Activity Based Interfaces in Online Social Networks

by

Jawad Laraqui

Submitted to the Department of Electrical Engineering and Computer Science

in Partial Fulfillment of the Requirements for the Degree of

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ABSTRACT

The goal of the project is to explore how activity-based interfaces can create more meaningful experiences for the users and builders of online social networking sites. Medina, a social-networking site based on the idea of exchanging knowledge, explores new interfaces for visualizing connections between people and ideas. The site constantly measures interactions between people and their interests in order to create a more accurate picture of what relationships and information are important.

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1. Introduction

Online social networks are not a new phenomenon. They have evolved slowly into their current form as the popularity of the Internet increased, and as technical advances allowed services to support more complicated feature sets. In the 90s, the fledgling online communities were either easy to maintain message boards or static "homepage" style web sites hosted by extremely large companies like Geocities or Lycos. These large companies had the financial resources required to run these services. As technology became more inexpensive it made hosting more advanced social networks with more complex feature sets financially feasible for small companies. Indeed, over the last decade, innovation in this space has always come from small startups. The social networking behemoths like MySpace and Facebook share the same humble beginnings as smaller communities like LiveJournal or Xanga. The final incarnation of all of these services has been the result of a long journey where challenges included creating a user base from scratch, marketing on extremely tight budgets, and facing fierce competition.

However, when online social networks are discussed only half the story is told. Interface design is analyzed from the user's perspective and fails to take into account the external constraints that shape the service. There are two realms in which design tradeoffs are evaluated. From the user's perspective, the purpose of a social networking service is to enable self-expression. At the site builder's level, the service is a tool used to turn a profit, to attract advertisers and investors, and to acquire new members. In this realm, providing a compelling user experience is just one of many constraints. Thus it can be expected that many of the design problems found in online social networking sites arise from the disconnect and inconsistencies between these incentives. In fact, the users are only peripherally involved in the major decisions that shape the world they operate in. The power struggle is analogous to a dictatorship where the needs of the population are subjected to the choices of the powerful. Additionally, it is hard for the site builders themselves to gain enough perspective to accurately pinpoint high level problems during the design process. The rush to build up a user base before money runs out often leaves many awkward design choices in the system.

We will explore the possibility of democratizing these design struggles by using activity-based interfaces in online social networking sites. Our analysis will begin by revisiting the definitions of social ties in light of this new dual view of constraints, and by introducing Signaling Theory as a framework for analyzing such services. Then, we will formalize the needs of users and site builders using Signaling Theory. Next, we will take a detailed look at Sconex, a current social networking service, to understand the evolving constraints a service must face and the far reaching effects of interface design. Finally, we will discuss the implementation of an activity-based service called Medina and evaluate its effectiveness in aligning the needs of site builders and users.

2. Background

2.1. Definition of Social Ties

Traditionally, social networking sites have used the same underlying network structure: a graph where the nodes are the users, and the connections are the explicit relationships between them. This scheme was inherited from the early social networking sites like Friendster. The structure is based on a very simplified model of how people interact offline. They explore the network by visiting each node and traveling on the connected edges. As we will see later, these simplified offline notions of friendships translate very poorly to the online world: services spend a lot of development time fixing inconsistencies in the interface that result from this faulty transposition. The builders of these networks have struggled to move away from this design for the same reason that users still demand it: people are used to it. A scheme that accurately depicts the status of user's online relationships would allow services to provide a more relevant and meaningful experience. Feld [1] and Granovetter [2] provide a good basic model for how general offline social networks are organized and grow. Granovetter establishes the semantics of talking about these networks, while Feld develops a complementary theory to explain how they evolve. We will use their definitions of social ties to define a new underlying structure for social networks.

In fact, explicit connections are replaced by activity dependant links. Granovetter posits that looking at the small-scale interactions between people can give you a lot more insight into the macroscopic behavior of the entire social network. He particularly uses his small-scale definitions to derive rules on how information flows through a social network. There are three types of ties that relate people: strong, weak, and local bridges. This categorization is a direct mapping of how much work has been put into the given relationship: the strength of a tie is characterized by the "amount of time, emotional intensity, intimacy and reciprocal services" that are invested in them. A local bridge is a tie that provides the only link between two sub-networks of friends. The links, as defined, still provide the basic network properties one would expect. Granovetter discusses some basic dynamics of these ties that allow us to predict their evolution. Relationships tend to be transitive: if A is strongly tied to B and C, then B and C are likely to be very tied. As the frequency of positive interaction grows, so does the strength of the tie. The stronger the tie between people the more likely they are to be similar.

Also, Granovetter's activity-based definition of links encompasses the notion of potential relationships. This notion is very valuable to site builders since they would like to promote a highly connected network. Instead of manually accumulating superfluous friend relationships to access new parts of the network, users already have latent connections to every other node. In fact, Granovetter very briefly discusses the idea of an "absent" tie; this is a potential relationship. His paper, written in 1973, doesn't deal with these much since their evolution contributes almost nothing to the changes in the social networks. In the offline world these are less important since the expected number of conversions of potential relationships into a real tie is very small. However, in the online world, the pool of available potential relationships as well as their conversion probability is much higher. Web applications allow a user to quickly search through millions of people's profiles and contact them; converting the potential into a real relationship is greatly facilitated. In fact, many social networking sites deem these relationships so important that they compute and display an approximation of their total for each user. The radius of a user's social horizon is a measure of his potential connectedness, and a barometer for the web site's popularity.

A more realistic social network can be formed by expanding the types of elements a node can represent. In the "Focused Organization of Social Ties", Feld explains how individuals tend to group themselves around foci of interest: these can be "social, psychological, logical, physical entities". In fact, browsing through the network isn't about moving between people, but around foci. The expansion of nodes around foci leads us to a more powerful network representation. Indeed, Focus theory explains many of the behaviors and dynamics that Granovetter discusses. For example, if A and B as well as A and C are strongly tied it is because they are grouped around many foci. It is therefore not inconceivable that B and C would also share a subset of those foci. The transitive nature of ties also comes out of Focus Theory. The evolution of a person's social ties is a main part of Feld's paper. Focus theory lends itself very well to online social networks since they are laid out in a very interest driven interface. When looking at a person's profile, you get a comprehensive view of his foci: what organizations he belongs to, what people he knows, and what his interests are. In fact, even if you don't have an explicit connection with the person, you are sometimes told how you overlap: how many friends are in common, through whom you do you know them, which organizations do you share? There are two forces that work together to drive the strengthening of old ties, and the creation of new ties in these networks. The first is the pressure individuals feel to associate themselves in stronger relationships: Feld notes that given a weak link, people will try to find more foci that they have in common. The second force is the engineering of the social space done by the builders of the site: keeping users active is a central goal. It is not by accident that profile pages invite you to find common interests and connections with people in the network. The stronger and more numerous the connections a given user has, the more content and communication he will be subjected to which will keep him active on the site. Any new piece of content or message now has the potential to reach anyone in a user's dense network of friends.

2.2. Signaling Theory

Signaling theory is a framework usually used for analyzing communication and behaviors in the animal world. It proposes that agents have qualities which they wish to signal to others. Judith Donath has proposed the application of this framework to the online world. We will present the basics of Signaling Theory [3] and show that it lends itself very well to the analysis of online social networking sites. In fact, it will allow us to precisely determine the trade-offs of design decisions for problems at any scale.

