Signals in Social Supernets

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Social network sites (SNSs) provide a new way to organize and navigate an egocentric social network. Are they a fad, briefly popular but ultimately useless? Or are they the harbingers of a new and more powerful social world, where the ability to maintain an immense network—a social "supernet"—fundamentally changes the scale of human society? This article presents signaling theory as a conceptual framework with which to assess the transformative potential of SNSs and to guide their design to make them into more effective social tools. It shows how the costs associated with adding friends and evaluating profiles affect the reliability of users' self-presentation; examines strategies such as information fashion and risk-taking; and shows how these costs and strategies affect how the publicly-displayed social network aids the establishment of trust, identity, and cooperation—the essential foundations for an expanded social world.

Grooming, Gossip, and Online Friending

Social ties provide many benefits, including companionship, access to information, and emotional and material support (Granovetter, 1983; Wellman, Garton, & Haythornthwaite, 1997; Wellman & Gulia, 1999). Increasing the number of ties increases access to these benefits, although time and cognitive constraints preclude indefinite expansions of one's personal network. Yet if maintaining ties were to become more temporally efficient and cognitively effective, it should be possible to increase the scale of one's social world—to create a "supernet" with many more ties than is feasible without socially assistive tools. The question this article addresses is whether social network sites (SNSs) are a technology that can bring this about.

In the wild, apes groom each other, picking through fur to remove parasitic bugs. This behavior helps with hygiene and is relaxing and pleasant for the recipient. Perhaps most importantly, it establishes social bonds: Apes who groom each other are more likely to help each other and not fight. Long grooming sessions are time consuming, however. Since the ape must also spend many hours finding food, sleeping, etc., it is clear that grooming can sustain only a limited number of relationships (Dunbar, 1996).

In *Grooming, Gossip, and the Evolution of Language,* Robin Dunbar (1996) argued eloquently that in human societies, language, especially gossip, has taken over the social function of grooming. Instead of removing lice from each other's hair, people check in with friends and colleagues, ask how they are doing, and exchange a few words about common acquaintances, the news, or the local sports team (Dunbar, 1996, 2004). Language is much more efficient than physical grooming, for one can talk to several people at once. Language also helps people learn about cultural norms, evaluate others' behavior, and keep up with the news and shifting opinions of their surrounding community. It makes reputation possible—individuals benefit from the experience of others in determining who is nice, who does good work, and who should be shunned for their dishonest ways. Using language to maintain ties and manage trust, people can form and manage more complex and extensive social networks.[1]

Communication technologies expand human social reach (Horrigan, Boase, Rainie, & Wellman, 2006). Email makes communication more efficient: Sending a message to numerous recipients is as easy as sending it to one, and its asynchrony means that there is little need to coordinate interaction. Contact management tools, from paper Rolodexes to complex software systems, increase one's ability to remember large numbers of people (Whittaker, Jones & Terveen 2002).

While these technologies provide some of the support an expanded social world needs, they alone are not sufficient. People need to be able to keep track of ever-changing relationships (Dunbar, 1996; Nardi, Whittaker, Isaacs, Creech, Johnson, & Hainsworth, 2002), to see people within the context of their social relationships (Raub & Weesie, 1990), and, most fundamentally, to know whom to trust (Bacharach & Gambetti, 2001; Good, 2000). Email and contact tools help maintain an expanded collection of individual relationships. Are social network sites the solution for placing these relationships into the greater social context?

A page on *MySpace*, filled with flashing logos, obscure comments, poorly focused yet revealing photos, and laced with twinkling animated gifs, may not look to the casual observer like the harbinger of the next stage in human social evolution. But perhaps it is. SNSs locate people in the context of their acquaintances, provide a framework for maintaining an extensive array of friends and other contacts, and allow for the public display of interpersonal commentary (boyd & Ellison, this issue).

At the same time, SNSs are still primitive; it is too early in their development to observe clear evidence that they have transformed society. The goal of this article is to present a theoretical framework with which to a) assess the transformative potential of SNSs and b) develop design guidelines for making them into more effective social tools. The foundation for this analysis is signaling theory, which models why some communications are reliably honest and others are not.

The argument begins with an introduction to signaling theory. The next section uses this theory to examine how the fundamental structure of SNSs can bring greater trust and reliability to online self-presentations, how specific site design decisions enhance or weaken their trust-conferring ability, and how seemingly pointless or

irrational behaviors, such as online fashion and risk taking, actually signal social information. The final section examines the transformative possibilities of social supernets—not only whether SNSs may bring them about, but if so, in what ways they might change our society.

An emphasis of this article is on ways of achieving reliable information about identity and affiliations. There are situations where ephemeral, hidden, or multiple identities are desirable. However, minimal online identity has been easy to create, while it is harder to establish more grounded identities in a fluid and nuanced way. A primary goal of this article is to understand how reliability is encouraged or enforced. For designers of future systems such knowledge is a tool, not a blueprint. Depending on the situation, they should choose the appropriate space between anonymous and whimsical and verified and trustworthy identities and communication.

