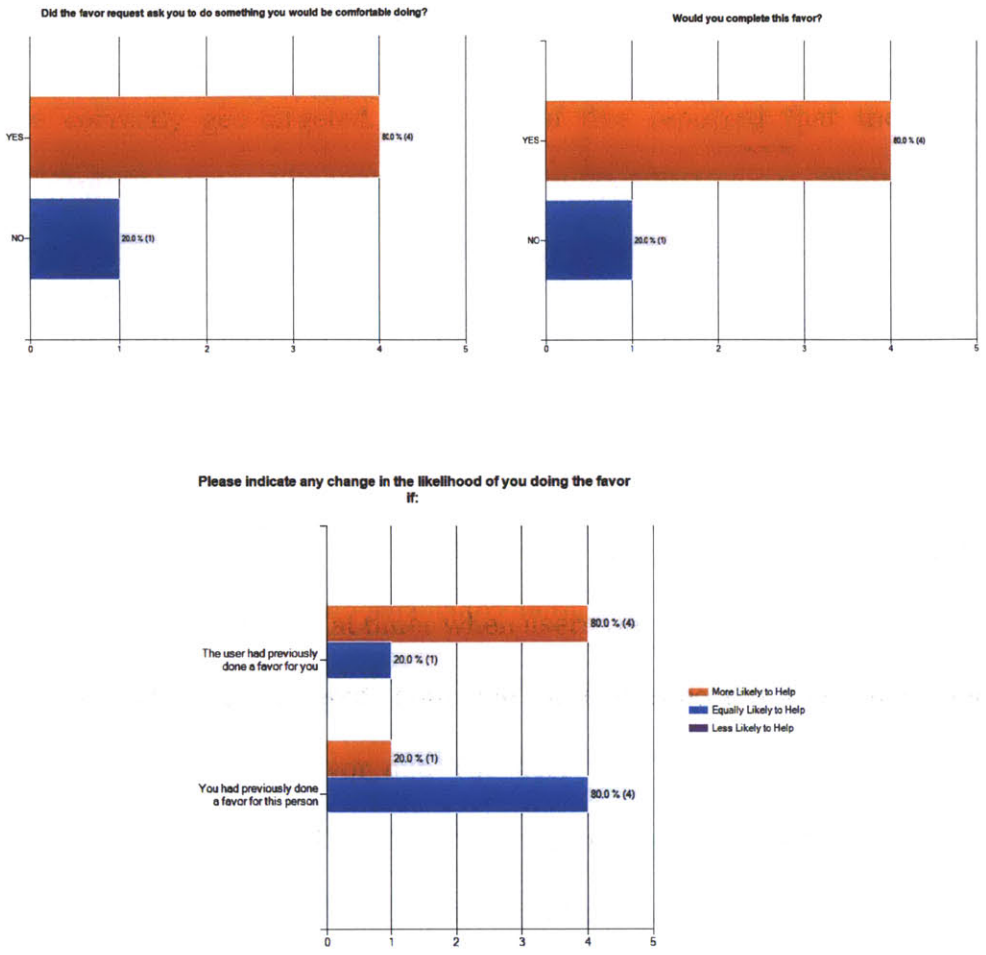


Figure 35: User's reflection on receiving a call to serve from Reach

Figure 35 shows the reactions of users called to serve by Reach. We see that all five requests were sent at times when users were available to respond and were correctly geo-targeted. Four out of five reported that they were prepared to carry the favor out. The user who did not feel comfortable performing the favor and declined to perform it wrote in that they did not feel comfortable helping a friend of a Facebook friend they had never met personally.

4.1.5 Discussion

We qualified a population of users who frequently use location-sharing services and would therefore be comfortable with a system like Reach, which takes as a baseline the location of its users. This population was then profiled and invited to sign up and participate in the favor exchange. Users found the tasks involved in Reach to be agreeable and the targeting mechanism to be accurate with respect to time and location. With regards to matching connectedness, we could not gather conclusive data given our small sample size, therefore until there is heavier use of Reach with feedback from users on which social connections really translate into closeness, the weighting of connections is an informed guess. On the other hand, users felt that interacting with the Reach network was akin to asking a specific friend for help, thereby bolstering our intuition that an intentional messaging network can preserve the intimacy of person-to-person communication while leveraging the redundancy of a network. That is, unlike a single friend who may not be available to provide help when you need it, Reach will find someone who is likely to help.

While the findings of this user study are preliminary they point to the fact that heavy users of social and mobility sharing networks are already comfortable with the constituent behaviors associated with a local social favor exchange. A system like Reach is therefore both feasible and desirable

and is likely to be adopted by an audience with the profile collected in this study.

5. Future Work

We assert that the findings presented in this paper validate Reach as a feasible system that can attract and benefit a population of users. Nonetheless, the system is currently a proof of concept that can be developed to be much more robust with the addition of more sophisticated location tracking and destination predicting technology, a more robust and informative reputation system and finally a user interface that is more adaptive and a favor ontology that is much more broad, relying on natural language processing for inferring the user's input into favor plans.

Reach currently implements a simple ranking by frequency and time of day of visits to a particular location to "predict" a user's suitability for performing a favor involving that location. While this method is acceptable for the user study we conducted, Reach would be much better served by a model that takes into account the paths users take from one location to another and then implement a statistical model to guess the likelihood that they are heading towards or away from a specific location.[99] In addition, the realtime location tracking employed by Reach and it's data sources relies on the "enhanced" gps made available in mobile devices and through the W3C Geolocation API specification compliant web-browsers for realtime location information. The positioning information provided by these methods can be extremely inaccurate and in the case of user initiated checkins, outdated. It

would be desirable to incorporate into Reach more robust locative technology, as this would assure more accurate favor targeting even at scale.

The Reach reputation system should be significantly developed such that it serves a much more central role in the system. The logical next step for developing this system is the introduction of user ratings and the ability to offer these ratings in a consumable data form so that they can be incorporated into other systems, so that ratings out of systems like Reach can be used as a public indicator of trust much like the credit rating is used today.[5] In addition, Reach should be able to pull in user ratings from other sources and allow these to be additional identifying information about users.

Finally, the Reach favor ontology is rigid and requires additional programming in order to add new tasks and adapt plans. Further the system is not aware of the difference between a person making a request from for example a moving train, an airport, and an office. Work being done in the MIT Media Lab's Software Agents Group on "goal networks" for building introspective applications could be incorporated into Reach in order to make it easier to use, more flexible and adaptive to the meaningful context of the users. A goal network is the combination of low level actions required to accomplish a high level goal. ToDoGo is a system capable of inferring these low level goals automatically from user input and context.[100] Such a system incorporated into Reach would greatly simplify the interface and,

assuming it could be made reliable, could make it much more difficult to make nonsensical favor requests or engage unavailable people.

Person to person exchanges that enable the transaction direct value with others is a recent phenomenon. Reach is the first such system to utilize physical and social proximity to enable people to transact favors. As such it is a very early stage application that can be improved and built upon in numerous ways. Here we have presented three that the author believes would both make the application significantly better and serve as interesting future research directions.

6. Conclusion

We have described social systems that amplify people's natural ability to form strong and weak ties. The natural impulse to form these ties drives the success of these systems, however as they become more popular they also become increasingly noisy. We observed that locative systems succeed by allowing people to create weak ties on the go, and offer physical proximity as a natural filter. However, because they are based on proximity, without meaningful social filters they become noisy channels even more quickly than applications that "live" online, and therefore out of the way. We then discussed algorithms already in play in our daily lives, helping us to discern information far faster than is possible with the un-augmented mind. Finally we postulated that local value exchanges will drive the demand for ramification of these interfaces and that that will drive innovation. In the pages that follow we will present our contribution to this innovation, a real-time social and physical proximity aware, intention focused messaging system. The system will leverage people's existing social networks, physical location and through optima seeking algorithms match them with others who can provide them with generative value. We believe this system will address the issues brought up throughout this section and provide a base design on which future proximal messaging platforms can be built.

We postulated that local value exchanges will drive the demand for ramification of these interfaces and that that will drive innovation. Reach, our

contribution to this innovation, is a real-time social and physical proximity aware, intention focused messaging system. The system leverages people's existing social networks, physical location and through optima seeking algorithms matches them with others who can provide them with generative value. In our use case, a favor exchange. We believe this system offers significant advantages over current state of the art peer-to-peer exchanges that flood users with the total information load on the network.

In our user study we found that users of present day social and location sharing networks are extremely receptive to the idea of a favor exchange that targets them and their friends based on availability, taste profile and social proximity. We found that user's equate sending a message to Reach with sending a message to a friend, even though they don't know the identity of that friend at the time. We believe Reach provides a base design on which future proximal messaging platforms can be modeled.