At the base of the theory is the idea that each agent has qualities that they wish to communicate. If the message is sent to the intended receiver we call the message a signal, while if it is overheard than it is called evidence. The goal of this transmission is to somehow alter the receiver's beliefs or behaviors. However, determining whether a signal is reliable can be problematic: we live in a world where deception can have many benefits. Signals have costs and are reliable when "they are beneficial to produce truthfully, and prohibitively costly to produce falsely." An agent can advertise a quality that exists in which case we have an honest signal, or he can be falsely promoting a quality he doesn't possess; this is a deceptive signal. An agent receiving the signal has to use his aggregate experience to determine whether the sender was being or honest or deceptive. The receiver will classify the signal as reliable if he can deduce that it was always honest. The signal will be unreliable if there are too many deceptive communications. In fact, the abuse of deceptive signalers destroys the reliability of honest ones: if a signal is too easy to produce deceptively than it can't be very reliable.

The application of signaling theory as an analysis framework will allow us to find flaws in current social networking interfaces and design better ones. Signaling theory is very well suited for analyzing the small-scale features of online social networks because each action can be broken down into measurable costs and benefits. In this case, the agents are the users of the service. The cost of using a feature can be calculated by estimating the number of clicks needed to finish a task, or the time required to complete a process. The builders must determine how expensive an interface should be based on the benefits it provides: costs should be proportional to the benefits of signaling the quality. Solving this economics problem will result in a feature that performs as desired. For example, the design of a registration process on a college social networking site can determine how honestly a user signals his membership to his school. Choosing to be a part of a school's community has many benefits: the site's feature set allows each member to have a profound local impact. If the users are allowed to pick their school from a list without verification, then being part of the school's online community will be a poor signal that the user attends the college. In fact, there is almost no cost in picking the wrong school out of the list and falsely registering for another university. In order to provide a more honest signal to its users, the builders could require that new users use their school supplied email address and click through on a verification email. The additional work for real users is minimal: they need to take a minute to check their emails and click on a link. On the other hand, a malicious user would have to do a lot of extra work in order to create a dishonest signal: he would have to somehow find or steal a working email account from that school and try not to get caught.

Finally, Signaling Theory is a useful tool in discussing the high level effectiveness of a service. The builders of websites have tremendous power in creating a service that matches their needs, often despite the wishes of their user base. However, the balance of power is not one-sided because, in the end, the users have the right to choose which service they want to belong to. Signaling theory provides the means to discuss the competition between different websites in evolutionary terms: it is literally a game of survival of the fittest. Each new service is competing against larger existing ones and trying to sway the same user base. For example, the site builders of a fictional service might want to attract new users by promoting themselves as the leading social network for doctors. In this case, the signaling agent would be the entire service itself and the quality would be the number of doctors using it. A press release with the size of the service's user base would serve to alter a potential member's belief in the value of joining the new site. Also, just like the loud roar of a lion, such a signal could also be intended to intimidate competitors. Here the site builders could decide to risk their credibility by weighing the benefit of providing exaggerated numbers versus the cost of an inquisitive user or competitor catching them. In fact, sometimes site builders themselves may choose to produce dishonest signals.

We have seen that Signaling Theory allows us to evaluate design decisions at many different levels. The agents, qualities, costs, and benefits can be clearly defined in all cases allowing users and site builders can make informed choices.

3. Signaling in Social Networks

3.1. User Level Signaling

Users will use the allotted feature set of a service to signal qualities that relate to the perception of their online identity [3]. The signal sender and recipients are users of the site. The actual signal will often be the output of a feature on the site: it can be anything from a funny posting on friend's message board, to a colorful profile customization. There are many qualities that a user may want to signal in a typical social networking site. For example, popularity can be gauged from the number of links to other people in the network, the number of people who have left comments on their profile, or the number of groups they belong to. Wit, humor and creativity are also important as most sites allow you to personalize your name, pick wacky interests. Joining groups often serve as badges of honor as they appear prominently on profile pages. Finally, technical expertise is also commonly a signaled quality: users can gain notoriety for their ability to cheat the system by adding video to the page when you're not allowed to for example.

3.2. Service Level Signaling

The site builders achieve their goals by promoting the qualities of their service internally to their users and externally to their advertisers, competitors, and investors. Online services are an ecosystem of signals where the main challenge is finding the balance between these constraints.

The site builders have multiple ways of targeting their current users. The first is to become an actual member of the site and use User Level signaling to communicate the advantages of the service. For example, employees could jump-start a service by registering and completely filling out their profiles: their profile page would be an honest signal that there is at least some activity on the site. Also, the design of the features on the site, and the resulting user experience, can be engineered to promote a quality. Throughout a user's lifetime on the service, he is forming subjective opinions about his experience; many of those belief changes are engineered by signaling. For example, site builders might want to communicate qualities of security and privacy by prominently displaying a privacy notice on the front page with links to profile viewing permissions. Through the design of the features, site builders can signal many qualities to their current users: fairness, transparency, reliability, and relevance. However, there is no stipulation that the signals have to be honest; there are sometimes clear benefits to cheating.

There are many qualities that site builders try to communicate to receivers outside the confines of their site. The signaling entity is the site builders and the actual signals are the various characteristics of the online service. These characteristics are packaged together to promote a quality very differently depending on the intended receiver. For example, the size and demographic distribution of the user base are basic characteristics that can be used for signaling. The site builders could issue a press release lauding important registration milestones in a particular age group. This communication is intended to lure potential users that match the thriving demographic to join the site: they will participate in an active and dynamic community that is seemingly tailored to their needs. Also, the communication might be a signal to competitors thinking of encroaching on their market: the new milestones make the service unassailable. In fact, site builders might want to signal the following qualities to receivers:

- Potential Users: The site builders want to show that the network is large, dense, relevant, and with limitless potential connections. The network will provide a meaningful experience.
- Competitors: The service has tremendous growth and imminent dominance in the space. There is no need to compete with the service because it will be a waste of energy.
- Investors: The management team is smart, can make good decisions, and knows how to monetize their service.
- Advertisers: The service is a large site with a lot of consumers in an attractive demographic.

3.3. Site Navigation Interfaces

Social networks set themselves apart from other online services by exposing the connections between people and using them to navigate the site. We have seen that members use these connections to shape their online identity while builders use them as tools to promote their interests to a larger audience. These goals are often contradictory and lead to inconsistencies in the navigation interfaces.

The site builders engineer their service so that it exhibits the qualities that they wish to communicate. The success of a site is measured by the size of its network and its level of activity. Features are designed to maximize the number of connections between users to create a dense a network where information flows effortlessly. Therefore, accumulating friend relationships is designed to be extremely attractive to the user: the cost of making a new connection is very small, and the benefit of the new link is immense. In her paper "Friends, Friendsters, and MySpace Top 8: Writing Community Into Being on Social Network Sites." [6], danah boyd lists 13 reasons users add friends in social networking sites. They were compiled from personal interviews she conducted between 2003 and 2006 and are reproduced verbatim below:

1. Actual friends
2. Acquaintances, family members, colleagues
3. It would be socially inappropriate to say no because you know them
4. Having lots of Friends makes you look popular
5. It's a way of indicating that you are a fan (of that person, band, product, etc.)
6. Your list of Friends reveals who you are
7. Their Profile is cool so being Friends makes you look cool
8. Collecting Friends lets you see more people (Friendster)
9. It's the only way to see a private Profile (MySpace)
10. Being Friends lets you see someone's bulletins and their Friends-only blog posts (MySpace)
11. You want them to see your bulletins, private Profile, private blog (MySpace)
12. You can use your Friends list to find someone later
13. It's easier to say yes than no

Not surprisingly, almost half the reasons (4,8,9,10,11, and12) are direct incentives put in place by the site builders. Reason 13 is evidence that the costs in the interfaces are purposely designed to push users to add new friends.

