

## Social Networks and Social Capital: Rethinking Theory in Community Informatics

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The emergence of community informatics as a research community was a response to the practical experience of communities adapting to the rapid changes brought on by new information technologies, known outside the United States as information and communications technologies. Based on a growing empirical literature we can begin to find patterns consistent with fundamental theoretical formulations. In this article, we are concerned with the related theories of social capital and social networks as taken up in community informatics scholarship. We review these theories carefully rather than taking concepts for granted. In the end, we hope that this analysis can help usher in a new stage of community informatics research, where empirically testing theoretical propositions can be the basis for research design.

Theory in community informatics is necessary in order to give coherence to what we know about technology in communities, as well as to help to relate this knowledge to all other aspects of our social experience. In this sense, theory is needed inside community informatics as well as in relating our field to other research foci, be they social informatics or many other lines of research into the information society.

This paper relies on and contributes to three threads of scholarship: social capital, social networks, and most of all community informatics itself. Each of these threads, or bodies of literature, is a contested space where different theoretical and/or research issues are debated. We will summarize these three literatures and discover a basic question in each literature that is key to the possibility of a theoretical synthesis for community informatics. This research aims to contribute to these threads by targeting key contradictions in current theory and pointing toward a new theoretical synthesis based on empirical investigation. Three strong and complementary analyses regarding the interaction of social capital and information technology in local communities can be found in Simpson (2005), Gaved and Anderson (2006), and Anderson et al (2006). An early version of this article appeared in Williams (2005).

### Social Network Theory

Social network theory contrasts with the type of sociological theory that defines society as built up of individuals. It starts instead from the relations between individuals, and models society as constituted of networks made up of sets of the relations or ties between the nodes. Wasserman and Faust (1999, p. 4) identify four additional fundamental principles of models built using social network theory: independence of actors; relations or ties consisting in the flow or transfer of resources; the constraining and/or enabling of individual actors by networks; and the generation of long-lasting ties and networks by social structures.

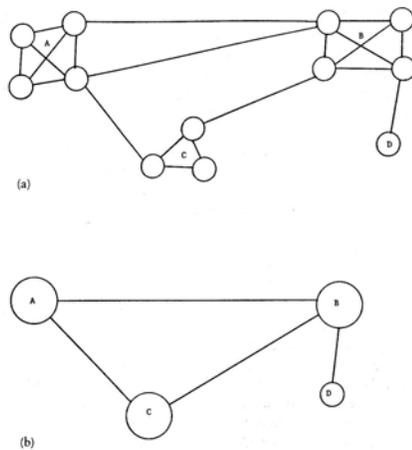
The perspective of social network analysis—which comprises both method and theory—mitigates against studying any single relationship in isolation from the network of which it is part. This is because the *dyad*, or relationship between two actors, is the building block of a network, but is itself conditioned by the network.

Across social network studies, the actors or the nodes have been variously defined as individuals, groups, companies, or even countries. The relationship or tie is a flow of resources that can be material or non-material (Wasserman & Faust 1999, p. 4). The resources might include social support, emotional support, companionship, time, information, expertise, money, business transactions, shared activity, and so on.

Wellman, Carrington, and Hall (1988) characterized social network theory not so much as competing directly with other approaches to identifying causality as

*reformulating basic questions. Thus, social network theorists have proposed, for example, substituting world systems theory for single state modernization theory, network communities for neighborhood communities, political networks for psychologistic interpretations of collective behavior, and vacancy chain analysis for individualistic analyses of social mobility. (Wellman et al., p. 48)*

In a social network, every node is not tied to every other node. This results in any given network having particular features. Clusters of densely knit areas are where many actors are tied to each other, as, for example, a family. These clusters are connected to other clusters via sparsely connected areas that form what are called bridges, as can be seen in Figure 1 (a) below. The clusters themselves may be more or less visibly bounded, or fuzzy, as in an extended family where you might (or might not) include ex-spouses and fiancés.



**Figure 1. Networks as ties between people, illustrated in (a) below, or as ties between clusters of people, as in organizations, illustrated in (b) below. From Figure 2.4, Wellman and Berkowitz, 1988, p. 45.**

Resources shared across ties are generally finite, and therefore scarce. As a result, the property of hierarchy enters an otherwise neutral network structure. In this context hierarchy describes the fact that some nodes are at the center of a network and others are less connected and peripheral. Because resource flow generally attenuates as it travels from node to node, an actor's position—as a bridge, or near a bridge, at the edge of a cluster or at the center of a cluster, influences his or her access to resources.