In conclusion we return to the sentiment expressed by Marshall McLuhan at the opening of this thesis, that our technologically extended nervous system makes us more connected to others and therefore more responsible for each other. We see Reach as a system that both materializes this sentiment and imagines how it might work in practice.

Table of Figures

References

[1] McLuhan, M. Understanding media; the extensions of man. McGraw-Hill, New York,, 1964.

[2] Corson, M. S., Laroia, R., Li, J., Park, V., Richardson, T. and Tsirtsis, G. Toward proximity-aware internetworking. Wireless Commun., 17, 6 2010), 26-33.

[3] boyd, d. m. and Ellison, N. B. Social Network Sites: Definition, History, and Scholarship. Journal of Computer-Mediated Communication, 13, 1 2007), 210-230.

[4] Tsai, J. Y., Kelley, P. G., Cranor, L. F. and Sadeh, N. Location-sharing technologies: Privacy risks and controls. In Proceedings of the In Research Conference on Communication, Information and Internet Policy (TPRC (2009).

[5] Botsman, R. and Rogers, R. What's mine is yours : the rise of collaborative consumption. Harper Business, New York, 2010.

[6] Rodriguez, M. A. and Neubauer, P. The Graph Traversal Pattern. CoRR, abs/1004.10012010).

[7] Weiser, M. The computer for the 21<supscrpt>st</supscrpt> century. SIGMOBILE Mob. Comput. Commun. Rev., 3, 3 1999), 3-11.

[8] Facebook. http://www.facebook.com

[9] Twitter. http://www.twitter.com

[10] Twitter #numbers. http://blog.twitter.com/2011/03/numbers.html

[11] Facebook Statistics. http://www.facebook.com/press/info.php?statistics

[12] Mannings, R. Ubiquitous positioning. Artech House, Boston, 2008.

[13] Kwak, H., Lee, C., Park, H. and Moon, S. What is Twitter, a social network or a news media? ACM, 2010.

[14] Tsotsis, A. Foursquare Now Officially At 10 Million Users. http://techcrunch.com/2011/06/20/foursquare-now-officially-at-10-million-users/, 2011.

[15] Benkler, Y. The wealth of networks : how social production transforms markets and freedom. Yale University Press, New Haven Conn., 2006.

[16] Granovetter, M. The Strength of Weak Ties. American Journal of Sociology, 78, 6 1973, 1360-1380.

[17] Barabási, A.-L. Linked : the new science of networks. Perseus Pub., Cambridge, Mass., 2002.

[18] Ahn, Y.-Y., Bagrow, J. P. and Lehmann, S. Link communities reveal multi-scale complexity in networks. City, 2009.

[19] Watkins, J. H. and Rodriguez, M. A. Weak Links: Stabilizers of Complex Systems from Proteins to Social Networks . Peter Csermely. (2006, Springer.) Hardcover, 64.95, 410 pages. Artificial Life, 13, 2 2007, 207-208.

[20] Hampton, K. and Wellman, B. Neighboring in Netville: How the Internet Supports Community and Social Capital in a Wired Suburb. City & Community, 2, 4 2003, 277-311.

[21] Christakis, N. A. and Fowler, J. H. Connected : the surprising power of our social networks and how they shape our lives. Little, Brown and Co., New York, 2009.

[22] Ellison, N. B., Steinfield, C. and Lampe, C. The Benefits of Facebook "Friends:" Social Capital and College Students' Use of Online Social Network Sites. Journal of Computer-Mediated Communication, 12, 4 2007), 1143-1168.

[23] Backstrom, L., Huttenlocher, D., Kleinberg, J. and Lan, X. Group formation in large social networks: membership, growth, and evolution. In Proceedings of the Proceedings of the 12th ACM SIGKDD international conference on Knowledge discovery and data mining (Philadelphia, PA, USA, 2006).

[24] Facebook Press Room. http://www.facebook.com/press.php

[25] boyd, d. Facebook is a utility; utilities get regulated 2010. http://www.zephoria.org/thoughts/archives/2010/05/15/facebook-is-a-utility-utilities-get-regulated.html

[26] Huberman, B. A., Romero, D. M. and Wu, F. Social networks that matter: Twitter under the microscope. 2008.

[27] Java, A., Song, X., Finin, T. and Tseng, B. Why we twitter: understanding microblogging usage and communities. In Proceedings of the Proceedings of the 9th WebKDD and 1st SNA-KDD 2007 workshop on Web mining and social network analysis (San Jose, California, 2007).

[28] PONTIN, J. The New Money. MIT Press, City, 2011.

[29] Grossma, L. Iran's Protests: Why Twitter Is the Medium of the Movemen. City, 2009.

[30] Ypodimitopolous, P. We Are The Network. City, 2011.

[31] Subrahmanyam, K., Reich, S. M., Waechter, N. and Espinoza, G. Online and offline social networks: Use of social networking sites by emerging adults. Journal of Applied Developmental Psychology, 29, 6, 420-433.

[32] Gopnik, A. THE INFORMATION How the Internet gets inside us. Conde Nast, City, 2011.

[33] Siegler, M. 2 Years And 10 Million Users Later, Google Latitude Locates The Check-In. Tech Crunch, City, 2011. http://techcrunch.com/2011/02/01/google-latitude-check-in/

[34] Foursquare. http://www.foursquare.com

[35] Raper, J. Editorial. Journal of Location Based Services, 5, 1 (2011/03/01 2011), 1-2.

[36] Location Awareness Programming Guide. Apple, City, 2010 http://developer.apple.com/library/ios/#documentation/UserExperience/Conceptual/LocationAwarenessPG/Introduction/Introduction.html.

[37] Fleishman, G. How the iPhone knows where you are: Apple uses GPS, Wi-Fi, and cell towers to get (and map) location data. macworld.com, City, 2011. http://www.macworld.com/article/159528/2011/04/how_iphone_location_works.html

[38] Lindqvist, J., Cranshaw, J., Wiese, J., Hong, J. and Zimmerman, J. I'm the mayor of my house: examining why people use foursquare - a social-driven location sharing application. ACM, City, 2011.

[39] Humphreys, L. Mobile social networks and urban public space. New Media & Society, 12, 5 2010), 763-778.

[40] Location Based Social Networks, Location Based Social apps and games - Links. http://bdnooz.com/lbsn-location-based-social-networking-links

[41] Carlson, N. Foursquare Doomed? Facebook Places Has 7X More Users. http://www.businessinsider.com/facebook-places-may-have-30-million-users-but-none-of-them-use-it-very-much-2010-10

[42] Simon, H. Designing Organizations for an Information-Rich World. 1971.

[43] Douglis, F. It's All About the (Social) Network. IEEE Internet Computing, 142010, 4-6.

[44] Maes, P. Agents that reduce work and information overload. Communications of the ACM, 37, 7 1994, 30-40.

[45] Freed, M., Carbonell, J., Gordon, G., Hayes, J., Myers, B., Siewiorek, D., Smith, S., Steinfeld, A. and Tomasic, A. RADAR: A Personal Assistant that Learns to Reduce Email Overload. Twenty-Third Conference on Artificial Intelligence 2008, 1287-1293.

[46] Yager, R. R. Targeted E-commerce Marketing Using Fuzzy Intelligent Agents. IEEE Intelligent Systems, 15, 6 2000), 42-45.

[47] Brozovsky, L. and Petricek, V. Recommender System for Online Dating Service. CoRR, abs/cs/07030422007.

[48] Ziegler, C. N. {Towards Decentralized Recommender Systems}. 2005.

[49] Rodriguez, M. A. and Pepe, A. Faith in the Algorithm, Part 1: Beyond the Turing Test. Computing Research Repository, abs/0903.0200.

[50] Page, L., Brin, S., Motwani, R. and Winograd, T. The PageRank Citation Ranking: Bringing Order to the Web. Technical Report, Stanford InfoLab, 1999.

[51] Bawden, D. and Robinson, L. The dark side of information: overload, anxiety and other paradoxes and pathologies. J. Inf. Sci., 35, 2 2009, 180-191.

[52] Bawden, D. and Robinson, L. The dark side of information: overload, anxiety and other paradoxes and pathologies. Journal of Information Science, 35, 2 2008), 180-191.

[53] CouchSurfing. http://www.couchsurfing.org/.

[54] About Couchsurfing. http://www.couchsurfing.org/about.html.

[55] Lauterbach, D., Truong, H., Shah, T. and Adamic, L. Surfing a Web of Trust: Reputation and Reciprocity on CouchSurfing.com. In Proceedings of the Proceedings of the 2009 International Conference on Computational Science and Engineering - Volume 04 (2009). IEEE Computer Society.