Connections between users are an unreliable signal for friendship. The imbalance in the cost structure leads to the rampant accumulation of friend links, creating many interface problems. We will discuss these in further detail in our case study of Sconex. For example, browsing the site is challenging when each user has thousands of connections. Also, it becomes very difficult to find meaning in the information carried by the links. In the offline world, there is a limit in time and energy to maintaining friendships. I can call up my 10 best friends and learn what they have been up to. In the online world, I can easily accumulate a high number of relationships at no maintenance cost: how can I sift through updates for 5000 friends? Often times, we see the more advanced web sites trying to fix the inadequacies stated above. Since the reasoning doesn't come from a comprehensive analysis of their problems, their solutions are ineffective fixes. For example, Facebook.com relies on geographic portioning and status updates, while MySpace.com uses an "n favorite friend" subset.

A naïve solution to the problem is to make adding friends an expensive process. It's possible to design interfaces with high costs, but a sufficiently patient user will almost always be able to circumvent them. If builders keep raising the cost of performing an action without increasing the benefit, the feature will eventually not get used. The users will stop coming to the site if the interface is prohibitively cumbersome. Every feature should be as clean, fast, and intuitive as possible to reduce the users' frustration. A solution will require designing better site-wide interfaces so that there is no incentive to abuse the features.

In fact, we will examine a new interface for site navigation through Medina, a social networking site based on the idea of exchanging knowledge. The design will use a more realistic model of how people interact online by using the underlying network structure discussed in Chapter 2. Also, activity weighted links will allow users to meaningfully browse the network while still expressing themselves through their set of friend connections.

4. Sconex: signaling from a builder's perspective

Social networks are not constructed in a vacuum: the builders of these networks have many design constraints aside from keeping their users happy. We will examine the design challenges of building a social networking site through the case study of Sconex (http://www.sconex.com). The internal and external constraints on services force builders to make bad decisions and mistakes. Through the analysis of Sconex we will show that some of the more serious mistakes can be avoided by using a comprehensive analysis of the interface design using Signaling Theory.

4.1. History

Josh Schanker and I founded a company called Sconex in August 2004. The name Sconex was an abstraction from the words "Stay Connected" and encapsulated our wish to build a social networking based service to enhance offline relationships. We started building a variety of web services aimed at different markets but had very little success: we focused primarily on the 25-45 age group with products ranging from business social networks to a site promoting "flash reunions" of user defined groups. After a conversation with my 16-year-old sister Meya Laraqui, I quickly realized that high school students didn't have a safe service that was dedicated to them. Although she knew of the largest social networking sites out there they offered very little that appealed to her friends: they preferred to communicate over instant messenger, and email. In fact, at this time in January 2005, the social networking phenomenon was still in relative infancy: there were a small amount of large players who dominated their respective markets, but small niche oriented social networks were still forming. Facebook was firmly entrenched as the college social networking site. Business professionals used LinkedIn. MySpace was replacing the ailing Friendster as the dominant social network for adults 18 and over. Of these behemoths, there were no sites dedicated to providing a safe place for 14-18 year old high school students to hang out online.

We quickly built the first version of the site, and preloaded it with all the private and public high schools that were indexed during the last government census. The service was based around the high school themselves: during the registration process, a user picks his high school and has to answer security questions in order to be granted access. Each high school had a profile page and was the center of the user's world: he could see the classes offered, ask homework questions, and contribute on the school's message board. We also built a suite of traditional social networking features to make the service more compelling: users had their own photo album, blog, profile, mailbox, and interest sections. As we launched we were faced with our first challenge: we had no users. Social networks are compelling because they can bring together a large number of people and facilitate information flow between them. However, without a single node in the network it is difficult to generate any value for potential users. We seeded communities on Sconex by spending our social capital: I asked my sister to sign up as many of her friends as possible, and to get them to sign up their friends. We recruited a fleet of college freshman in the Boston area and gave them $50 if they could sign up 50 people from their high school. This was relatively effective in bringing initial users to the site but didn't make for a compelling service: users were isolated in small unexciting communities and had very little loyalty to Sconex since they were begged by their friends to join.

Initially, we had designed in a high cost to joining the service because we were very concerned with keeping the school communities safe and preventing fraud. In order to join Sconex, you had to be explicitly invited by a current member and you had to answer security questions about your school in order to complete the registration. In terms of Signal Theory, being part of a high school on Sconex was an honest signal that you attended that establishment since the registration cost was so high. However, the growth of our user base was still linear. We thus decided to eliminate the need to be invited, and opened up registration off the homepage to get more growth. We realized that a formal invitation from one student to another carried a lot of social risk: the inviter was vouching that Sconex was interesting and leaving himself open to judgment from the invitee. Students preferred to casually mention Sconex to friends and let them go to the site on their own and register. As a result, Sconex had a strong nucleus of around 5 thousand members, a good portion of which were returning regularly to the site.

The next challenge was to find a way to increase Sconex's user base by a factor of 100. We devised a plan based on the characteristics of the small communities that we had seen form on the site. High Schools range in size from less than a hundred students for some private schools, to thousands for large public schools. Our initial approach to getting users had randomly sprinkled a handful of students in many of the high schools across the country. The security settings that we had implemented also meant that a user couldn't see the profile of a student unless they went to the same high school, or if they were friends. This meant that we had a lot of isolated communities with very few users in them. However, the reality of a community space like New York is that there are a lot of cross connections between different high schools. If schools are close geographically many students will know each other through various in and out of school activities. We first decided to add more security permissions so that student's profiles could be seen by more people: friend's of friends, and classmates of friends could now see your profile by default. This broadened the horizon of possible nodes a given student could visit in the network. Also, we created a new class of users called Sconex Reps who were special ambassadors within their school. In fact, in a service like Facebook, each community is large enough that they can stand on their own: if the feature design isolates small colleges with 5,000 students, the users can still generate enough content to make their experience compelling. On Sconex, we had to create features that allowed high schools to be more visible to each other so that 10 1,000-student high schools could be the basis of a meaningful experience. A pattern is starting to emerge of meeting unforeseen challenges by redesigning elements on the site in an ad-hoc manner.

The growth plan was to concentrate on a small geographic area and try to grow schools one at a time, hoping that growth would spillover into neighboring communities. We focused on New York City first since it had a very high density of high schools. When a new school was created, the first user would provide security questions for it. We would then manually verify that the questions were valid by cross-referencing school answers using publicly available data. If the school was in an area of interest, we would contact the user through the system and motivate him to invite friends. When the school reached a non-negligible size (around 50 students), we would try to elect a Sconex Rep. The Sconex Rep was a coveted title because it meant that the user was in charge of his school's community. Reps had a special set of features at their disposal to manage their school: they could edit teacher and class lists, create better security questions, and report students that didn't belong to the school. The Sconex Rep program was a real success and there were usually competing candidates for the position. Sconex Reps had an outlined 5 step program to grow their school: fix the security questions, invite 20 friends, create school groups, add teachers and classes, and ask school group leaders to join Sconex and manage their community (ex: the Softball team).