Signaling Theory

Whether face-to-face or online, much of what people want to know about other people is not directly observable. We rely instead on signals, which are perceivable features and actions that indicate the presence of those hidden qualities. We cannot directly observe others' beliefs, experiences, or what they really think of us; instead we rely on signals such as facial expressions, consumption patterns, or the statements they make on their profiles in order to infer these qualities.

Signaling theory seeks to explain what keeps communication honest (Donath, in press; Maynard-Smith & Harper, 2003). In many social interactions, there are motivations for deception. Some are overt and obvious: Parents want to know where their teenager has been until two o'clock in the morning, and the teenager wants to avoid getting in trouble. But everyday interactions are rife with subtly diverging goals and small deceptions. People want to make the best possible impression, to appear important, creative, and popular, while others want to know if they really possess those qualities (DePaulo & Kashy, 1998). When the costs of being deceived are low, people may not care if something is an exaggeration. However, when the costs are high, they may demand a more reliable signal. An online discussion group may require few proofs of identity and intention so long as the conversation is civil, but if troublemakers infiltrate it, the group may revise its policy and, through means such as moderation or becoming invitation-only, raise the cost of participation (Donath, 1998).

Signaling theory, developed initially in economics (Spence, 1973a) and biology (Zahavi, 1975), models the relationship between signals and qualities, showing why certain signals are reliable and others are not. For a signal to be reliable, the costs of deceptively producing the signal must outweigh the benefits. The core of signaling theory is its analysis of the types of signals and situations that bring this about.

One class of signals, termed *assessment signals*, is inherently reliable, because producing the signal requires possessing the indicated quality. Lifting a 500-pound weight is a reliable signal of strength; a weaker person simply cannot do it. "Strategic"

or "handicap" signals are assessment signals that indicate possession of a great deal of some resource by wasting that resource (Maynard-Smith & Harper 2003; Zahavi, 1977). A moose's antlers waste energy; a fast sports car wastes money. Here the term "waste" is descriptive rather than pejorative—the idea is that only someone who has an excess of a given resource can afford to expend it for communicative display. Zahavi (1977) emphasized that these costly signals are only reliable in the domain of the cost. The owner of an expensive car may use it to signal both wealth and attractiveness, but its high price only guarantees that the owner is wealthy; it is an unreliable indicator of attractiveness.

Another class of signals, termed *conventional signals*, is not inherently reliable (Guilford & Dawkins, 1995; Maynard-Smith & Harper, 2003). Here the link between signal and quality is arbitrary, a matter of social convention. Rare in the animal world, conventional signals are very common in human communication. The self-descriptions in online profiles are mostly conventional signals—it is just as easy to type 24 or 62 as it is to enter one's actual age, or to put M rather than F as one's gender. Conventional signals are kept honest through the outside intervention of laws and social mores. A siren on a car is a conventional signal of being an official emergency responder. Anyone can buy one and use it to speed through traffic, but society imposes costs on those who do so illegitimately. Putting one's profile in a social network site, linked to by one's acquaintances, places it into a context subject to the latter's social mores, be they for factual truthfulness or identity play (Donath & boyd, 2004).

However, costs may discourage deception but not be high enough to guarantee honesty. The SNS *LinkedIn* requires that users provide the email address of the person with whom they wish to connect; this makes deceptively claiming to know someone costlier, but it certainly does not prevent all contact by strangers, especially for those with published email addresses.

To ensure that people link only with those they truly know, one design approach is to increase the amount of knowledge about the other that potential linkers need to provide. *Sconex,* a social network site for high school students, requires that potential users answer questions about the school with which they claim affiliation. "What color are the third floor lockers?" and "which of the following is a history teacher?" are easy for actual students to answer, but harder for outsiders. Another approach is to sanction members who attempt to connect with others who do not know them. *aSmallWorld* revokes the networking privileges of people whose connection requests are rejected.

Still, humans are ingenious. Given sufficient motivation, very few signals are impossible to fake, no matter how costly and closely tied to the signaled quality (Donath, in press). Once tanned skin became a signal of status and luxury, humans invented tanning beds and spray-on skin coloring. Once having many friends on social network sites became a signal of status and popularity, users invented fake friends and software for automating connections (boyd, 2006; Slotnick, 2007). The costs and benefits that motivate people to act in certain ways are in continuous flux.

Trust and Identity in Large Mobile Societies

It can be quite beneficial to an individual to claim to have expert knowledge, high status, or sought after connections, whether or not these claims are true. Small, tightly-knit communities handle this problem by limiting interaction to known individuals. In this way, they remain safe from unpleasant surprises but also closed off from new people and ideas. In contrast, a very open society in which people interact with numerous strangers, such as today's online world, has the advantage of novelty and being accessible to new-comers, but is also vulnerable to deception (Enquist & Leimar, 1993). Can SNSs provide a means for extending trust and assessing reliability in large-scale, mobile communities? Are particular implementations better suited for doing so than others?