In addition to hierarchy, two other characteristics of social networks will inform the analysis in this paper: transitivity and homophily. Transitivity means that if A is tied to B, and A is tied to C, it is likely that B is tied to C. Granovetter's work (1973, 1983, 1974/1995) on weak ties, to be discussed below, follows from this principle. Homophily reflects that a person's ties tend to be with people like them. So our personal networks tend to be homogeneous and defined by the following characteristics, in ascending order: gender, occupation, education, religion, age, and most of all race and ethnicity (McPherson, Smith-Lovin, & Cook, 2001).

Finally, two overarching approaches characterize social network analysis. Whole network analysis looks at the network from the outside, with all the data that one chooses to collect on each tie and each node. Personal or egocentric network analysis looks at the network from the inside, with all the data that one chooses to collect on one node (also called *ego*) and its ties (*alters*).

### *Personal networks*

Wellman's studies of personal networks in East York, Canada, exemplify this egocentric network approach (Wellman, 1979; Wellman & Leighton, 1979; Wellman et al., 1988; Wellman & Wortley, 1990; Wellman & Hogan 2006). Wellman and his research team collected data on the personal ties of residents of a working-to-middle class Toronto locale. In 1968 these researchers surveyed 845 people about their six closest relationships and analyzed these partial personal networks. In 1978 they interviewed and surveyed 33 people about their current ties, focusing in their analysis on the reported 403 *significant* ties. The research started from a network concept of community, defining community as a set of relationships between people.

Wellman asked: what is community in a "large scale division of labor"—an industrialized metropolis, a so-called mass society? Is community lost, saved, or liberated? Lost would mean that individuals are not connected to each other and depend on bureaucratic resources for help. Saved would mean that people still live in solidarities—the densely knit and geographically bounded networks seen as typical of small settlements and preindustrial societies. Liberated would mean that people are neither embedded in solidarities nor alienated, but instead choose their own communities.

In the analysis, East Yorkers' communities were either lost, saved, or liberated, generally according to their position in the division of labor. Unemployed men and skilled tradesmen lived in *community lost* (they were self-sufficient or fended for themselves); people near kin or in workplaces that encouraged collegiality lived in

*community saved*, and people climbing an occupational ladder lived in *community liberated*.

It is important to note that even those living in community lost, without social ties, were likely to get their needs met. Unless they meet their own needs, like the skilled carpenter who repairs his own home, they likely use what community studies (e.g. Gans, 1962/1982) called *formal bureaucracies*. Bureaucracy is a form of organization that is, for the purpose of most community studies, tie-free. An individual with no personal ties can still get resources from any number of institutions: banks, supermarkets, psychiatric clinics, real estate agencies, welfare departments, schools, libraries, public transit systems, and so on—although often money is required.

Altogether, East Yorkers' ties were to kin, family, neighbors, co-workers, and (in the case of a very few) to fellow members of voluntary or civic organizations. Graphic depictions of personal networks, as in Figure 2 below, were a part of Wellman's analysis. The majority of the ties were within metropolitan Toronto but outside of a one-mile radius of home; transportation and communications technology had loosened (but not separated) people from their immediate neighborhoods. (Homemakers were most likely to have neighborhood ties.) Face-to-face and phone were the most typical modes of contact, and different contexts served for different ties, rather than a collective setting bringing many ties together. The ties were long-lived, with only one-quarter less than 10 years in duration. Four-fifths of the ties were transitive and embedded—in other words, a vast majority of East Yorkers' ties were also tied to each other. The content of the ties—the resources shared—were sometimes multidimensional and sometimes focused, but generally consisted of companionship, emotional support, and small-scale services. Specialized information emerged (but infrequently) as tie content: for example, two people were involved in community organizations, an animal rights activist and the mother of a child with a health condition.