As a result Sconex explodes in New York City, where almost 75% of all high school students are using the service by the end of 2005. Sconex is also the most "sticky" web site in the country: Sconex users spend more time and consume more pages on the site then any other social network. In fact, the most active user base is the urban youth in public schools in and around the city. As people connect with friends and family in other states, very strong communities start appearing in Miami and Atlanta and a presence across the country develops. At its apogee, Sconex is delivering 300 million page views a month to millions of users and is profitable without taking in money.

In 2006, interest in social networking sites reached feverish levels. Facebook had registered every college student in the US and was expanding into High Schools. MySpace slowly started realizing that an ever-growing percentage of their users were under the age of 18: they dropped their age limit from 18 to 16, and then from 16 to 13 (the youngest allowable by law). In fact, most of MySpace's growth came from the under 18 demographic. Many high school social networking sites start appearing like MyYearbook.com, Tagged.com, and ClassFace.com to name a few. Faced with a difficult battle we joined forces in March 2006 with Alloy, a youth media and marketing company based in New York. Since then, the intense battle to wrestle users away from competitors has only intensified.

4.2. Money Shapes Design

One of the greatest drivers of interface and feature design in online social networking sites is profit. In fact, much of the feature design on the site was geared towards honestly signaling usage patterns to advertisers so that profits could be maximized and the service could stay afloat. It was important to honestly communicate our traffic patterns since there exists industry trusted monitoring tools that our signals would be verified against. We will follow the evolution of how design priorities were modified to generate new signals.

There are several important metrics that a service is judged on: the number of users, the number of page views it serves, the unique number of users who visit in a month, and the average number of pages each user sees. For most social networking sites the revenue model is tied to advertising based on usage. There are only a handful of successful niche social networks that are able to charge a premium fee to use some part of their feature set. For example, Classmates.com allows users to create profiles and search for their classmates, but charges to get their contact information. In fact, the problem of finding new revenue streams in large social networks like MySpace or Facebook is not solved. The path that Sconex traveled is fairly typical of social networking sites and we will discuss it further.

When Sconex first started getting traction and generating a non-negligible amount of page views it became useful to invest time into monetizing that traffic. The Google Ads program was the obvious first choice: there were no minimum impression thresholds to be a part of the service, registration and installation were straightforward, and Google sent a check within 30 days. In online advertising, the term CPM (Cost per mille) is used to measure the amount of revenue generated by one ad during a thousand impressions. Google Ads was easy to set up but had a very poor CPM, which means that each page impression was poorly monetized. Under this scheme, the main design goal of the site was to extract as many page views per person as possible. Since acquiring a new user takes a lot of work, the more revenue that can be derived from him the better. Also, since the largest financial burden on the organization was paying for servers, revenue would scale at the same rate as costs. Increasing the CPM and number of page views, and decreasing the cost to serve one page maximized profit.

As Sconex got larger, we started developing relationships with more advertising networks. They could offer us better CPMs because they were reselling our ad space to targeted buyers. However, our previous emphasis on maximizing page views was now seen as a fault: advertisers are interested in getting a large reach, not pummeling the same user with the same ad 100 times. In order to get to the next level of revenue goals, and maintain the organization afloat, we had to shift our focus onto features that would attract more unique users. During this period we added public contests and school polls; these features were fun for registered users but also gave unregistered users content to look at. The hope was that unregistered users would stumble onto the site and look at contests, and the ads next to them, thus increasing Sconex's number of unique users per month. If even a small percentage converted to registered users, we would have also increased our user base.

As part of Alloy, we had access to many direct relationships with very large customers. The goals in feature design shifted again: with the potential of more lucrative deals, we would build features that tied directly into custom promotions we were running. Often these new promotions would be at odds with our current user base. The most striking example is a model search contest Sconex hosted for Delia's (http://www.delias.com), a clothing company geared towards white suburban teenage girls. Although the contest was a success, there was a tremendous amount of friction between the predominantly white contestants and the regular Sconex users.

It seems that social networking sites have their priorities reversed: it is ironic that the users that make up their service are often the voices that get drowned out. The builders of social networking sites have many qualities that they wish to communicate; unfortunately their users are a minority in the audience. Creating a valuable experience for users often comes second to creating value for advertisers and investors. As we have seen, although users are mostly interested in sending signals to other users, site builders are sending signals to their users, advertisers, customers, parent company, investors, etc.

4.3. Stimulating Information Flow and Visibility

4.3.1. Increasing Number of users

There are several interfaces that we built at Sconex in order to try to increase the number of users on the site. The first was to make the accumulation of friend relationships a sign of popularity. Each person's number of friends was prominently displayed on their profile. In most social networks, a user's popularity is often measured by the number of friend connections they have amassed. For Sconex, being in the socially unforgiving world of high school, this effect was all the more prevalent. Also, if a person had a small number of connections, belittling labels would accompany the number. For example, on a profile page it would say "You *only* have 4 friends". These tactics were very effective in getting people motivated to invite more people from their school to join.

The spirit of competition and school pride were also motivating factors. Each school had its own profile page with the number and breakdown of students prominently displayed. For many schools we were able to an estimate the number of students attending from government census information. This allowed us to display the percentage of students using Sconex and served as a goal the students could track as they tried to get their school to 100%. Although creating a profile page for schools in a high school social networking site seems obvious, Sconex was one of the few to do it. For example, Facebook only started created school profiles in early 2007, more than 2 years after the site launched. As we have seen, the user does not dictate feature design: Facebook probably didn't feel it needed to aggregate school data for its users to meet its goals. Also, we developed a "Nearby Schools" feature that appeared as a module on school profiles. This was meant to spur school rivalry, broaden the number of users visible within a couple clicks, and form super-communities of schools. School profiles drove students to invite more of their friends.

With the success of previous popularity experiments, we tried to get users excited about the number of people they invited. We kept track of when a new student registered as a result of an invite link, or invite email from a current user. Each users profile page had the number of users they were responsible for bringing to the site. Unfortunately, the feature was unsuccessful: students didn't like to be held accountable for the people they brought to the site.

In order to get current users to invite their friends, we tried to provide a compelling feature set. We found that aggregating connection data and effectively displaying it back to the students could be positive drivers of growth. Also, linking up smaller communities with their neighbors created a competitive landscape where students wanted to outgrow their rivals.

4.3.2. Increasing Page Views Per Person

The major goal of the website is to increase the number of page views. For the users, it means that the site has enough relevant content that they can consume a couple hundred pages in one sitting. For the builders, it means that each user is consuming a couple hundred ads each day. Therefore builders focus on providing a compelling feature set that continuously generates new relevant content for the users. However, most social networking sites have a lot of security constraints that restrict the flow of information through the network. For example, on Sconex, if you have no friends in other schools you can only access content from people in your school. Users can quickly get isolated into small communities with very little activity. You can design a more compelling service by maximizing the effect of any action in the community: even a little activity that is very visible can provide a compelling experience.