[56] CouchSurfing From Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/CouchSurfing.

[57] airbnb. http://www.airbnb.com/.

[58] Hickman, L. The end of consumerism? the guardian, http://www.guardian.co.uk/money/2011/jun/14/collaborative-consumption, 2011.

[59] Collaborative Consumption Hub. http://www.collaborativeconsumption.com/the-movement/cc_antenna/.

[60] eBay. http://www.ebay.com.

[61] Dellarocas, C. N., Fan, M. and Wood, C. A. Self-interest, reciprocity and participation in online reputation systems, 2004.

[62] Who We Are - eBay Inc. http://www.ebayinc.com/who.

[63] Suhonen, E., Lampinen, A., Cheshire, C. and Antin, J. Everyday favors: a case study of a local online gift exchange system. In Proceedings of the Proceedings of the 16th ACM international conference on Supporting group work (Sanibel Island, Florida, USA, 2010). ACM, [insert City of Publication],[insert 2010 of Publication].

[64] NeighborGoods. http://neighborgoods.net/.

[65] thefreeconomy. http://justfortheloveofit.org/.

[66] icancanu. http://www.icancanu.com/home.

[67] Horowitz, D. and Kamvar, S. D. The anatomy of a large-scale social search engine. ACM, City, 2010.

[68] Quercia, D. and Capra, L. FriendSensing: recommending friends using mobile phones. City, 2009.

[69] Groundcrew. http://groundcrew.us/.

[70] Inneract. http://inneract.us/.

[71] Situationist. http://www.situationistapp.com/.

[72] Localmind. http://www.localmind.com/.

[73] Fischer, G. Distributed intelligence: extending the power of the unaided, individual human mind. In Proceedings of the Proceedings of the working conference on Advanced visual interfaces (Venezia, Italy, 2006). ACM.

[74] Meet Gatsby. http://meetgatsby.com/.

[75] Message Party. http://messageparty.com/.

[76] Ask Around. http://around.ask.com/.

[77] MeetMoi. http://www.meetmoi.com/welcome.

[78] Grindr. http://www.grindr.com/.

[79] Sonar. http://itunes.apple.com/us/app/sonar-mobile-profile-for-local/id422549956?mt=8.

[80] Submate. http://www.submate.com/.

[81] Zaarly. http://www.zaarly.com/.

[82] Considerate Information Systems. http://wiki.media.mit.edu/view/MAS962SP09/WebHome.

[83] Burger, J. M., Sanchez, J., Imberi, J. E. and Grande, L. R. The norm of reciprocity as an internalized social norm: Returning favors even when no one finds out. Social Influence, 4, 1 2009, 11-17.

[84] Hokky, S. and Deni, K. Social Balance Theory: Revisiting Heider, A Balance Theory for many agents. EconWPA, 2004.

[85] Mcpherson, M., Lovin, L. S. and Cook, J. BIRDS OF A FEATHER: Homophily in Social Networks. Annual Review of Sociology, 272001, 415-445.

[86] Axelrod, R. M. The evolution of cooperation. Basic Books, New York, 2006.

[87] Heider, F. {Attitudes and cognitive organization}. Journal of Psychology, 21, 2 1946), 107-112.

[88] Fiore, A. T. and Donath, J. S. Homophily in online dating: when do you like someone like yourself? In Proceedings of the CHI '05 extended abstracts on Human factors in computing systems (Portland, OR, USA, 2005). ACM.

[89] Neo4j. http://www.neo4j.org.

[90] Gremlin. https://github.com/tinkerpop/gremlin.

[91] Rodriguez, M. A. The Graph Traversal Programming Pattern. http://www.slideshare.net/slidarko/graph-windycitydb2010, 2010.

[92] Rodriguez, M. and Neubauer, P. A Path Algebra for Multi-Relational Graphs. http://arxiv.org/abs/1011.0390, 2010.

[93] Ashbrook, D. and Starner, T. Using GPS to learn significant locations and predict movement across multiple users. Personal Ubiquitous Comput., 7, 5 2003, 275-286.

[94] Kickstarter. Wikipedia, http://en.wikipedia.org/wiki/Kickstarter.

[95] Alnemr, R., Bross, J. and Meinel, C. Constructing a Context-Aware Service-Oriented Reputation Model Using Attention Allocation Points. In Proceedings of the Proceedings of the 2009 IEEE International Conference on Services Computing (2009). IEEE Computer Society.

[96] Shirky, C. Cognitive surplus : creativity and generosity in a connected age. Penguin Press, New York, 2010.

[97] Henrich, J. P. Foundations of human sociality : economic experiments and ethnographic evidence from fifteen small-scale societies. Oxford University Press, Oxford New York, 2004.

[98] Freecycle. http://www.freecycle.org/.

[99] Krumm, J. and Horvitz, E. Predestination: Inferring Destinations from Partial Trajectories. UbiComp 2006: Ubiquitous Computing, 42062006, 243-260.

[100] Smith, D. A. and Lieberman, H. The why UI: using goal networks to improve user interfaces. In Proceedings of the Proceedings of the 15th international conference on Intelligent user interfaces (Hong Kong, China, 2010). ACM.

APPENDIX

Physical Layer

Reach is a Python application running the Tornado web server with a neo4j datastore. The front end is HTML5, CSS3, and jQuery Mobile. It is hosted on Amazon EC2 and can be accessed at http://reach.media.mit.edu. The codebase is archived in http://src.media.mit.edu/hg/reach.

User Study

Usage of location based services, attitudes towards online reputation and serendipitous encounters

SurveyMonkey

1. Do you consent to participate in this research?

	Response Percent	Response Count
Yes	98.0%	97
No	2.0%	2
answered question		99
skipped question		0

2. Age Range

	Response Percent	Response Count
Under 18	0.0%	0
18 - 21	7.2%	7
22 - 25	22.7%	22
26 - 30	**24.7%**	**24**
31 - 35	18.6%	18
36 - 40	13.4%	13
41 and over	13.4%	13
	answered question	**97**
	skipped question	**2**

3. Your Email:

	Response Count
	90
answered question	**90**
skipped question	**9**

4. Home Zip Code:

	Response Percent	Response Count
	100.0%	86
answered question		86
skipped question		13

5. How far away from your home does your daily commute take you?

	Response Percent	Response Count
0 - 10 miles	**81.4%**	**70**
10 - 30 miles	16.3%	14
30 - 50 miles	1.2%	1
Over 50 miles	1.2%	1
answered question		86
skipped question		13

6. How often do you drive a car?

	Response Percent	Response Count
Daily	20.9%	18
A few times a week	20.9%	18
A few times a month	25.6%	22
I drive very infrequently or not at all	**32.6%**	**28**
answered question		**86**
skipped question		**13**

7. Gender

	Response Percent	Response Count
Female	39.5%	34
Male	**60.5%**	**52**
answered question		**86**
skipped question		**13**

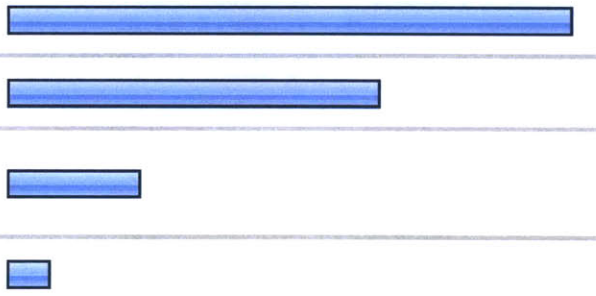
8. Education

	Response Percent	Response Count
High School	0.0%	0
Some College	7.0%	6
Bachelor's Degree	25.6%	22
Some Graduate School	19.8%	17
Master's Degree	**32.6%**	**28**
Phd	15.1%	13
	answered question	**86**
	skipped question	**13**

9. Do you have children?

	Response Percent	Response Count
Yes	30.2%	26
No	**69.8%**	**60**
	answered question	**86**
	skipped question	**13**

10. How much do you like your mandatory, day to day, responsibilities? If you have a job, do you like it? If you're a student, do you like school? If you're a caregiver, do you like what you do?



	Response Percent	Response Count
I love what I do	**51.2%**	**44**
I'm fine with what I do	33.7%	29
I have to do what I do, but my mind and aspirations are elsewhere	11.6%	10
I hate what I do	3.5%	3
answered question		**86**
skipped question		**13**

11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

	Response Average	Response Total	Response Count
How much do you keep?	**54.94**	**4,725**	86
How much do you give away?	45.06	3,875	86
answered question			**86**
skipped question			**13**

12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?