Dunbar (1996) argued that while new communication technologies could increase the flow of information, they would be unable to change basic social structure and scale. He claimed that people would need to fall back on face-to-face interaction in order to establish trust, rather than relying on what he call the "mere ciphers" people encounter in the mediated domain (Dunbar, 1996, p. 204).

In challenging the assertion that new technologies will not significantly change human sociability, a key issue is what happens to trust in the mediated world. Dunbar's impression of a world where shadowy "ciphers" disappear at will to avoid punishment for their misdeeds and where social order routinely breaks down is not entirely undeserved. Tales of deception fill the online world; there are many decaying conversation spaces where angry ranters and floods of spam have driven out once lively discussions (Donath, 1998). What role can the publicly-displayed social network play in establishing identity and trust?

SNS users represent themselves with a profile, which includes a self-description, comments from other users, and the technology's defining feature, a list of links to chosen other members. The self-description can include pictures, affiliations, career goals, and other personal details. Alone, these are conventional signals, easily faked; even references to favorite obscure books and other displays of esoteric knowledge may have simply been copied from another's page. Yet the links to other members implies that they have vetted this description as true—although it is important to note that "true" means "true to the mores of our community," which can range from strict adherence to known facts to highly imaginative role-playing (boyd & Heer, 2006; Donath & boyd, 2004; Lenhart & Madden, 2007b).

The list of acquaintances provides social context. One expects people to be similar to their friends (McPherson, Smith-Lovin, & Cook, 2001). An aggressive, rebellious profile linked to similar ones reinforces the writer's claims, but if linked to many mild and conservative profiles, the viewer may interpret it as a fictionalized performance or question the circumstances that led to these seemingly anomalous connections. The network context can clarify ambiguous presentation, moderate an extreme performance, and confirm an ambitious one.

SNSs can provide a richer social context for people one knows only superficially. Seeing who other people know and how they treat and are treated by others provides

important cues for understanding them (Holland & Skinner, 1987). A person one meets in isolation can make difficult-to-verify claims in an effort at impression management (Goffman, 1959). A person one meets in the social context of friends or colleagues, however, is tethered to the identity developed among them.

Trust is belief that the other is trustworthy. This belief is inferred from cues and signals; trustworthiness itself is not directly perceivable (Bacharach & Gambetti, 2001). People trust new information and acquaintances that come to them via people they trust. Thus, one's display of connections signals one's trustworthiness (Donath & boyd, 2004). One of the most valuable contributions of SNSs is their potential to add trust to weak ties. Trusted weak ties are very useful sources of information, combining the heterogeneity that such ties generally have with the believability that comes with trust (Levin & Cross, 2004). Furthermore, SNSs can actually increase trustworthiness, by placing people within a context that can enforce social mores. SNSs make people aware that their friends and colleagues are looking at their self-presentation.

SNSs have these functions only if users care about being, even implicitly, trusted recommenders. When people indiscriminately add connections, others who trusted their judgment can suffer and will eventually cease trusting them as a source for useful vouching. Site design influences this: Sites designed to make adding connections as easy as possible, emphasizing indiscriminate network growth, create networks that do little to increase trust or trustworthiness.

Site Design Affects Reliability

Variation in the design of SNSs promotes the development of different cultures (Donath & boyd, 2004; Lampe, Ellison, & Steinfield, 2007; Lenhart & Madden, 2007b). On a site where creating a link involves little cost, users may amass thousands of "friends," but an observer has no way of knowing which, if any, of these links represent a relationship between people who care about or even know each other (boyd, 2006; Fono & Raynes-Goldie, 2007). On *Orkut*, for instance, one simply clicks on a profile to request a connection, and being connected provides no special access or information.

On sites with higher costs for creating a link, the observer has reason to believe that the links represent genuine relationships. Members of *aSmallWorld* are careful to request connections only with others whom they are sure wish to be linked to them, since they can be banished for having a few link requests declined (Price, 2006). On *LiveJournal*, making the link is easy: It is one of the few sites in which this can be done unilaterally. However, linking is generally done to give someone access to part of one's journal, and linked members' posts appear on one's own space. This makes "friend" a relatively significant signal, as friending someone both reduces one's privacy and publicly connects one with that person's writing (Fono & Raynes-Goldie, 2007).

The meaning of these links is also personally subjective. For some people, listing someone as a "friend" on a social network site is an indication of personal and

positive acquaintance. Others are far more casual, willing to add friends indiscriminately (boyd, 2006). This has ramifications for the reliability of the profile itself. Viewers may trust the self-created content of a profile if they believe that its links are to people who know that user well, while links that they believe have only minimal connection add little credence.