At Sconex, we tried to institute a design philosophy that every action should have a reaction. Any user input into the system shouldn't just increase the size of our databases, but should engage other users. We designed a suite of alerts that appeared on a person's homepage to notify them of any relevant activity. An alert would appear if they had a friend request, a comment on their profile, a comment on their blog, or pending group requests. These alerts were a motivation for users to come back to the site every day and check what was new. Attaching emails notifications to alerts was a powerful tool in getting users back to the site. However, we used this very sparingly for only the most important notifications as to not lose credibility.

Another approach to increasing page views was to bubble up and aggregate content. Many of the objects on the site had an associated profile so that small communities could form around them. Not only did people, groups, and schools have profiles but so did classes, teachers, and interests. Each object had a picture, membership information, message boards and paths to other objects. For example, the teacher profiles had the lists of classes the teacher taught, interests had a "Related Interest" section based on the most commonly shared interests from the member list. There we also "Top Lists" for almost every type of content. In communities where there wasn't much data, using different ways of visualizing the data gave the users more engaging content.

4.3.3. New User Experience

First impressions are always very important. When a new user joins the service there is a good chance that he will be in a community that isn't completely developed. He will at the very least have very few connections in the network. Getting enough relevant information to a weakly connected node in a sparse community was a challenge.

In order to create a better new user experience, a new user was automatically added to a couple of groups, was sent a private message, and sometimes a member of the

Sconex Staff was added as a friend. The goal was to have the user see a vibrant homepage when he finished registering: the alert module at the top of the page would lead the user to his welcome message, a "Recent Group Postings" module showed new content from the automatically joined groups. For example, about the first half million users on Sconex were added to the Sconex Central group up registering. The shear number of members in the group resulted in new many messages being posted every second. A new user would have a starting point in exploring the site; he could see that although his community was sparse, other parts of the network were very exciting.

4.4. Challenges from Design Decisions

We faced many challenges at all phases of Sconex's life: we very often made design decisions to solve short term problems knowing full well that we would have to deal with the consequences down the road. However, when faced with the constant struggle of staying afloat in a startup company, any progress is welcomed. In this section we will discuss some of the challenges that we faced, while in the next we will analyze their causes using Signaling Theory.

As Sconex became larger, site navigation became a major challenge. Our efforts to create dense networks where a lot of information was being exchanged on each link were successful. Users were inviting a lot of their friends to fill out their schools, but they were also meeting a lot of new people on the site. The number of friends the average user had was on the rise. In the most extreme cases, some users had up to 50,00 friends which was represented a couple percent of the total user base. On MySpace this would be equivalent to having a couple million friends on the site. The number was an issue in that the friends feature was growing much faster then our scaling plan had anticipated. Also, many of the features that we had designed around friends were losing their relevance and become an infrastructure burden. For example, it is hard to retrieve and organize the most recent blog posts of your 10,000 friends. We saw the same effect for groups and interests. In fact, on each profile page we listed the name of the groups they had joined. Soon retrieving and listing 10,000 group names was technically and visually cumbersome. Traditionally, if you wanted to browse all the groups that a person was involved in you would be sent to a "Browse Groups" page where 10 groups at a time would be displayed. We had done studies to find that almost 90% of people don't go past the first couple of pages. It became clear that this interface was hugely ineffective as users only consulted a small random sample of the total number of groups.

Site performance suffered at the expense of our extensive aggregation needs. As we have seen, exposing a lot of interesting membership calculations and providing a lot of data aggregation pages was instrumental in getting the Sconex community off the ground. However, this content requires a lot of work from the site infrastructure in order to keep it up to date and relevant. We had used aggregation as a crutch when Sconex was small to simulate a denser network but we were having a hard time supporting it as it scaled. The aggregation tools we had designed had also lost a lot of their relevancy. It became more difficult to tease out the most relevant data: there were too many links producing too much data, and no good way to pick which one was the most important. For example, the Recent Group Posts module designed to help the new user experience was getting swamped. Even if a user had only 500 groups, each one was producing a couple hundred posts a day. We tried to design new interfaces by looking more generally at most recently updated groups for a person, but there was again much more information than one human could digest.

The management of the user base was also a constant struggle. The users of any service are creatures of habit that will have a strong resistance to any changes. The worst change is the removal or modification of a feature. Although we were excited that our users felt very strongly about our service, it made it a challenge to fix interface or feature issues we had created. We improved our communication strategy to get more input and guidance from them, and leaned on the Sconex Reps to convince the rest of the users a change was worthwhile.

Conversely, not giving in to the requests of your users can be very dangerous. A common feature request was to allow profile customization. Although there was a tremendous outcry for more personalization, we didn't want to anger our advertising networks by drowning out their ads. In fact, the personal profile page was the most viewed page on the site and contributed a lot of revenue. Faced with our lack of flexibility, Sconex users found very resourceful ways to personalize their experience: they decorated their first and last names. For example, by adding ASCII characters users would transform *Lady Tinkerbell* into *~*LAD!!*~*T!NK3RB3LL*~*. Uses would also very frequently change their names to coincide with what was going on their lives. This little bit of creativity created tremendous interface problems for us: you were no longer able pick your friends' names out of a drop down list, searching for users by name didn't work, and exotic ASCII characters sometimes confused the database and the browsers.

4.5. Signal Theory Analysis

Many of the challenges that Sconex faced when there were millions of users were based on decisions made when there were only 5 thousand. We will see that many of these problems came from designing a poor cost structure for signals on the site.

When trying to attract users, site builders try to design the most efficient interfaces possible: the amount of energy a user expends to become part of the service should be minimal. In a world without dishonesty and cheating, the cost to becoming part of Sconex would ideally be zero: we would like every high school student in the world to have the quality "Sconex Member". In order to build realistic interfaces that admit users into the Sconex community, the minimum amount of costs were added in order to keep the signals for exclusivity and security as honest as possible. We have seen in the Sconex history, that originally we had placed too heavy a cost on membership: a user needed to find answers to security questions and get a current user to invite him. By eliminating the second constraint we effectively lowered the membership cost of a user. We saw the anticipated effect: more users were joining the site, but the Sconex community required more policing to remove unwanted users. In the same vein, the cost structures associated with honestly signaling friendship were purposely skewed. A friend request is an extremely powerful tool for site builders because it generates an email that will bring an inactive back to the site, and also signals activity in the system. We spent a lot of time designing an extremely efficient friend request process in order to drop the costs to a minimum. Again, it isn't surprising that 9 months later we are faced with users with much too many friend requests.

In fact, there was a disconnect between the assumed signaling costs between related features. Interfaces lost coherency since the expectation and reality of the signal costs were not aligned. While designing the "get a new friend" interface, we wanted there to be a very low energy cost in completing the process. The service would gain many more members, and reinvigorate inactive users. On the other hand, when we were displaying friend relationships in the service we were assuming that there was a much higher acquisition cost. In these instances, we assumed that signaling online friendship was just as expensive as signaling offline friendship. For example, the interface that allowed you to see the latest blog posts from your friends made sense in this context. We were assuming that you would be checking up on a small number of friends since each relationship was so expensive to acquire and maintain. The same quality was signing different cost contracts with different features. The problems stemming from irregular cost assignments were exacerbated by the patching of broken interfaces. It is very difficult to completely re-implement a broken feature without alienating large portions of the user base.