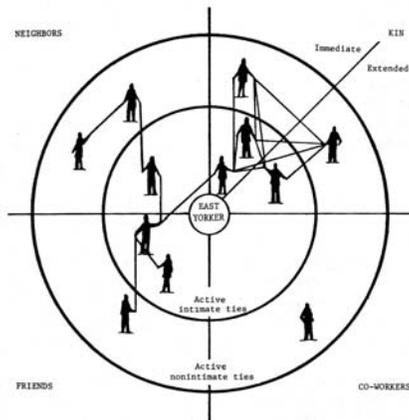


Figure 2. Typical personal network of an East Yorker. From Figure 2.3, Wellman and Berkowitz, 1988, p. 27.

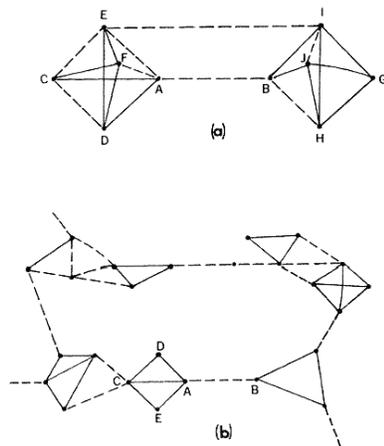
Summing up, Wellman et al. note, "We have not found communities in the traditional sense. But we have found networks, and they seem to have satisfied most East Yorkers." (Wellman et al., 1988, p. 176) In this particular metropolis, the significant ties of people did not conform to a small, geographically bounded community. As we shall see, this finding, generally thought to be true across most metropolitan areas, complicate attempts to identify strong and weak ties.

### *The strength of weak ties*

Social network theorist Granovetter (1973, 1974/1995) examined the process of getting a job. He asked how people find out about the jobs they take. He examined the tie between the jobseeker and the person who supplied the information that led to the job. (The jobseekers were all professional, technical, or managerial workers residing in a particular suburb of Boston.) His is also a study of personal networks rather than whole networks, and focused solely on personal ties that provide information leading to a job that is actually taken. As such, it is an example of activity-specific network analysis, the activity being jobseeking.

Some respondents used bureaucratic structures to answer their needs: job agencies and classified ads. But most of the 54 people interviewed relied on their informal networks. One of Granovetter's findings was that study subjects tended to hear of the jobs they took from people who were their weak ties. Looking more specifically, the informal social contacts that led to a job were skewed towards being weak ties rather than strong (Granovetter, 1973, p. 1371): 16.7% of the contacts the jobseeker sees twice a week or more often; 55.6% of the contacts he sees less than twice a week but more than once a year; and 27.8% of the contacts he sees once a year or less often. Granovetter proposed a model that built on the principle of transitivity described above: if A is connected to B and A is connected to C, then likely B is connected to C. Furthermore, Granovetter noted that if the two ties A-B and A-C were strong, then B

had to be tied to C, either strongly or weakly. As a result, in his model all local bridges were necessarily weak ties. Figure 3 below illustrates this rule and makes the point that some bridges are more important or critical than others. In Figure 3, (b) shows a bridge, a weak tie between A and B, that is more important or critical than the A-B bridge in (a). Consider how much further C and D are from B without the bridge.



**Figure 3. Examples of bridges between A and B. Strong ties are solid lines; weak ties are dotted lines. In both (a) and (b), A to B is a weak tie and a bridge, but in (b), A to B is of greater importance, as the alternative paths from A to B are much longer. From Figure 2, Granovetter, 1973, p. 1365.**

Information about a job is new information, so Granovetter hypothesized that new information comes via weak ties, those that are local bridges in particular, and titled his 1973 paper, "The Strength of Weak Ties." In other words, weak ties are strong (that is, effective) when it comes to job lead information. In addition, the information paths between the jobseeker and the hiring person were found to be short (Granovetter, p. 1372): 39.1% were just one tie long (the jobseeker heard about the job from the person hiring); 45.3% were two ties long (the jobseeker heard about the job from someone who was tied to the person hiring); and 3.1% were more than two ties long. As we discussed above regarding the attenuation of resource flow along ties, information leading to a job appears not to travel very far. This suggests that if a person depended only on a densely knit strong-tie network, that person would be insulated from information that would lead to a job.

Granovetter reasoned that job lead information from a person's strong ties might be the same as his or her own job lead information, since a person communicates with strong ties more often, and thus a person might not use them. Or, he reasoned, people might avoid querying their strong ties about a job unless they had to, so as not to strain the relationship.