SNSs are designed for different audiences. *LinkedIn* is for professionals. It has no photographs, the profiles are resumés of education and work, and the comments are in the form of testimonials from co-workers. Identity is firmly tied to one's professional self, and there is limited ability to explore other people's networks. *MySpace*, popular with young people, has a very different atmosphere. Its profiles feature photographs, music, and embedded programs, and users can explore the network far beyond their own acquaintances (although they can choose to make their profile visible only to direct connections). This open interface makes it a rich environment for the jokes, links, and software that function as information fashions (discussed below).

Identity in *MySpace* is fluid. Some profiles are real people, presenting themselves much as they would offline. Some are commercial entities, such as bands, charitable organizations, or celebrities; still others are fictional personas, made for creative experimentation or as fronts for spam. No single design is ideal for all sites. What is important is that designers be fluent in not only the fonts and colors that make up the graphical design of the site, but in the social costs and benefits that shape its emerging culture.

Types of Relationships

Social network research classifies ties as strong or weak, heterogeneous or homogeneous (Granovetter, 1973, 1983; Wellman, Garton, & Haythornthwaite, 1997). While the specifics of any individual relationship are more complex, broadly characterizing them is useful for understanding the technology that can best support them. Current research suggests that both strong and weak ties are sustained on SNSs (boyd, 2006; Ellison, Steinfield, & Lampe, 2007; Horrigan et al., 2006; Lenhart & Madden, 2007a).

Strong ties are close confidants, people relied upon in an emergency and with whom one is likely to share multiple interests. A close-knit network of strong ties can supply extensive support. Being a member of such a group requires a large commitment of time and attention; there is frequent contact among the members of the group, often together. Close networks of strong ties tend to be homogeneous and insular, reinforcing beliefs rather than introducing new ideas.

Weak ties are more distant acquaintances, people known in a specific context and towards whom one feels less responsibility. A sparsely connected network of weak but heterogeneous ties provides access to a great variety of ideas and experiences. SNSs make establishing and sustaining large numbers of such ties more efficient.

The combination of these types of ties arguably makes social supernets viable: The stronger ties bring reliability to the profile, and a large set of weaker ties expands the scale and scope of the network. This raises important questions about how the

balance of personal networks may change. Will SNSs shift people's social world from one focused on a few important relationships to one consisting of an immense number of weak relationships? What would this mean for social support, information finding, and simply how people spend time?

The list of connections on a profile does not differentiate between close friends known in person for years and people known only through cursory glances at their profiles. The significance of these "unnuanced" links is thus ambiguous. However, precisely defining relationships is not necessarily the solution. In the face-to-face world, people are circumspect about explicitly defining the parameters of their friendships. This is often a matter of saving face—of not embarrassing someone by pointing out the limits of one's affection for him or her. Links that specify the type of relationship provide information to the viewer, but also increase social discomfort (boyd, 2006; Fono & Raynes-Goldie, 2007). Indeed, simply publishing lists of friends on a social network site goes against some of people's fundamental social training about making these boundaries public.

One solution is to look at interactions rather than explicit articulations. Public comments and other communication also signal the strength and context of a relationship and do so with greater nuance. Returning to a friend's page, day after day, to say hello is a way of engaging in "social grooming." The cost in time is a signal of the resources one is willing to commit to this relationship, and references to mutual friends and external events are indices of shared experience. The length, frequency, and content of these comments form a conversational profile of each relationship.

It is important to keep in mind that the interpretation of any signal is subtle and subjective. The time spent on "social grooming" may be a "signal of need"—its purpose being not to indicate how much free time one has, but rather the importance one places on the relationship. With signals of need, one pays a cost in resource a to indicate the seriousness of one's desire to signal quality b—in this case, the importance of the relationship (Godfray, 1991). Devoting a lot of time to a relationship can thus indicate its importance. It can also simply mean that one has a lot of extra time (Spence, 1973b). Thus an unemployed acquaintance may spend many hours a day keeping up with online correspondents, while a close but busy friend may seldom do so. Excess time may itself be an important thing to signal. A very busy individual may have little time to help friends move or go on a trip, whereas a less close one with more time may be more available. Interpreting the significance of time spent on a relationship benefits from knowing both the actual time spent and how it compares with the time that person spent corresponding with others.

Gathering such information can be quite time consuming. "Receiver costs" are an important component in communication dynamics: If a reliable signal is very costly to assess, receivers may choose to rely on one that is less reliable but easier to obtain (Guilford & Dawkins, 1991). A key design goal is thus to enable signals that are reliable yet not costly to assess.