	Response Average	Response Total	Response Count
How much do you keep?	**50.22**	**4,269**	85
How much do you give away?	49.78	4,231	85
	answered question		**85**
	skipped question		**14**

13. How frequently do you share your location with Google Latitude?

	Response Percent	Response Count
Daily	16.5%	14
Weekly	4.7%	4
Monthly	2.4%	2
Tried it once or a couple of times	25.9%	22
Never	**50.6%**	**43**
	answered question	**85**
	skipped question	**14**

14. How frequently do you share your location with Foursquare?

	Response Percent	Response Count
Daily	7.1%	6
Weekly	4.7%	4
Monthly	5.9%	5
Tried it once or a couple of times	15.3%	13
Never	**67.1%**	**57**
	answered question	**85**
	skipped question	**14**

15. How frequently do you share your location with Gowalla?

	Response Percent	Response Count
Daily	0.0%	0
Weekly	1.2%	1
Monthly	0.0%	0
Tried it once or a couple of times	7.1%	6
Never	**91.8%**	**78**
	answered question	**85**
	skipped question	**14**

16. How frequently do you share your location with Facebook Places?

	Response Percent	Response Count
Daily	2.4%	2
Weekly	12.9%	11
Monthly	5.9%	5
Tried it once or a couple of times	15.3%	13
Never	**63.5%**	**54**
	answered question	**85**
	skipped question	**14**

17. How frequently do you share your location with Location enabled Tweets on Twitter?

	Response Percent	Response Count
Daily	5.9%	5
Weekly	9.4%	8
Monthly	3.5%	3
Tried it once or a couple of times	12.9%	11
Never	**68.2%**	**58**
	answered question	**85**
	skipped question	**14**

18. How do you use Google Latitude on your phone or tablet?

	Response Percent	Response Count
I let Google Latitude detect my location	**85.0%**	**17**
I set my own location on Google Latitude	0.0%	0
I have location updating turned off on Google Latitude	5.0%	1
I don't use Google Latitude on my phone or tablet	10.0%	2
answered question		**20**
skipped question		**79**

19. Do you use Google Latitude to "check-in" to Google Places?

	Response Percent	Response Count
Yes	20.0%	4
No	**80.0%**	**16**
answered question		**20**
skipped question		**79**

20. Do you have have the "location history" feature enabled in Google Latitude?

	Response Percent	Response Count
Yes	**50.0%**	**10**
No	25.0%	5
I don't know	25.0%	5
answered question		**20**
skipped question		**79**

21. When did you first start using location sharing services?

	Response Percent	Response Count
Before 2009	19.0%	11
2009	22.4%	13
2010	**34.5%**	**20**
2011	24.1%	14
answered question		**58**
skipped question		**41**

22. How frequently do you "check in" at the following locations?

	Every time I'm there	Frequently	Sometimes	Rarely	I've done it once or twice	Never	Response Count
Work	5.2% (3)	5.2% (3)	10.3% (6)	5.2% (3)	17.2% (10)	**56.9% (33)**	58
Home	3.5% (2)	3.5% (2)	5.3% (3)	8.8% (5)	15.8% (9)	**63.2% (36)**	57
Night-Life Venues	5.3% (3)	15.8% (9)	19.3% (11)	5.3% (3)	10.5% (6)	**43.9% (25)**	57
Outdoor Venues (parks, landmarks, etc)	1.7% (1)	13.8% (8)	19.0% (11)	12.1% (7)	10.3% (6)	**43.1% (25)**	58
Restaurants	3.4% (2)	17.2% (10)	22.4% (13)	3.4% (2)	8.6% (5)	**44.8% (26)**	58
Stores and Markets	1.7% (1)	5.2% (3)	17.2% (10)	17.2% (10)	10.3% (6)	**48.3% (28)**	58
Travel Venues (airports, train stations, bus stations, etc)	5.2% (3)	15.5% (9)	20.7% (12)	8.6% (5)	8.6% (5)	**41.4% (24)**	58
						answered question	**58**
						skipped question	**41**

23. How frequently do you use location sharing services when/to:

	Every time	Frequently	Sometimes	Rarely	I've done it once or twice	Never	Response Count
To find people in an emergency	0.0% (0)	1.8% (1)	3.6% (2)	1.8% (1)	1.8% (1)	**91.1% (51)**	56
To find information based on your location	5.4% (3)	**28.6% (16)**	21.4% (12)	3.6% (2)	12.5% (7)	**28.6% (16)**	56
To keep track of your friends and/or family to make sure they are ok	0.0% (0)	3.6% (2)	10.7% (6)	5.4% (3)	10.7% (6)	**69.6% (39)**	56
Finding nearby friends to join for social activities	0.0% (0)	7.1% (4)	14.3% (8)	5.4% (3)	14.3% (8)	**58.9% (33)**	56
Using people's location to coordinate a meeting	0.0% (0)	5.4% (3)	12.5% (7)	1.8% (1)	8.9% (5)	**71.4% (40)**	56
Keeping track of elderly relatives	0.0% (0)	0.0% (0)	3.6% (2)	0.0% (0)	1.8% (1)	**94.5% (52)**	55
Keeping track of where you've been	3.6% (2)	19.6% (11)	21.4% (12)	12.5% (7)	5.4% (3)	**37.5% (21)**	56
Coordinating Family Activities	0.0% (0)	1.8% (1)	10.7% (6)	14.3% (8)	8.9% (5)	**64.3% (36)**	56
Finding coworkers who are late for a meeting	0.0% (0)	1.8% (1)	14.3% (8)	5.4% (3)	10.7% (6)	**67.9% (38)**	56
Coordinating rideshare or carpools	0.0% (0)	3.6% (2)	7.3% (4)	3.6% (2)	5.5% (3)	**80.0% (44)**	55
Having fun	3.6% (2)	19.6% (11)	17.9% (10)	10.7% (6)	17.9% (10)	**30.4% (17)**	56
Recruiting people to participate in activities	0.0% (0)	3.6% (2)	5.5% (3)	3.6% (2)	9.1% (5)	**78.2% (43)**	55

Finding new people with similar interests	0.0% (0)	1.8% (1)	7.1% (4)	5.4% (3)	8.9% (5)	**76.8% (43)**	56
Tag a location with a note or announcement for others to read	0.0% (0)	7.1% (4)	23.2% (13)	7.1% (4)	16.1% (9)	**46.4% (26)**	56

If you've used a location sharing service for something else, please share it here:	3
answered question	**56**
skipped question	**43**

24. Have you ever met someone you didn't know before through a location sharing service?

	Response Percent	Response Count
Yes	10.7%	6
No	**89.3%**	**50**
If yes, optionally describe the meeting		4
answered question		**56**
skipped question		**43**

25. Have you ever bought something on ebay?

	Response Percent	Response Count
Yes	81.7%	67
No	18.3%	15
answered question		82
skipped question		17

26. Did the seller's reputation (their star rating) factor into your decision to buy?

	Response Percent	Response Count
Yes	95.5%	64
No	4.5%	3
answered question		67
skipped question		32

27. Did you leave feedback on your transaction?

	Response Percent	Response Count
Yes	**82.1%**	**55**
No	17.9%	12
	answered question	**67**
	skipped question	**32**

28. On a scale of 1 to 5, with 5 being the strongest motivator, how strongly did the following factors motivate your decision to leave feedback?

	5	4	3	2	1	Response Count
Product or Service quality	**43.6% (24)**	23.6% (13)	14.5% (8)	7.3% (4)	10.9% (6)	55
Desire for reciprocal feedback	18.2% (10)	**32.7% (18)**	18.2% (10)	7.3% (4)	23.6% (13)	55
Obligation for feedback received	18.2% (10)	**32.7% (18)**	20.0% (11)	10.9% (6)	18.2% (10)	55
Desire to support the Ebay community	**27.3% (15)**	25.5% (14)	21.8% (12)	7.3% (4)	18.2% (10)	55
Personal sense of duty	**36.4% (20)**	25.5% (14)	18.2% (10)	9.1% (5)	10.9% (6)	55
					answered question	**55**
					skipped question	**44**

29. Have you ever participated in a freecycle transaction?

	Response Percent	Response Count
Yes	14.6%	12
No	85.4%	70
answered question		82
skipped question		17

30. Did you qualify (talk to them on the phone or by email about anything other than the time/place of meeting) the other freecycler before meeting them in person?