As a site builder, we also had a lot of power that allowed us to cheat the cost structures that we had implemented. By not playing by our own rules, we also created more inequalities in the signaling structures. Site builders have complete control over every aspect of their service: they have access to the data and the tools to modify their service as they wish. With access to the databases and scripts to quickly do mass changes, there is no signal that can't be dishonestly produced with near zero cost. We had complete control of every aspect of the system: we could send mass emails to users, modify the database to create artificial friend or group relationships, etc. For example, by shortcutting the group joining process and automatically adding new member to Sconex Central we cheapened the quality of group membership. Users quickly learned that being a part of a group has little meaning and we thus contributed to the frenzy of adding groups as a means of self-expression.

Finally, the service as whole measured up poorly to competitors because of mistakes in choosing which qualities to signal. For example, the Sconex users adamantly requested profile customizations as a feature. However, we decided that building that feature would make us too similar to MySpace, which had built its reputation on being a free-form means of expression for teens. We didn't want to duplicate their signals to prospective users: by having a network orders of magnitude smaller, we would clearly be the loser in the head to head match-up. However, it turns out the teenage demographic cared very strongly about this feature. Ultimately, Sconex's lack of ability to provide attractive enough signals to compete with other larger sites has marginalized the service.

5. Medina: exploring activity based interfaces

In the previous sections, we've outlined the need for a strong unified approach to the interface design of a social networking service. We have demonstrated that a simplistic model of social interactions, and the conflicting needs of users and builders can result in awkward navigation interfaces. Medina is a project that explores design decisions that can provide meaningful site navigation while meeting the goals of all parties.

5.1. A marketplace for knowledge

The particular implementation example we have chosen to pursue is a social networking site based around the idea of exchanging knowledge. The service is meant for an audience like the MIT Media Lab. The lab is composed of professors, graduate and undergraduate students, administrators, alumni, and sponsors. Each user has a very specific set of knowledge expertise covering a potentially very wide range of topics. Indeed, the research projects coming out of the lab are very different: projects range from technology initiatives in developing countries to building quantum computers. The people connected to the lab form a very rich network of heterogeneous knowledge. However, in the offline world, access to this knowledge is difficult. There is first a cataloguing and aggregation problem: it is difficult for a researcher to know every exotic area of expertise that someone he is peripherally acquainted to might possess. Also, physical access to the knowledge isn't trivial. If a professor is the leading expert in his field, he will most likely posses the answer to a related question; but it might not be worth his time to spend his entire day fielding questions from inquisitive undergraduate students. Finally, there is no permanent record of the knowledge transfers so that other may benefit from past exchanges. The social networking site we propose to design will aim to solve these problems among others. The word Medina, literally meaning "city" in Arabic, is commonly used to describe the original historic part of a Moroccan city. These old historic centers are still extremely active marketplaces. Analogously, the goal of the Medina service is to provide an effective marketplace for knowledge. The service's interfaces will try to align the interests of the users and site builders by examining new ways of connecting people and ideas. Also, we will propose a new paradigm for browsing through the network.

Typically, a user of the system will alternate between two modes: searching for an answer and providing one. When the user is searching for an answer he is relying on someone in the network to expend energy to help him solve a problem. When providing the answer he is the one expending energy. The user would like to get responses to his questions very quickly, and usually not get bothered about answering questions unless he gets something in return. In the offline world, people will usually exchange social capital with their acquaintances in order to get/provide answers. Otherwise, there is some hidden benefit: for example, a graduate student will answer the questions of his peers to establish himself as the expert in a given subject. Users like to signal their expertise in a given subject, but are rarely willing to provide help gratuitously. A challenge in the design of Medina is honestly signaling the level of expertise of a user and his availability to participate in a discussion. Also, Medina should allow users to signal the benefits of being an active participant in the knowledge exchange.

Builders want to generate as much usage as possible. A large part of this task is acquiring new users and having them visit the site on a regular basis. The builders are thus forced to share a lot of the same concerns as its user base. Users should be able to quickly track down an answer to their question, or find another member that will provide a satisfactory answer with a high degree of probability. Members who are casual participants shouldn't be annoyed with requests even though they may be experts in their field. As always, builders want to accurately signal that the service is a vibrant and dynamic destination. In Medina's case, this can be achieved by seeding the service with organizational data already compiled by the Media Lab, as well as integrating external data sources like archived mailings lists.

5.2. Activity-Based Interface

We have seen that the cost structures for signals in social networking sites are often poorly designed. Firstly, there is competition between the qualities that the builders and the users wish to signal. Secondly, there are many outside pressures that force the builders to consciously make bad design decisions. Finally, features are often not rigorously designed within a consistent framework. Just like any complex system, features are added without taking into account previous assumptions. Services get trapped by their own bad interfaces and can only apply superficial fixes instead of solving the real underlying problems. The goal of the Medina project is to design a social networking site where the basic elements of the service take into account the needs of all signaling entities.

The first step to addressing our design goals is to define a new underlying structure for the network. We are going to use Feld's general construction of social networks where all elements have equal importance. In fact, users, groups, interests, and ideas will all be considered foci. This is a departure from how online social networks are traditionally viewed: the network is a set of nodes representing people, and the edges are the explicit connections they have defined. For example, Sconex was designed such that each high school student was a node in the network and the user-supplied friend connections where the set of edges. On Medina, both users and groups are considered to be network foci: this view matches the intuition that a user can either find the answer to a question directly in an interest group or by directly asking another member.

Signaling Theory will help us define how the links between foci should be created. As we have seen with Sconex, the cost of manually creating links between nodes is extremely cheap: adding a friend, or joining a group are no longer reliable signals for friendship and group membership. In the offline world, it takes energy to create and maintain a relationship so the resulting signals are harder to fake. Therefore, Medina measures the activity between foci and uses the resulting score as an edge weight. Therefore, the edges between foci represent the amount of energy put into the relationships. Accordingly, if there is a lot of activity over time between foci then their activity score increases; if the relationship is neglected the activity score should slowly decay. Many of the design goals discussed can be achieved by measuring activity between elements of the network. For example, users are able to quickly find the right person to help them. A user might label himself an expert in "Social Visualizations" but never participate in the group. The people who claim to know the most about something aren't always the most helpful. A person who is a learning novice but spends a lot of time contributing to the group will have time to actually share his knowledge and end up being more helpful. Therefore the member with the higher activity score will be the most apt to help with a related question.

These activity scores also define a new means of browsing the website. Traditionally, users will explore a social networking service by moving along the group membership and friend links in the network. As we have seen, it is difficult to attach meaning to these since they are so easy to create. On Medina, the connections between foci are defined by the amount of activity between them: by providing a network visualization where links with a high activity score are more visible, users can explore the network in a more meaningful way. It is important to note that we are disassociating the idea of explicit user supplied connections and edge links. For example, two users might send messages back and forth to each other every day and thus have a very strong activity score between them. They will appear very prominently in each other's network. However, they may or may not choose to explicitly label their relationship as a "Friend Connection": explicit connections are just another input to the activity score calculation.

Using this design, users can still express themselves through the public display of their connections. Those who like accumulating links can coexist with users with a more literal definition of a "Friend". In both cases, the network visualization will provide the same type of navigation functionality: the most meaningful connections for each will be the most prominently displayed. From the builder's perspective, the network will have many opportunities for information to flow between users since there will be a high conversion rate of absent ties to weak ties. In the case that a user's numerous connections might carry too much information, sorting by incident activity score organizes the data in a relevant manner.