Reducing Receiver Costs

Many reliable signals take time to evaluate. In the wild, a female frog assesses the desirability of potential mates by listening to their call. However, the longer she spends making this assessment, the more likely she is to be eaten by a predatory snake. If many snakes are present, females may make assessments based on shorter though less reliable calls (Grafe, 1997). In the human world, résumés of job applicants are quickly scanned at establishments such as fast food restaurants; the costs of occasionally hiring an unqualified worker are less than those of meticulously checking each applicant's background. An employer hiring for a highly paid and responsible position will spend far more time verifying applicants' claims of experience and expertise, since the cost of making a poor choice is higher.

In an SNS, users assess the desirability of potential friends by perusing their profiles. On a site such as *MySpace*, choosing whom to friend is significant: Only listed friends can view private profiles and comment on each others' pages. While some users limit their connections to people they already know, others would like to be open to potentially interesting new people. *MySpace* users receive numerous friend requests, from people with shared interests who wish to strike up an online correspondence, bands who wish to add people to their fan base, people trying to acquire as many links as possible, and fictional characters enacted on the site. How to choose which to accept?

Deceptive spammers complicate this problem. Some pose as legitimate users to convince others to accept their friend requests and then fill the accepting user's message-board with advertising. The consequences of mistakenly accepting a spam agent as "friend" are both social (one's comments section fills with advertising and one may appear as a spammer to others) and financial (people falling for advertised scams lose money). SNS spam is a new phenomenon, although email spam has been around for many years. While in-depth studies of reactions to the former are not yet available, predictions can be made based on studies of the latter. When spam is prevalent, sorting through one's mail becomes increasingly time consuming; people become less enthusiastic about receiving messages and may become disillusioned with the entire experience (Fallows, 2003; Pavlov, Melville, & Plice, 2005). In SNSs, spam is likely to change the social atmosphere, causing people to becoming more suspicious, more likely to keep their profiles private, and less likely to accept any connections from strangers.

Spammers persist as long as their benefits exceed their costs. Their widespread presence is evidence that they can prosper in the current environment. Discouraging them requires reducing their benefits (few people respond to them) or raising their costs (by imposing penalties or making it more difficult to achieve the deception) (Goodman & Rounthwaite, 2004). Making assessment easier makes spam more costly, by forcing spammers to put greater effort into mimicking legitimate users.

On SNSs, there are many cues and signals about an individual's identity. Some, such as the self-description featured in the profile, are easily perceived, but are composed of conventional signals and easily faked. Others, such as the network

and communication patterns of everyone connected to the individual, are more reliable, yet tracing the network and uncovering evidence that many of the "friends" are fakes, or noting that the comments were added en masse, is time consuming. It is easier just to peruse the (unreliable) profile.

Making the reliable cues more accessible would improve the receiver's assessing ability, while reducing the cost. Among the most promising cues to highlight are clustering coefficients, degree of bi-directionality in communication, and media sharing practices (Zinman & Donath, 2007). While hard to assess by perusing individual profiles, such information could be compactly visualized to provide an intuitive data portrait of potential connections. Network depictions such as *Comment Flow* (Offenhuber & Donath, 2007), which animates the flow of communication in a SNS, can make individuals' overall communication patterns easy to see (Figure 1).

Figure 1 *Comment Flow* shows public communication patterns within a social network site. Boxes on the lines linking connected members represent comments, moving from sender to recipient.

Designs such as *Comment Flow* that visualize the history of a profile and its interactions can give weight to longevity, show with whom someone has consistently interacted, and indicate a person's role within his or her network. By making it easy to see these telling but otherwise difficult to perceive cues, such designs can bring social legibility to a site.

Beyond their effect on spam, designs such as *Comment Flow* can potentially change the dynamics of a site. They may change behavior by making people more aware of the cues they are revealing; such awareness can turn unconscious cues into conscious signals, as people learn to manipulate the impressions they wish to give off. These designs may also create a new level of network legibility, making network structure and activity into an everyday part of impression formation.

These changing dynamics can be both good and bad. People may become more self-conscious about the sort of network they display and manipulate relationships in order to show a socially preferred pattern. In today's relatively primitive designs, the network feature most prominently depicted is size, which encourages people to add connections to create the largest network (boyd, 2006). A more nuanced depiction may encourage other mores, such as making greater effort to create a dense network by introducing compatible acquaintances to each other.

How someone exists within the social world is one of the key things people wish to know about each other, although in everyday existence it is only inferred indirectly. Does he have a dense and homogeneous network or a large and heterogeneous one? Does she frequently or sporadically maintain contact with more distant friends? One of the most intriguing possibilities of future social network technologies is that these social features can become part of one's visible persona.

Signaling Status and Invulnerability

The costs in a communication system have many functions. The previous section considered costs related to spam—the problem of the costs it imposes on users and how new designs may reduce it by making it more costly to the spammers. This section looks at some signaling functions of costs—how the wastefulness of some seemingly irrational behaviors is actually a cost that ensures the reliability of a communicative signal.