	Response Percent	Response Count
Yes	50.0%	6
No	50.0%	6
If Yes, optionally elaborate on how you qualified them?		3
answered question		12
skipped question		87

31. Are you a member of any of either or both of these sharing community sites? (check all/any that apply)

	Response Percent	Response Count
justfortheloveofit.org	20.0%	1
Neighborgoods	**100.0%**	**5**
	answered question	**5**
	skipped question	**94**

32. Have you ever loaned anything to another member?

	Response Percent	Response Count
Yes	40.0%	2
No	**60.0%**	**3**
	answered question	**5**
	skipped question	**94**

33. On a scale of 1 to 5 with 5 being crucially important, how important were the following factors in your decision to loan out your item(s).

	5	4	3	2	1	Response Count
The borrower's online profile	**50.0% (1)**	**50.0% (1)**	0.0% (0)	0.0% (0)	0.0% (0)	2
Other users' feedback about the borrower	**50.0% (1)**	**50.0% (1)**	0.0% (0)	0.0% (0)	0.0% (0)	2
					answered question	**2**
					skipped question	**97**

34. Have you ever borrowed anything from another member?

		Response Percent	Response Count
Yes		0.0%	0
No		**100.0%**	**5**
		answered question	**5**
		skipped question	**94**

35. On a scale of 1 to 5 with 5 being crucially important, how important were the following factors in your decision to borrow an item from them?

	5	4	3	2	1	Response Count
The lender's online profile	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0
Other users' feedback about the lender	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0
					answered question	0
					skipped question	99

36. Based on your answers to this survey we may be interested in inviting you to participate in additional research for this project. Would it be okay to contact you by email with another survey? We will be running an additional drawing of a $100 American Express card.

		Response Percent	Response Count
Yes		91.5%	75
No		8.5%	7
		answered question	82
		skipped question	17

Page 4, Q4. Home Zip Code:	
1	
11205	Jul 24, 2011 6:17 PM
2	
02141	Jul 15, 2011 4:35 PM
3	
28277	Jul 15, 2011 9:33 AM
4	
00000	Jul 14, 2011 2:59 AM
5	
90405	Jul 13, 2011 1:52 PM
6	
02144	Jul 13, 2011 11:47 AM
7	

Page 4, Q4. Home Zip Code:

60189		Jul 13, 2011 10:56 AM
	8	
02139		Jul 13, 2011 1:38 AM
	9	
94704		Jul 13, 2011 1:11 AM
	10	
02141		Jul 12, 2011 11:02 PM
	11	
02139		Jul 12, 2011 10:15 PM
	12	
48103		Jul 12, 2011 8:13 PM
	13	
78758		Jul 12, 2011 7:17 PM
	14	
02114		Jul 12, 2011 4:41 PM
	15	
92092		Jul 12, 2011 4:32 PM
	16	
02141		Jul 12, 2011 4:22 PM
	17	
2200		Jul 12, 2011 4:08 PM

Page 4, Q4. Home Zip Code:	
18	
02144	Jul 12, 2011 4:03 PM
19	
02472	Jul 12, 2011 3:35 PM
20	
134-1000 - CR	Jul 12, 2011 3:32 PM
21	
02139	Jul 12, 2011 3:14 PM
22	
00000	Jul 12, 2011 2:58 PM
23	
02143	Jul 12, 2011 2:26 PM
24	
02130	Jul 12, 2011 2:09 PM
25	
02142	Jul 12, 2011 12:40 PM
26	
02140	Jul 12, 2011 10:22 AM
27	
48439	Jul 12, 2011 9:36 AM
28	

Page 4, Q4. Home Zip Code:

122738	Jul 12, 2011 9:33 AM
29	
02139	Jul 12, 2011 9:13 AM
30	
ASI|KR|KS013|SEOUL	Jul 12, 2011 3:51 AM
31	
KS013	Jul 12, 2011 1:45 AM
32	
02139	Jul 11, 2011 11:13 PM
33	
02139	Jul 11, 2011 10:36 PM
34	
02139	Jul 11, 2011 10:07 PM
35	
02139	Jul 11, 2011 10:01 PM
36	
02142	Jul 11, 2011 10:00 PM
37	
02446	Jul 11, 2011 9:59 PM
38	
01239	Jul 11, 2011 9:54 PM

Page 4, Q4. Home Zip Code:	
39	
98027	Jul 8, 2011 8:57 PM
40	
50010	Jul 8, 2011 1:18 PM
41	
96814	Jul 8, 2011 1:02 PM
42	
55435	Jul 8, 2011 11:51 AM
43	
52228	Jul 8, 2011 11:14 AM
44	
02474	Jul 8, 2011 10:59 AM
45	
98102	Jun 29, 2011 1:42 AM
46	
11211	Jun 28, 2011 5:18 PM
47	
02143	Jun 28, 2011 2:02 PM
48	
02132	Jun 27, 2011 11:24 PM
49	

Page 4, Q4. Home Zip Code:		
28277		Jun 27, 2011 11:06 PM
	50	
02139		Jun 27, 2011 10:44 PM
	51	
02143		Jun 27, 2011 10:09 PM
	52	
02476		Jun 27, 2011 9:53 PM
	53	
02144		Jun 27, 2011 8:11 PM
	54	
02133		Jun 27, 2011 8:02 PM
	55	
02139		Jun 27, 2011 7:21 PM
	56	
10035		Jun 27, 2011 7:08 PM
	57	
02139		Jun 27, 2011 6:16 PM
	58	
02139		Jun 27, 2011 6:12 PM
	59	
02139		Jun 27, 2011 6:07 PM

Page 4, Q4. Home Zip Code:	
60	
02139	Jun 27, 2011 6:03 PM
61	
28307	Jun 19, 2011 4:03 PM
62	
02139	Jun 18, 2011 3:11 PM
63	
02139	Jun 17, 2011 7:23 PM
64	
24219	Jun 17, 2011 2:04 PM
65	
98126	Jun 17, 2011 11:40 AM
66	
02139	Jun 17, 2011 11:25 AM
67	
02139	Jun 17, 2011 10:50 AM
68	
02138	Jun 17, 2011 9:41 AM
69	
20001	Jun 16, 2011 10:53 PM
70	

Page 4, Q4. Home Zip Code:

02142		Jun 16, 2011 9:43 PM
	71	
02139		Jun 16, 2011 9:22 PM
	72	
02130		Jun 16, 2011 8:06 PM
	73	
48230		Jun 16, 2011 7:13 PM
	74	
11201		Jun 16, 2011 2:10 PM
	75	
02139		Jun 16, 2011 11:46 AM
	76	
50023		Jun 16, 2011 11:10 AM
	77	
02492		Jun 16, 2011 11:05 AM
	78	
10019		Jun 16, 2011 11:03 AM
	79	
11238		Jun 16, 2011 10:24 AM
	80	
10017		Jun 16, 2011 10:03 AM

Page 4, Q4. Home Zip Code:

	81	
	11215	Jun 16, 2011 10:02 AM
	82	
	02145	Jun 16, 2011 8:10 AM
	83	
	22202	Jun 16, 2011 8:02 AM
	84	
	02139	Jun 16, 2011 5:10 AM
	85	
	98117	Jun 16, 2011 1:36 AM
	86	
	97330	Jun 16, 2011 1:23 AM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

		How much do you keep?
1	0	Jul 24, 2011 6:18 PM
2	90	Jul 15, 2011 4:36 PM
3	60	Jul 15, 2011 9:36 AM
4	70	Jul 14, 2011 3:02 AM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

5	100	Jul 13, 2011 1:53 PM
6	50	Jul 13, 2011 11:48 AM
7	50	Jul 13, 2011 10:56 AM
8	50	Jul 13, 2011 1:39 AM
9	70	Jul 13, 2011 1:13 AM
10	75	Jul 12, 2011 11:03 PM
11	50	Jul 12, 2011 10:16 PM
12	75	Jul 12, 2011 8:14 PM
13	100	Jul 12, 2011 7:18 PM
14	90	Jul 12, 2011 4:41 PM
15	50	Jul 12, 2011 4:36 PM
16	50	Jul 12, 2011 4:22 PM
17	50	Jul 12, 2011 4:09 PM
18	50	Jul 12, 2011 4:04 PM
19	50	Jul 12, 2011 3:35 PM
20	50	Jul 12, 2011 3:33 PM
21	50	Jul 12, 2011 3:14 PM
22	50	Jul 12, 2011 2:58 PM
23	50	Jul 12, 2011 2:27 PM
24	50	Jul 12, 2011 2:09 PM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