5.3. Site Functionality

5.3.1. Platform Specifications

Medina is a web application written in PHP version 5 and supported by open source software. It is hosted on a server running Linux Fedora Core 6, using Apache HTTP Server version 2.2.2 as a web server, and MySQL version 5.0 as a database server. The service also relies on network visualization applications written for Flash 7 using ActionScript 2.0.

5.3.2. Feature Set

The implementation of the Medina service is meant as a proof of concept of the design outlined above. As such, we have tried to build a diverse feature set where each important element is fully flushed out. However, we preferred to focus our efforts on general interface design rather than providing tremendous depth and aesthetics to each feature. The Medina service includes a suite of traditional social networking features. Users must register to use the service and login with an email and password to gain access. There is a registration page that only allows users with a unique "mit.edu" address to join. The registration process is very simple and requires very limited information: first name, last name, unique email address, and password. Once inside the site, the service is made up of 5 main pages around which the major features are organized: the homepage, the profile page, a mailbox, a blog, and the focus page. Most pages are organized in two columns with sub-elements divided into modules. Let us describe the features in more detail:

- The homepage is a centralized information source for the user. If there are any alerts from friend requests, unread mail messages, or unseen profile comments the Alert Module appears at the top. The rest of the modules on the page give the user a feeling for what's going on the site: there is a module listing the most active users on the site, and a module with the most active external mailing lists.
- The mailbox is a listing of private messages that have been sent to the user. Messages are either read or unread, and can be deleted. There is no notion of threading, although message replies are tracked.

- The blog is a time-sorted sequence of posts a user has made. Other users can comment on each post.
- The profile page is an aggregation of all the content for a user: as in Figure 1, it contains sample modules for his friends, profile comments, basic information, and questions he has successfully answered. Also, the page lists all the foci the user has declared himself a member of.
- The profile comments are publicly viewable messages that anyone can leave on another user's profile. A sample of the last comments appears on profile pages, and a browse-page allows users to access all of them.
- The focus page is another aggregation page. It contains a sample of the members that have joined, the most recent questions asked about the focus, and the latest associated archived mailing lists posts. In fact, when creating a focus a mailing list can associated with the group: if the list is archived by the Media Lab its message will be accessible from inside Medina.
- The knowledge base of a focus is represented by a question and answer style message board. Any user can post a question to a focus, and any user can provide possible answers. The user who asked
- The focus and profile pages have a network visualization that provides a new way to access new interesting nodes.
- A small set of administration tools are also provided. There are multiple user levels that allow level specific security settings. In actuality, only two are used to separate administrators from regular users. The main difference is that

administrators can change their display to a debug mode, and impersonate other users.

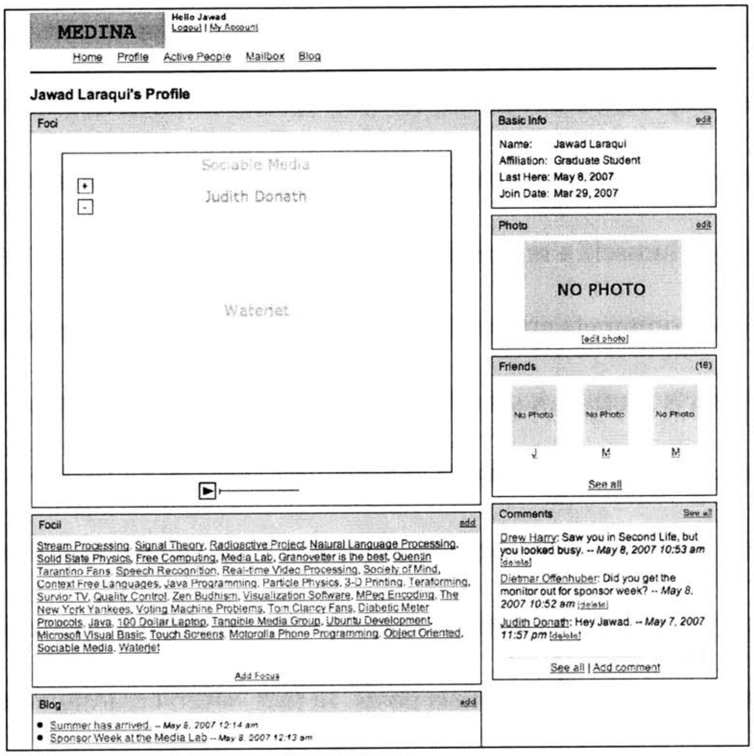

Figure 1: Medina Person Profile Page

5.3.3. Measuring Activity

The structure of the underlying network has been changed to include people and groups, referred together as foci, as the nodes in the network. The links between them are edge-weighted links based on the amount of activity between the elements. The links are unidirectional. Just as Feld and Granovetter postulated, the more effort is put into the link between two foci, the stronger the tie between them. Conversely, if relationships are not maintained they will slowly decay. The Medina service measures activity between foci and updates the activity scores accordingly.

The traditional social networking features were included to provide a realistic means of measuring activity between elements in the network. For each action a user performs his activity score will be updated. The time cost and social importance of the different possible actions were subjectively calculated and hardwired into the code. When an action is performed its positive or negative cost is added to the activity score between the elements. For example, viewing another user's profile increases the activity score by one point. Sending a personal message increases the activity score by 5 points; if the user replies to the message then the score is increased by 10 points. In fact, viewing a profile has very little cost, therefore the impact on the activity score should be very minimal. When a user sends a message to another member, there are not only more clicks required in producing the action but also the social significance is deeper as the user is initiating a personal communication. If the recipient replies to the message then he is validating the exchange as fruitful. The idea of decay in a relationship is implemented by docking the activity score of each link by 1 at the end of each day. Also, the score between each foci is archived so that the history of a link can be visualized.

The implementation of the scoring system matches up to our earlier definitions of how the underlying network should be organized. Foci have activity scores with other nodes in the interval $[-\infty;+\infty]$. Once two foci are connected the absent tie between them is converted to a weak tie. One of the most common actions on a social networking site is viewing the profile page of a focus (either a person or a group on Medina). Users will casually visit hundreds of profile pages without investing much energy, past satisfying a fleeting curiosity. One could ask what is the purpose of increasing the activity score for such a mundane action? In fact, the addition of this small score will convert absent ties in the network into weak ones. This will create dense connected networks, even for users haven't been members for a long time.

5.4. Activity Visualization

The activity scores between foci can be used to create a better browsing interface for the service: the visualization can filter out weak ties and guide attention to the valuable strong ties. Instead of providing long lists of connections, the interface can sort a person or groups' outgoing links based on activity. In fact, the elements with the highest score will be the most relevant. This visualization will be prominently displayed on the person and group profile page: it will be the main means of site navigation. For example, a user has a question about using the WaterJet machine in the basement of the Media Lab. He searches for the WaterJet group and lands on its profile page: he would like to find the user that could offer him the most help. Traditionally, he would have had to randomly look through the group member list to find a partner; perhaps he will increase his chances of success and will look for an intersection with his close friends, or consult the list of users who have labeled themselves as experts. These procedures don't have a large probability of getting our user a reliable response to his question. However, if the user could quickly see a view of the most active users in the group, he could find a user with a high probability of responding with a valid answer. In fact, these activity visualization maps would be useful for user and group profile pages. On a user's profile page, the visualization would include the users and groups he had interfaced with. On the group profile page, the visualization would have the users who were active. The visualization has a zoom feature to see varying levels of network details. It also has a history feature that animates the foci in the visualization based on the history of activity scores.