Amotz Zahavi (1977) developed costly signaling theory in order to explain the presence of so much seemingly irrational wastefulness in nature. Why do moose carry such enormous and metabolically expensive horns? Why do some gazelles jump up and down when they see a predator, wasting time and energy instead of running off as fast as they can? Zahavy's insight was that this wastefulness ensures the honesty of their signals of fitness and speed: Only animals with an excess of the signaled resource can afford to waste it on expensive communicative displays.

Similarly, observers have been puzzled or concerned by seemingly irrational behavior on SNSs. Users may spend considerable time updating their pages, adding new pictures and music; the comments they send each other are often in the form of

jokes and images. Why spend so much time on seemingly inconsequential changes of imagery and uninformative communication? Deep concerns have also been raised about young people who create overly revealing profile pages, in which they appear in provocative photographs or recount illegal activities such as drug use or underage drinking. Warnings about the dangers of doing so have stopped some, but not all. Why would someone choose to post such material once he or she was aware of the negative consequences? Signaling theory can help explain such behavioral phenomena.

Fashion and the Display of Information-Based Status

While an outsider might see as wasted the time expended on profile updates and exchanges of the latest pictures and URLs, another interpretation is that these seemingly trivial activities are examples of online fashion, signals of social position in an information based society (Donath, in press; McCracken, 1998; Thornton, 1996).

Fashions, the constant change in the way of doing something, are signals whose form—the currently popular object or saying—changes frequently, while the meaning—social position—remains the same. There are fashions in clothing, slang, and management techniques. Their individual instantiations are easily-copied conventional signals; it is the constant evolution of forms that creates the reliable signal. Fashion is about information, about knowing the changing social meaning of an object or way of doing things.

Individuals' location on an adoption curve situates them in a complex world of multiple and shifting subcultures. *What* they adopt—the cars they drive, music they listen to, stories they link to—signals their affiliations. *When* they adopt indicates their status and commitment to those affiliations. Are they among the earliest adopters, willing to risk mistakes (e.g., wearing boots that never shift from weird to cool, spending months to learn a new computer language, only to see it abandoned by its developers) or among the latter ones, knowing the choices they made have been vetted by numerous predecessors—safe, but never a leader? The rewards of being a leader are status and influence; the costs are the energy it requires and the risk of mistaken judgment. Even in the world of blogs, where fashion is in the ostensible "free" medium of information, being at the forefront is costly. Much time is required to find and disseminate new ideas (Levy, 2004), and publishing erroneous stories is also a risk (Donath, in press).

Successful blog topics follow the classic innovation diffusion model (Rogers, 2003). A creative but perhaps unknown innovator introduces a link, highly connected "A-list" bloggers popularize it, and then it diffuses, over a period of weeks, through the rest of the population (Adar, Zhang, Adamic, & Lukose, 2004). Fashion in SNSs has not yet been formally analyzed, but it is likely to follow a similar pattern.

A tremendous amount of fashion exists on many SNSs, with images, movies, and jokes tracing network paths as they spread from user to user. For example, *Facebook* users can add applications to their profile; these programs, of which there are thousands, help users share books, movies, and music; play games; create maps of where

they have been, and so forth. Many are social grooming aids for the information world—their fundamental message is "I'm thinking of you," conveyed via virtual gifts or imaginary zombie bites or by letting users throw virtual sheep at each other. The profile of the fashion-conscious user is studded with icons signaling application use, and one looks to the fashion leaders to learn which of the newest offerings are worth adopting, for while some are very clever or useful, others are badly designed and programmed. Using one of these applications displays one's fashion knowledge and status: Is it a cool new app or one that was going out of style a week ago? Does the sender have enough influence to be able to introduce something new and have it catch on, or will it just seem like a strange thing to do ("Why are you throwing a make-believe sheep at me?")?

In the public space of SNSs, information fashions can create virtual walls, allowing those in the know to recognize others within their subculture via their common understanding of jokes and references that have not yet spread to the mainstream (Thornton, 1997). For example, in the spring of 2007, a photo of a cat with a slice of cheese on its head and the caption, "CHEEZ: you doin it wrong" appeared on some profiles. Anyone not privy to the Internet fashion of "lolcats" would find this image baffling, but for those in the know, it was a witty play on the preceding week's wildly popular cat picture captioned with, "I can haz cheezburger?"(Wikipedia, 2007). Fashion is one way of maintaining privacy, while still signaling beliefs and affiliations to potential connections.

Being in fashion—whether via physical clothing or online linking—signals fitness in the continuously changing information world. It signals status in a society where "information prowess"—i.e., having access to information, the ability (often termed taste) to distinguish between good and bad information, and the willingness to adapt to the changes brought by new information—is a fundamental part of the culture.