25	50	Jul 12, 2011 12:42 PM
26	50	Jul 12, 2011 10:23 AM
27	40	Jul 12, 2011 9:38 AM
28	50	Jul 12, 2011 9:38 AM
29	51	Jul 12, 2011 9:14 AM
30	50	Jul 12, 2011 3:57 AM
31	0	Jul 12, 2011 1:51 AM
32	50	Jul 11, 2011 11:14 PM
33	50	Jul 11, 2011 10:42 PM
34	50	Jul 11, 2011 10:08 PM
35	50	Jul 11, 2011 10:03 PM
36	99	Jul 11, 2011 10:00 PM
37	50	Jul 11, 2011 10:00 PM
38	50	Jul 11, 2011 9:55 PM
39	50	Jul 8, 2011 8:58 PM
40	50	Jul 8, 2011 1:19 PM
41	50	Jul 8, 2011 1:02 PM
42	40	Jul 8, 2011 11:51 AM
43	75	Jul 8, 2011 11:15 AM
44	50	Jul 8, 2011 11:00 AM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?		
45	0	Jun 29, 2011 1:43 AM
46	50	Jun 28, 2011 5:19 PM
47	50	Jun 28, 2011 2:03 PM
48	100	Jun 27, 2011 11:26 PM
49	60	Jun 27, 2011 11:09 PM
50	50	Jun 27, 2011 10:46 PM
51	50	Jun 27, 2011 10:10 PM
52	50	Jun 27, 2011 9:54 PM
53	25	Jun 27, 2011 8:12 PM
54	50	Jun 27, 2011 8:02 PM
55	100	Jun 27, 2011 7:22 PM
56	50	Jun 27, 2011 7:09 PM
57	50	Jun 27, 2011 6:18 PM
58	50	Jun 27, 2011 6:13 PM
59	80	Jun 27, 2011 6:08 PM
60	50	Jun 27, 2011 6:03 PM
61	0	Jun 19, 2011 4:04 PM
62	50	Jun 18, 2011 3:12 PM
63	80	Jun 17, 2011 7:25 PM
64	0	Jun 17, 2011 2:05 PM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

65	50	Jun 17, 2011 11:41 AM
66	70	Jun 17, 2011 11:26 AM
67	50	Jun 17, 2011 10:51 AM
68	50	Jun 17, 2011 9:42 AM
69	50	Jun 16, 2011 10:54 PM
70	100	Jun 16, 2011 9:44 PM
71	50	Jun 16, 2011 9:23 PM
72	20	Jun 16, 2011 8:28 PM
73	50	Jun 16, 2011 7:14 PM
74	60	Jun 16, 2011 2:11 PM
75	70	Jun 16, 2011 11:47 AM
76	60	Jun 16, 2011 11:12 AM
77	90	Jun 16, 2011 11:06 AM
78	50	Jun 16, 2011 11:04 AM
79	50	Jun 16, 2011 10:33 AM
80	50	Jun 16, 2011 10:04 AM
81	50	Jun 16, 2011 10:03 AM
82	75	Jun 16, 2011 8:11 AM
83	50	Jun 16, 2011 8:03 AM
84	100	Jun 16, 2011 5:11 AM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

85	0	Jun 16, 2011 1:38 AM
86	100	Jun 16, 2011 1:25 AM
	How much do you give away?	
1	100	Jul 24, 2011 6:18 PM
2	10	Jul 15, 2011 4:36 PM
3	40	Jul 15, 2011 9:36 AM
4	30	Jul 14, 2011 3:02 AM
5	0	Jul 13, 2011 1:53 PM
6	50	Jul 13, 2011 11:48 AM
7	50	Jul 13, 2011 10:56 AM
8	50	Jul 13, 2011 1:39 AM
9	30	Jul 13, 2011 1:13 AM
10	25	Jul 12, 2011 11:03 PM
11	50	Jul 12, 2011 10:16 PM
12	25	Jul 12, 2011 8:14 PM
13	0	Jul 12, 2011 7:18 PM
14	10	Jul 12, 2011 4:41 PM
15	50	Jul 12, 2011 4:36 PM
16	50	Jul 12, 2011 4:22 PM
17	50	Jul 12, 2011 4:09 PM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?		
18	50	Jul 12, 2011 4:04 PM
19	50	Jul 12, 2011 3:35 PM
20	50	Jul 12, 2011 3:33 PM
21	50	Jul 12, 2011 3:14 PM
22	50	Jul 12, 2011 2:58 PM
23	50	Jul 12, 2011 2:27 PM
24	50	Jul 12, 2011 2:09 PM
25	50	Jul 12, 2011 12:42 PM
26	50	Jul 12, 2011 10:23 AM
27	60	Jul 12, 2011 9:38 AM
28	50	Jul 12, 2011 9:38 AM
29	49	Jul 12, 2011 9:14 AM
30	50	Jul 12, 2011 3:57 AM
31	100	Jul 12, 2011 1:51 AM
32	50	Jul 11, 2011 11:14 PM
33	50	Jul 11, 2011 10:42 PM
34	50	Jul 11, 2011 10:08 PM
35	50	Jul 11, 2011 10:03 PM
36	1	Jul 11, 2011 10:00 PM
37	50	Jul 11, 2011 10:00 PM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?		
38	50	Jul 11, 2011 9:55 PM
39	50	Jul 8, 2011 8:58 PM
40	50	Jul 8, 2011 1:19 PM
41	50	Jul 8, 2011 1:02 PM
42	60	Jul 8, 2011 11:51 AM
43	25	Jul 8, 2011 11:15 AM
44	50	Jul 8, 2011 11:00 AM
45	100	Jun 29, 2011 1:43 AM
46	50	Jun 28, 2011 5:19 PM
47	50	Jun 28, 2011 2:03 PM
48	0	Jun 27, 2011 11:26 PM
49	40	Jun 27, 2011 11:09 PM
50	50	Jun 27, 2011 10:46 PM
51	50	Jun 27, 2011 10:10 PM
52	50	Jun 27, 2011 9:54 PM
53	75	Jun 27, 2011 8:12 PM
54	50	Jun 27, 2011 8:02 PM
55	0	Jun 27, 2011 7:22 PM
56	50	Jun 27, 2011 7:09 PM
57	50	Jun 27, 2011 6:18 PM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

58	50	Jun 27, 2011 6:13 PM
59	20	Jun 27, 2011 6:08 PM
60	50	Jun 27, 2011 6:03 PM
61	100	Jun 19, 2011 4:04 PM
62	50	Jun 18, 2011 3:12 PM
63	20	Jun 17, 2011 7:25 PM
64	100	Jun 17, 2011 2:05 PM
65	50	Jun 17, 2011 11:41 AM
66	30	Jun 17, 2011 11:26 AM
67	50	Jun 17, 2011 10:51 AM
68	50	Jun 17, 2011 9:42 AM
69	50	Jun 16, 2011 10:54 PM
70	0	Jun 16, 2011 9:44 PM
71	50	Jun 16, 2011 9:23 PM
72	80	Jun 16, 2011 8:28 PM
73	50	Jun 16, 2011 7:14 PM
74	40	Jun 16, 2011 2:11 PM
75	30	Jun 16, 2011 11:47 AM
76	40	Jun 16, 2011 11:12 AM
77	10	Jun 16, 2011 11:06 AM

Page 7, Q11. Imagine you were given $100 and asked to share it with someone you knew. The person who gave you the money does not know who, if anyone, you will share it with and no one else knows you have the money. How would you split the $100?

78	50	Jun 16, 2011 11:04 AM
79	50	Jun 16, 2011 10:33 AM
80	50	Jun 16, 2011 10:04 AM
81	50	Jun 16, 2011 10:03 AM
82	25	Jun 16, 2011 8:11 AM
83	50	Jun 16, 2011 8:03 AM
84	0	Jun 16, 2011 5:11 AM
85	100	Jun 16, 2011 1:38 AM
86	0	Jun 16, 2011 1:25 AM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?