The actual visualization built for the Medina web site was a Flash 7 application written entirely in Action Script 2.0. The application is embedded in the profile pages of foci and passed both the focus type and its unique focus id. The flash application then fetches a representation of the focus' network through an XML interface. The data collected includes information on the main focus and a listing of all the foci that are connected to it. Each connected focus comes with its type, current activity score, and 30-day activity score history. The activity scores were rescaled such that they represented a real distance in pixels in the visualization and that all nodes would appear at the highest zoom level. When designing the visualization, two layout options inspired by the email visualizations of Fernanda *et al* [5].were entertained. The first design is a circular arrangement where the main focus is at the center of the visualization: the connected foci are randomly placed on a circle with the scaled activity score as the radius. The foci representing people are colored in red, and the foci representing interest groups are colored green. In Figure 2, we are looking at an example visualization for the user Jawad, who is most active with the users Carl and Peter, followed by the group "Sociable Media".

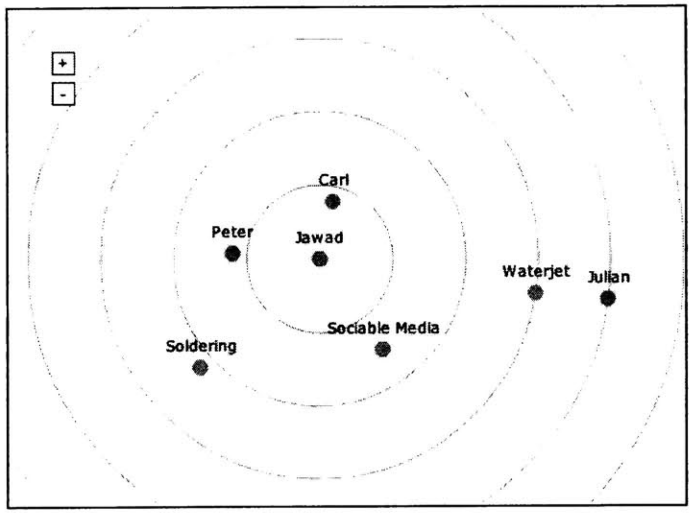

Figure 2: Circular View of Visualization.

A drawback of this visualization is that the second degree of freedom, the angle around the circle, isn't assigned a meaning. The second visualization option represents the foci in a waterfall: the nodes with the highest activity score are closer to the top. For example, in Figure 3, we have the visualization embedded on Jawad Laraqui's profile page. The interest group Sociable Media is the node with the highest activity score.

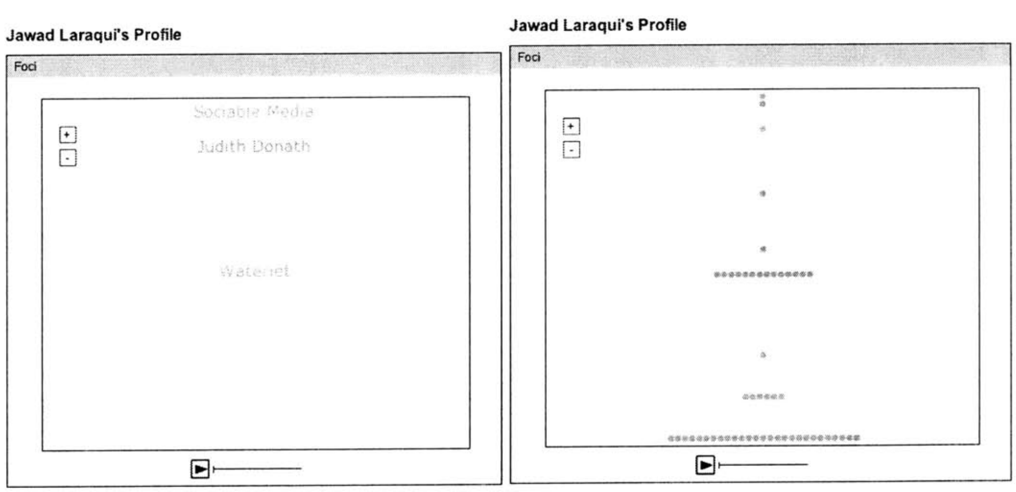

Figure 3: Waterfall View of Visualization Zoomed In, and Zoomed Out.

Ultimately, the waterfall layout was chosen because it didn't contain the ambiguity of a meaningless degree of freedom.

Though the two visualization options lay out the nodes differently, they have the same functionality. First of all, they are a browsing interface: clicking on a node sends the user to the profile for that focus. Also, the zoom controls in the upper left hand corner allow the most active nodes to be visible at a high resolution. As the visualization is zoomed out, a high-level view of a user's activity connections emerge. For example in the zoomed out visualization in Figure 3, the users seems to be casually browsing many interests groups but not contributing much; this can be seen from the mass of green foci at the bottom of the waterfall. This view represents a snapshot of a user's contribution to the service. Also, the application allows users to visualize the history of a foci's connections by using the movie controls near the bottom. The ensuing animation traces the changes in activity scores for each node over the last 30 days.

5.5. Medina Evaluation

The Medina project was a proof-of-concept implementation of the activity-based interfaces we have been discussing. As such, there are still open questions as to the behavior of the interface under real world scenarios. The scoring of the features was subjective and might not correspond well to the user's expectations. It is expected that the scoring coefficients will constantly be tweaked during the lifetime of such a service. Also, the strength of an activity-based interface is that it removes absolute power from the site builders to shape the network as they please. On the other hand, it also forces the users to expose their usage patterns on the service. Users might not like the lack of control over the browsing interface of their profile page, and feel frustrated by the inability to easily fake their online identity. Finally, we are placing a burden on the users who contribute a lot within an interest to be gurus for all others.

6. Conclusion

We have seen that poor interfaces in online social networking sites stem from the inconsistent analysis of the evolving constraints placed on them. These constraints not only originate from the users of the service but also the people that build them. In the hopes of providing a better foundation for our analysis, we first revisited the underlying structure of social networks. We argued that a more realistic network definition could be utilized by using a more general definition for nodes, and using activity weighted links between them. In fact, we saw that using activity was a more natural transposition of how social network function offline.

Then we introduced Signaling Theory as a framework for analyzing social networks: through the analysis of the costs and benefits, design decisions can be evaluated at all scales. This provided the foundation for a consistent discussion of online interfaces. We discussed how users signal qualities in order to shape their online identity, while site builders try to resolve the constraints imposed by their members, advertisers, and investors. We saw that current social networking interfaces fail to adequately address both sets of goals and contain important inconsistencies.

Then this framework was used in the case study of Sconex, a high school social networking site for teens. We saw the importance of building consistent interfaces that satisfy the needs of all signaling entities. Also, we saw how bad design decisions in terms of signaling can produce life-threatening interface issues.

Finally, we discussed a possible solution with the activity-based interfaces of Medina. The underlying network structure discussed in Chapter 2 was used. A network visualization tool emphasized the most active foci for a person or interest group allowing for a more meaningful way to navigate the site. The users of the site were still able to express themselves, while the site builders could satisfy the external constraints imposed by the business side of the service.

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