Information Exposure: Signaling Imperviousness

Excessive risk taking is another behavior that may seem irrational, but when viewed as a signal, can be seen as a way of claiming a high level of fitness. From lion-hunting Masai warriors to cigarette-smoking, drag-racing American teenagers, people (often young) perform risky acts to prove that they are so fit or skilled that they can afford to be daring (Dunbar, 1996; Hawkes & Bliege Bird, 2002). Today, posting revealing or culpable material online arguably has become another forum for signaling imperviousness to danger and repercussions.

The issue of privacy has generated considerable concern in social network sites. People give away personal identification and publish intimate and revealing stories about themselves (Barnes, 2006; Gross, Acquisti, & Heinz III, 2005). They may do so for several possible reasons. Some may think of the site as a closed and safe world, where only the small audience of their friends will look at their profile. Some may seek attention and find publishing controversial and provocative material to be an effective means of gaining quick fame (or infamy). In some cases, the users whose

profiles feature self-portraits with bongs and tales of ripping off the boss may be unaware of the potential consequences. Others, however, may be quite aware—and be signaling lack of concern. They may be indicating that their future is so secure that no social network site indiscretion would jeopardize it, or they may be showing their alienation from the sort of future where discretion is needed. For such users, the risk itself is the benefit.

Research Implications

Signaling theory provides a framework for researchers to formulate new hypotheses about the communicative function of behavior. It suggests new avenues of investigation: For example, if frequent profile updating is hypothesized to signal status, then an interesting study would be to examine whether frequent updaters are more influential. The signaling model can also suggest ways of communicating concerns about the behavior. If reducing risky activity is the goal, distinguishing among different possible motivations is needed to counteract them. In the example of users posting overly revealing information, learning about the consequences can alter the behavior of those users who were simply unaware of the danger (Lenhart & Madden, 2007b). However, if courting risks is done to signal imperviousness to danger, exhortations from others to be careful are counterproductive, in that raising perception of the act as risky increases its value as a signal of daring (Donath, in press). In such situations, making the behavior seem foolish rather than dangerous can be a better approach.

Understanding which costs have communicative value is important for designers. Efficiency and ease of use are common design goals. Yet if a design eliminates costs that had functioned as signaling costs, a decrease in reliability may have an unforeseen effect. Thus with information access, if the information itself is the end (as it is with "useful" information), making access easier is beneficial. When information is used to signal status, as it is with fashion, then making access easier accelerates the race, rather than increasing efficiency (Donath, in press). Designers can use signaling theory to distinguish between useful costs that aid reliability and ones that are inefficiencies.

Supernets and Social Transformation

Will SNS-based social supernets transform society? To do so, SNSs must first flourish as a social technology, with large populations using them extensively. They must also be capable of increasing the scale of social groups. As this article has discussed, this depends on their ability to extend trust and improve trustworthiness, abilities in part determined by their design. If these conditions are met and social supernets do arise, how might they affect society?

Perhaps their greatest potential is to augment personal information flow. Before the invention of mass media, people learned new things from their acquaintances (Ong, 2002). Knowledge flowed through social networks, and the limits of a network limited the spread of knowledge. If two villages had only one person who traveled

between them, information flow between the two communities was constrained by what that "bridge" was privy to and deemed worthy to pass on (Burt, 2000).

Until about 500 years ago, human populations were so isolated from each other that over the millennia they evolved divergent languages, cultures, and even distinct physical characteristics (Cavalli-Sforza & Cavalli-Sforza, 1995). Today, as paved roads criss-cross continents and thousands of passenger airplanes circle the globe every day, a chain of personal relationships connects every person on earth (with the exception of a few thousand isolated tribes-people in the remote Amazon; Roach, 2003) to every other person in a global social network.

The human beings who make up this global network are in some ways unchanged. They still must eat, find shelter, and acquire information. Yet how they do these things has changed. Eating no longer involves a dangerous group hunt for scarce meat, but rather a trip to the grocery store, where the perils come not in the form of fangs and claws, but as sneak attacks from stealth marketing campaigns that leave one guiltily but gluttonously checking out a cartful of junk food. Building a shelter is no longer a communal effort requiring an extensive network of close personal ties, but rather a commercial one requiring only a good relationship with a bank. Acquiring information about current events or how to do something no longer requires maintaining social ties and engaging in conversation, but instead simply watching the news or typing a query. Markets and commercial services have in many ways replaced cultivating connections.

It is perhaps ironic that at the point in history when people have the greatest ability to stay in touch with each other, they are the least dependent on personal relationships for daily survival. Modern markets make it possible to survive in social isolation and, by choice or circumstance, some people do. Yet most choose to live in a socially connected world of family, friends, co-workers, and acquaintances.

Given that people no longer have to rely on personal relationships for building their homes, obtaining their food, or acquiring information, what is it that they seek in friendship and in social ties? Certainly, people still receive material assistance and support from their friends, and being part of a close-knit network brings companionship and a sense of belonging (Wellman & Gulia, 1999). These benefits flow primarily from close relationships. What of casual acquaintances, the weaker ties that would account for many of the connections in a social supernet?