	How much do you keep?	
1	0	Jul 24, 2011 6:18 PM
2	50	Jul 15, 2011 4:36 PM
3	50	Jul 15, 2011 9:36 AM
4	50	Jul 14, 2011 3:19 AM
5	50	Jul 13, 2011 1:53 PM
6	50	Jul 13, 2011 11:48 AM
7	50	Jul 13, 2011 10:57 AM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?		
8	50	Jul 13, 2011 1:40 AM
9	50	Jul 13, 2011 1:14 AM
10	50	Jul 12, 2011 11:03 PM
11	50	Jul 12, 2011 10:16 PM
12	50	Jul 12, 2011 8:14 PM
13	50	Jul 12, 2011 7:19 PM
14	50	Jul 12, 2011 4:42 PM
15	50	Jul 12, 2011 4:37 PM
16	50	Jul 12, 2011 4:23 PM
17	50	Jul 12, 2011 4:10 PM
18	50	Jul 12, 2011 4:04 PM
19	50	Jul 12, 2011 3:36 PM
20	50	Jul 12, 2011 3:33 PM
21	50	Jul 12, 2011 3:15 PM
22	50	Jul 12, 2011 2:58 PM
23	50	Jul 12, 2011 2:27 PM
24	50	Jul 12, 2011 2:10 PM
25	50	Jul 12, 2011 12:43 PM
26	50	Jul 12, 2011 10:23 AM
27	50	Jul 12, 2011 9:42 AM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?		
28	50	Jul 12, 2011 9:38 AM
29	50	Jul 12, 2011 9:15 AM
30	80	Jul 12, 2011 4:01 AM
31	50	Jul 11, 2011 11:14 PM
32	50	Jul 11, 2011 10:42 PM
33	50	Jul 11, 2011 10:08 PM
34	50	Jul 11, 2011 10:03 PM
35	50	Jul 11, 2011 10:01 PM
36	50	Jul 11, 2011 10:01 PM
37	50	Jul 11, 2011 9:55 PM
38	50	Jul 8, 2011 8:58 PM
39	50	Jul 8, 2011 1:19 PM
40	50	Jul 8, 2011 1:03 PM
41	50	Jul 8, 2011 11:52 AM
42	75	Jul 8, 2011 11:15 AM
43	50	Jul 8, 2011 11:00 AM
44	50	Jun 29, 2011 1:43 AM
45	50	Jun 28, 2011 5:19 PM
46	50	Jun 28, 2011 2:03 PM
47	50	Jun 27, 2011 11:26 PM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?

48	50	Jun 27, 2011 11:09 PM
49	50	Jun 27, 2011 10:46 PM
50	50	Jun 27, 2011 10:10 PM
51	50	Jun 27, 2011 9:55 PM
52	25	Jun 27, 2011 8:12 PM
53	50	Jun 27, 2011 8:03 PM
54	50	Jun 27, 2011 7:22 PM
55	50	Jun 27, 2011 7:09 PM
56	50	Jun 27, 2011 6:18 PM
57	50	Jun 27, 2011 6:13 PM
58	80	Jun 27, 2011 6:08 PM
59	50	Jun 27, 2011 6:04 PM
60	0	Jun 19, 2011 4:05 PM
61	50	Jun 18, 2011 3:12 PM
62	50	Jun 17, 2011 7:25 PM
63	50	Jun 17, 2011 2:05 PM
64	50	Jun 17, 2011 11:41 AM
65	50	Jun 17, 2011 11:26 AM
66	50	Jun 17, 2011 10:51 AM
67	50	Jun 17, 2011 9:42 AM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?		
68	50	Jun 16, 2011 10:54 PM
69	99	Jun 16, 2011 9:45 PM
70	50	Jun 16, 2011 9:24 PM
71	50	Jun 16, 2011 8:29 PM
72	50	Jun 16, 2011 7:14 PM
73	50	Jun 16, 2011 2:11 PM
74	50	Jun 16, 2011 11:47 AM
75	50	Jun 16, 2011 11:12 AM
76	50	Jun 16, 2011 11:07 AM
77	50	Jun 16, 2011 11:04 AM
78	50	Jun 16, 2011 10:33 AM
79	50	Jun 16, 2011 10:04 AM
80	50	Jun 16, 2011 10:04 AM
81	50	Jun 16, 2011 8:12 AM
82	50	Jun 16, 2011 8:03 AM
83	60	Jun 16, 2011 5:11 AM
84	50	Jun 16, 2011 1:38 AM
85	50	Jun 16, 2011 1:25 AM
	How much do you give away?	
1	100	Jul 24, 2011 6:18 PM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?

2	50	Jul 15, 2011 4:36 PM
3	50	Jul 15, 2011 9:36 AM
4	50	Jul 14, 2011 3:19 AM
5	50	Jul 13, 2011 1:53 PM
6	50	Jul 13, 2011 11:48 AM
7	50	Jul 13, 2011 10:57 AM
8	50	Jul 13, 2011 1:40 AM
9	50	Jul 13, 2011 1:14 AM
10	50	Jul 12, 2011 11:03 PM
11	50	Jul 12, 2011 10:16 PM
12	50	Jul 12, 2011 8:14 PM
13	50	Jul 12, 2011 7:19 PM
14	50	Jul 12, 2011 4:42 PM
15	50	Jul 12, 2011 4:37 PM
16	50	Jul 12, 2011 4:23 PM
17	50	Jul 12, 2011 4:10 PM
18	50	Jul 12, 2011 4:04 PM
19	50	Jul 12, 2011 3:36 PM
20	50	Jul 12, 2011 3:33 PM
21	50	Jul 12, 2011 3:15 PM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?		
22	50	Jul 12, 2011 2:58 PM
23	50	Jul 12, 2011 2:27 PM
24	50	Jul 12, 2011 2:10 PM
25	50	Jul 12, 2011 12:43 PM
26	50	Jul 12, 2011 10:23 AM
27	50	Jul 12, 2011 9:42 AM
28	50	Jul 12, 2011 9:38 AM
29	50	Jul 12, 2011 9:15 AM
30	20	Jul 12, 2011 4:01 AM
31	50	Jul 11, 2011 11:14 PM
32	50	Jul 11, 2011 10:42 PM
33	50	Jul 11, 2011 10:08 PM
34	50	Jul 11, 2011 10:03 PM
35	50	Jul 11, 2011 10:01 PM
36	50	Jul 11, 2011 10:01 PM
37	50	Jul 11, 2011 9:55 PM
38	50	Jul 8, 2011 8:58 PM
39	50	Jul 8, 2011 1:19 PM
40	50	Jul 8, 2011 1:03 PM
41	50	Jul 8, 2011 11:52 AM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?

42	25	Jul 8, 2011 11:15 AM
43	50	Jul 8, 2011 11:00 AM
44	50	Jun 29, 2011 1:43 AM
45	50	Jun 28, 2011 5:19 PM
46	50	Jun 28, 2011 2:03 PM
47	50	Jun 27, 2011 11:26 PM
48	50	Jun 27, 2011 11:09 PM
49	50	Jun 27, 2011 10:46 PM
50	50	Jun 27, 2011 10:10 PM
51	50	Jun 27, 2011 9:55 PM
52	75	Jun 27, 2011 8:12 PM
53	50	Jun 27, 2011 8:03 PM
54	50	Jun 27, 2011 7:22 PM
55	50	Jun 27, 2011 7:09 PM
56	50	Jun 27, 2011 6:18 PM
57	50	Jun 27, 2011 6:13 PM
58	20	Jun 27, 2011 6:08 PM
59	50	Jun 27, 2011 6:04 PM
60	100	Jun 19, 2011 4:05 PM
61	50	Jun 18, 2011 3:12 PM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?		
62	50	Jun 17, 2011 7:25 PM
63	50	Jun 17, 2011 2:05 PM
64	50	Jun 17, 2011 11:41 AM
65	50	Jun 17, 2011 11:26 AM
66	50	Jun 17, 2011 10:51 AM
67	50	Jun 17, 2011 9:42 AM
68	50	Jun 16, 2011 10:54 PM
69	1	Jun 16, 2011 9:45 PM
70	50	Jun 16, 2011 9:24 PM
71	50	Jun 16, 2011 8:29 PM
72	50	Jun 16, 2011 7:14 PM
73	50	Jun 16, 2011 2:11 PM
74	50	Jun 16, 2011 11:47 AM
75	50	Jun 16, 2011 11:12 AM
76	50	Jun 16, 2011 11:07 AM
77	50	Jun 16, 2011 11:04 AM
78	50	Jun 16, 2011 10:33 AM
79	50	Jun 16, 2011 10:04 AM
80	50	Jun 16, 2011 10:04 AM
81	50	Jun 16, 2011 8:12 AM

Page 8, Q12. Imagine you and a friend are called into a room. With your friend present, YOU are given $100 and asked to share it with them at your sole discretion. How would you split the $100?		
82	50	Jun 16, 2011 8:03 AM
83	40	Jun 16, 2011 5:11 AM
84	50	Jun 16, 2011 1:38 AM
85	50	Jun 16, 2011 1:25 AM

Page 12, Q23. How frequently do you use location sharing services when/to:		
1	Fun and amusement	Jul 12, 2011 9:41 AM
2	To brag about where I am with proof.	Jun 27, 2011 6:20 PM
3	To broadcast prestige (Hey! Look where I am!)	Jun 17, 2011 9:45 AM