Referring to prior theory as did Wellman, Granovetter (1983) examined strong ties between people, believed to result in local cohesion, and weak ties, believed to result in alienation. (As he defined them beyond his original Massachusetts study, ties are weak or strong based on time spent together, emotional intensity, intimacy, and reciprocal services.) He theorized that strong ties by themselves generate fragmentation, as subgroups in a community become isolated from each other, and weak ties allow for community integration, connecting these subgroups. The event he studied, the sharing of information regarding job openings, is an example of the integration process.

#### *Where weak ties are not strong*

Many studies have cited Granovetter's Strength of Weak Ties study; among them several that Granovetter later discussed as part of an ongoing dialogue within the field (Langlois, 1977; Ericksen & Yancey, 1980; Lin et al., 1981; Murray et al., 1981; Boomran, 1975; cited in Granovetter, 1983). A 2005 search on ISI Web of Science identified 1,668 such articles; a search of Proquest's Digital Dissertations database, 111 abstracts mentioning Granovetter or weak ties.

But other research evidence did not completely support Granovetter's theory. To cite just a few studies, various groups were found to tend to rely on strong rather than weak ties for job leads (Murray et al., 1981; Ericksen & Yancey, 1980; and Langlois, 1977; all cited in Granovetter, 1983; Brenes, 1983; Watanabe, 1987; Triegaardt, 1992; and Longjohn, 2001). These groups included newly minted PhDs, less well-educated Philadelphians, non-managerial Quebec government workers, clerical finance/insurance/real estate workers, Japanese workers, laid-off South African workers, and workers with mental retardation. These results were not explained away by the fact that studies defined a weak tie in different ways, for example, as someone with whom an actor is in less frequent contact, or as a non-kin, non-friend relationship.

Results testing the Strength of Weak Ties theory in domains other than that of job lead

information are also mixed. Of the 60 dissertation abstracts (extracted from Proquest Digital Dissertations in 2005) that described their findings in testing the theory, 45% confirmed Granovetter, 37% found that both strong and weak ties play a role, and 17% found that strong ties were preferred or preferable in achieving goals. This is summarized in Table 1 below.

	%	N
Confirm theory, weak ties are more effective than strong ties	45%	27
Reject theory, both strong and weak ties play a role	37%	22
Reject theory, strong ties are more effective than weak	17%	10
No clear results as to Strength of Weak Ties theory	2%	1
Total	100%	60

**Table 1. Findings of 60 dissertation abstracts which report tests of Granovetter's Strength of Weak Ties theory (Williams 2005 p 32).**

Certain findings are generally accepted. When it comes to personal contacts for job leads, higher-status or higher-skilled jobs tend to use weak ties while lower-status or lower-skilled jobs use strong ties. This could be out of urgency, as when a person is out of work and his or her family and friends help resolve the crisis. Or it could be because in lower-status jobs employers prefer to hire through an ethnic or other solidary group, because current workers can vouch for, train, and even discipline new hires. Generally, people use strong ties for emergencies, for emotional support, or when they do not have weak ties (Wasserman & Faust, 1994/1999).

Disadvantaged people are often found to be *encapsulated* without weak ties outside their community, ties that could provide new information or new resources. The focus of such people, the reasoning goes, is on basic needs and emergencies, which require maintenance of strong ties (Lin, 2001). Another explanation for the focus on strong ties is that society has a pyramidal structure, and towards the bottom it is not as easy to access people not like you—weak ties (Lin, 2001). As we have seen with Wellman, however, the personal nature of community makes it unclear whether we can characterize a geographic community by the personal networks of a sampling of its residents.

Context is a particular lesson here. Granovetter studied dyads without looking at the personal networks of the jobseekers. What might he have missed? An exchange between social network theorist Granovetter and ethnographer Herbert Gans (Gans 1974a, 1974b; Granovetter 1974) is instructive here. Granovetter (1973) had generalized from his jobseeker study and commented on Gans' (1962/1982) study of residents of Boston's West End, which was demolished in the late 50s without significant local mobilization. Granovetter argued that the lack of successful protest was the result of the absence of weak ties across the community. Gans replied that weak ties were necessary but not sufficient. He enumerated six contextual issues that he felt needed to be considered along with social network analysis: at the time there was no precedent for fighting urban renewal; residents did not get information in time; there was a lack of trust or informal contacts with politicians, and no single politician for area; there was no cultural tradition of protesting, and leader of protests was an oddball; settlement houses and Catholic church were pro-renewal; and The West End was not one single community, but several neighborhoods. While many of these factors can be restated in social network terms, it is important to see that even the whole network approach Granovetter takes in the debate with Gans, looking at cliques and the absence of ties between them, could be incomplete, let alone the dyad approach that he took in his own study.