As Granovetter (1973, 1983) demonstrated, a key strength of weak ties is their ability to provide a wide range of information. Despite the ubiquity of mass media, personal networks remain an important information source. People can use their beliefs about another person's knowledge and credibility to assess new ideas that come from that source. People care about many matters that are too personal, too local, to be part of a central repository. They may care more that people they know recommend a book than about how it is generally received. By increasing the number of weak ties one can maintain, social supernets have the potential to expand their users' range of information sources, while maintaining a socially local context of personal acquaintanceship.

Seeking information from acquaintances puts information giving and seeking into the social economics of the relationship; it is an exchange of favors, of revealing needs and providing assistance. Whether as a means for bolstering status, strengthening ties, or for showing one's esoteric knowledge, people use information strategically (Burt, 1997; Paine, 1967). For social supernets to thrive and to affect society significantly, their design needs to support such strategic information sharing.

Changing Relationships

As SNSs expand, they may transform the concepts of friendship, personal acquaintance, and public celebrity. New types of relationships are already emerging within them, such as "friendsters," i.e., people known only in the context of an SNS (boyd 2006). These changes are occurring in the midst of related cultural reconfigurations, from the reduced autonomy of American youth to the increased attention to the private lives of public figures.

Twenty years ago, students might have gathered after school; today, they spend less time together in person, but stay in constant touch by instant messenger and are aware of the daily events in each other's lives through updates on their profiles. The relationships may not be markedly different from pre social technology (bullying, famously, has migrated to the online world), but they have adapted the signals they use to indicate and infer popularity, romantic interest, and social adeptness to this ubiquitously connected space (Herring, 2008). One of the consequences of these changes is that information that was once local is becoming global. The dramas of high school friendships, blind date traumas, and mundane job irritations, once hot gossip only to the immediate circle of the people involved, are now published for worldwide consumption on blogs and network sites.

News about public figures inundates culture—their homes, diets, and breakups; what they ate for dinner; and how much they drank afterwards. Once celebrities were unreachable, open for idolization and emulation, but not interaction. Today, many SNS users fill their friend lists with famous stars. Some celebrities truly engage with their fan base; others have employees or software programs standing in. The interaction constitutes the celebrity as a sort of fantasy friend. Moreover, as the software improves and the interactions become more personalized, the line between real and fictional friend becomes blurred. Is this deception—or entertainment? When is the signal's form, i.e., the appearance of friendship, sufficient and when is its implied quality, i.e., a genuine sentiment, what is really desired? (Donath, in press; Turkle, 2006)

The changes wrought by SNSs are migrating from the private world of the personal screen to the physical and public space of the city. In the 1930s, Louis Wirth (1938) wrote about the isolation of urban life, where one is alone in the midst of millions. While lonely, the isolation of the unconnected city is necessary to preserve not only privacy but also sanity: All activity would come to a halt if every rush hour commuter was obliged to greet and acknowledge everyone encountered. Yet the less guarded mores of the online world seem poised to spread to the physical world.

Mobile social network sites allow people to broadcast profiles designed to be viewed by physically proximate strangers (Jones, Grandhi, Whittaker, Chivakula & Terveen, 2004; Smith, 2005), simultaneously lessening the anonymity of the crowd and providing a buffer to the commitments of engagement.

What does it mean to be acquainted with a person? To be a friend, to have met them, to be a "friendster"? What does it mean to know someone in this world of ubiquitous awareness and mass celebrity intimacy, in a city flooded with social computing? Researchers seeking to understand the phenomenon of articulated social networks and designers creating their future incarnations need to study the evolution of social networks and base their theories and designs on the understanding that the social ecosystem is rapidly evolving and that the very purpose of connection is in flux.

The Pleasures of Social Grooming

Grooming is soothing and sensuous. Much of that hedonic quality was lost in the evolution from grooming to gossiping, although situating social interactions around meals and other sensory-rich experiences recaptures some of this. Computer-based communication, in contrast, is decidedly austere. Hunching over a keyboard and peering at a flat screen to log into an SNS is a somatically uninspiring experience. A big question about the ultimate cultural significance of these sites is whether people will use them enough for them to effect real transformation.

One significant draw of SNSs is the appeal of ceaseless novelty—of seeing blog entries, getting new comments, seeing what has changed. Perhaps the basic pleasure that social network sites provide is endless novelty in the flow of new people and new information, and the knowledge that someone is paying attention to you—social grooming for the information age.

Note

1 Dunbar estimated that apes maintain about 50 ties, while humans, in cultures ranging from tribal groups to modern institutions, maintain groups of 150 to 200 people. "The figure of 150 seems to represent the maximum number of individuals with whom we can have a genuinely social relationship" (Dunbar, 1996, p. 77). He noted that most people have an average of 10-15 intimate acquaintances and can recognize at most 2,000.

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