Page 12, Q24. Have you ever met someone you didn't know before through a location sharing service?		
1	via linkedin	Jul 15, 2011 9:40 AM
2	I've met people through Twitter but not specifically through LBS	Jun 29, 2011 1:46 AM
3	I checked in to a location using foursquare when I was standing near the other person checking in at the same time. She recognized my picture as the guy standing next to her.	Jun 16, 2011 10:57 PM
4	I used Meet-up to find people in a knitting group. I am also seeking people in my new location that also have an interest in knitting fro ma site called Ravelry.	Jun 16, 2011 7:18 PM

Page 17, Q30. Did you qualify (talk to them on the phone or by email about anything other than the time/place of meeting) the other freecycler before meeting them in person?		
1	I answered questions to ensure they knew what they were receiving.	Jul 8, 2011 1:22 PM

Page 17, Q30. Did you qualify (talk to them on the phone or by email about anything other than the time/place of meeting) the other freecycler before meeting them in person?		
2	Asked specific questions about the goods	Jul 8, 2011 11:56 AM
3	Asked to describe the product in more detail.	Jun 16, 2011 7:20 PM

Qualified User Exit Survey

SurveyMonkey

1. How inclined would you be to *ask* for the following types of favors on a system like Reach? Requests will be seen by those connected to you in some way; friends on social networks, friends of friends, fellow students, coworkers, alumni or people with similar likes or similar travel patterns. Please note that when in doubt, assume that the favor is a small one (think pick coffee, rides locally in the direction you are going, buy something that costs less than $15, etc)

	No hesitation				I would never	N/A	Rating Average	Response Count
lend – as in lend me something (Iphone/Ipad/Ipod cable/charger)	21.1% (4)	**57.9% (11)**	21.1% (4)	0.0% (0)	0.0% (0)	0.0% (0)	4.00	19
buy – as in buy me something with expectation of being re-imbursed (small like cough medicine, some packaging tape, etc)	15.8% (3)	**57.9% (11)**	15.8% (3)	10.5% (2)	0.0% (0)	0.0% (0)	3.79	19
buy food – as in pick up some lunch, coffee	21.1% (4)	**42.1% (8)**	15.8% (3)	15.8% (3)	5.3% (1)	0.0% (0)	3.58	19
move – with the expectation of being re-imbursed	5.3% (1)	**36.8% (7)**	26.3% (5)	21.1% (4)	10.5% (2)	0.0% (0)	3.05	19
as in move something heavy (like a couch)	15.8% (3)	**42.1% (8)**	15.8% (3)	21.1% (4)	5.3% (1)	0.0% (0)	3.42	19
return/drop off – (as in return books to the library)	31.6% (6)	**36.8% (7)**	21.1% (4)	10.5% (2)	0.0% (0)	0.0% (0)	3.89	19
ride – (as in give me a ride somewhere, assume you are going there already)	21.1% (4)	**57.9% (11)**	10.5% (2)	5.3% (1)	5.3% (1)	0.0% (0)	3.84	19
give – (as in give something cheap or single use (batteries, diapers, cardboard boxes))	26.3% (5)	**36.8% (7)**	21.1% (4)	15.8% (3)	0.0% (0)	0.0% (0)	3.74	19
Pay a parking meter	15.8% (3)	**57.9% (11)**	5.3% (1)	15.8% (3)	5.3% (1)	0.0% (0)	3.63	19
Basic Tech Support	15.8% (3)	**31.6% (6)**	21.1% (4)	26.3% (5)	5.3% (1)	0.0% (0)	3.26	19

Add any comments you may have	2
answered question	**19**
skipped question	**0**

2. How inclined would you be *to assist* someone with the following types of favors on a system like Reach? As before, assume that you will only see request from people connected to you in some way; friends on social networks, friends of friends, fellow students, coworkers, alumni or people with similar likes or similar travel patterns. Please note that when in doubt, assume that the favor is a small one (think pick coffee, rides locally in the direction you are going, buy something that costs less than $15, etc)

	No hesitation				I would never	N/A	Rating Average	Response Count
lend – as in lend me something (Iphone/Ipad/Ipod cable/charger)	21.1% (4)	**52.6% (10)**	21.1% (4)	0.0% (0)	5.3% (1)	0.0% (0)	3.84	19
buy – as in buy me something with expectation of being re-imbursed (small like cough medicine, some packaging tape, etc)	26.3% (5)	**47.4% (9)**	21.1% (4)	5.3% (1)	0.0% (0)	0.0% (0)	3.95	19
buy food – as in pick up some lunch, coffee	21.1% (4)	**57.9% (11)**	10.5% (2)	5.3% (1)	5.3% (1)	0.0% (0)	3.84	19
move – with the expectation of being re-imbursed	5.3% (1)	21.1% (4)	**42.1% (8)**	26.3% (5)	5.3% (1)	0.0% (0)	2.95	19
as in move something heavy (like a couch)	15.8% (3)	21.1% (4)	26.3% (5)	**31.6% (6)**	5.3% (1)	0.0% (0)	3.11	19
return/drop off – (as in return books to the library)	36.8% (7)	**42.1% (8)**	15.8% (3)	5.3% (1)	0.0% (0)	0.0% (0)	4.11	19
ride – (as in give me a ride somewhere, assume you are going there already)	31.6% (6)	**52.6% (10)**	5.3% (1)	5.3% (1)	5.3% (1)	0.0% (0)	4.00	19
give – (as in give something cheap or single use (batteries, diapers, cardboard boxes))	**36.8% (7)**	26.3% (5)	31.6% (6)	5.3% (1)	0.0% (0)	0.0% (0)	3.95	19
Pay a parking meter	36.8% (7)	**42.1% (8)**	5.3% (1)	10.5% (2)	5.3% (1)	0.0% (0)	3.95	19

Basic Tech Support	33.3% (6)	**38.9% (7)**	11.1% (2)	16.7% (3)	0.0% (0)	0.0% (0)	3.89	18
						Add any comments you may have		1
							answered question	**19**
							skipped question	**0**

3. Based on your answers to this survey we may be interested in inviting you to participate in a live user study where you will be invited to either ask for or do a favor during the course of your normal day. If you choose to participate you will be entered into a third raffle for a $100 American Express Gift Certificate. Would you be willing to participate in our live user study?

		Response Percent	**Response Count**
Yes		**94.7%**	**18**
No		5.3%	1
		answered question	**19**
		skipped question	**0**

Request Exit Survey

SurveyMonkey

1. If you had a need for the same favor you just requested today, how would you ask for it?

	Response Percent	Response Count
Post on Facebook	33.3%	4
Post on Twitter	16.7%	2
Send an email/sms blast	8.3%	1
Post to a mailing list	16.7%	2
Email/sms/phone a specific person	**58.3%**	**7**
I wouldn't ask for it	8.3%	1
Other (please specify)	25.0%	3
answered question		**12**
skipped question		**0**

Favor Targeting Exit Survey

SurveyMonkey

1. Did this favor request reach you at a convenient time?

	Response Percent	Response Count
YES	100.0%	5
NO	0.0%	0
answered question		5
skipped question		0

2. Did the favor request require you to be/go somewhere that would be convenient for you?

	Response Percent	Response Count
YES	100.0%	5
NO	0.0%	0
answered question		5
skipped question		0

3. Did the favor request ask you to do something you would be comfortable doing?

	Response Percent	Response Count
YES	80.0%	4
NO	20.0%	1
answered question		5
skipped question		0

4. Would you complete this favor?

	Response Percent	Response Count
YES	**80.0%**	**4**
NO	20.0%	1
answered question		**5**
skipped question		**0**

5. Please indicate any change in the likelihood of you doing the favor if:

	More Likely to Help	Equally Likely to Help	Less Likely to Help	Rating Average	Response Count
The user had previously done a favor for you	**80.0% (4)**	20.0% (1)	0.0% (0)	1.20	5
You had previously done a favor for this person	20.0% (1)	**80.0% (4)**	0.0% (0)	1.80	5
answered question					**5**
skipped question					**0**

6. If you found the favor request timely, convenient and doable, ie answered questions 1- 3 with a yes, but would still NOT do the favor (ie answered question 4 with a no) please take a moment to indicate why.

	Response Count
	1
answered question	**1**
skipped question	**4**

Page 2, Q6. If you found the favor request timely, convenient and doable, ie answered questions 1- 3 with a yes, but would still NOT do the favor (ie answered question 4 with a no) please take a moment to indicate why.

1	I don't know Boris	Sep 10, 2011 3:49 PM

Page 2, Q6. If you found the favor request timely, convenient and doable, ie answered questions 1- 3 with a yes, but would still NOT do the favor (ie answered question 4 with a no) please take a moment to indicate why.