At the same time, the discussion between the two scholars helped to replace an old paradigm (strong ties as key and weak ties as a drift into individual alienation) with a new paradigm: weak ties make a society whole. Furthermore, later work rooted in social network theory found that weak ties strengthen a community *over time*, by their very persistence.

In sum: The social network literature examines social phenomena as activity across a network of actors with various ties between them. Granovetter (1973) asserted that weak ties were strong; in other words, as his data indicated, they were the dominant source of new information—information that led to a new job. Scholars have since explored the comparative roles of strong and weak ties. These roles are not completely understood, particularly in disadvantaged settings, and they are explored by the community informatics studies we will review. The fundamental question is how do our social networks help us initiate and sustain social activity. This applies to community informatics as well as to social life in general.

### **Social capital**

The literature of social capital is distinct from, but convergent with, social network theory. This section will review the work of James Coleman, Robert Putnam, and Nan Lin to demonstrate how this is so, and will arrive at a continuing question in the social capital literature concerning bonding and bridging social capital, a question taken up in the community informatics studies we review.

### *Social capital to explain group behavior*

Coleman (1988) advanced social capital as a conceptual tool for resolving two conflicting theories on how microstructures in society generate macrostructures. One theory, typically sociological, held that the actions of people are governed by norms, rules and obligations; the other, usually from the point of view of economics, held that people are independent and self-interested and act to maximize their own utility. The first theory erased agency; the latter did not allow for social or collective organization. Social capital, Coleman felt, would put economic rationality into a social context.

Echoing social network theory, Coleman identified social capital as something inherent in the structure of relations between actors. His examples were of the trust that is possible within a stable set of people: among diamond merchants based on family and religious ties; among members of secret cells in the Korean student movement based on common hometown or school or church; and among merchants in an Egyptian market based on family ties and business longevity. He pointed up two features of social capital. The first was *multiplexity*, where two actors have multiple dimensions to their relationship, as in the case of two friends who attend the same church and whose children attend the same school. Closure was the second, where everyone in a set of people knows at least two other people in that set and therefore has recourse to sanctions against any other person in the group.

Looking for empirical evidence of family social capital, he analyzed data on school dropouts. The data revealed that children in smaller, *intact* (that is, two-parent) families, where the mother expects children to attend college, evidence a lower dropout rate. He explained this as the children benefiting from a larger measure of social capital from their parents, social capital that expresses itself as attention and support. Coleman also measured lower dropout rates among children at parochial schools, and ascribed this to increased social capital represented in their ties to parents, classmates, and teachers. The actors in this close-knit setting would be expected to have both multiplex ties and closure.

Coleman's descriptions are generally of social capital via strong ties, and the two features he describes map to strong ties: multiplexing has its analogue in the social network literature where Wellman discusses multistranded ties, and the concept of closure echoes the concept of densely knit social networks. In conclusion, Coleman warns that family and community ties seem to be weakening, so that in the future we will rely more on formal organizations than on informal networks, echoing community lost sentiments of social network theorists and presaging the work of Putnam.

### *Social capital to maintain the fabric of civil society*

Putnam (1995, 2000) examines social capital via a focus on the relationship between democracy and civil society. As did Coleman, Putnam formulates a definition of social capital that relies on social networks: "connections among individuals—social networks and the norms of reciprocity and trustworthiness that arise from them." (2000, p. 19) Putnam argues that social capital is declining in the U.S., on the basis of three indicators for which he reports a great deal of survey data: fewer people are members or active in civic associations and organizations; families spend less time together; and neighborliness and socializing with neighbors is down. He covers both bonding and bridging social capital and makes an important point: "In short, bonding and bridging are not 'either-or' categories into which social networks can be neatly divided, but 'more or less' dimensions along which we can compare different forms of social capital." (2000, p. 23)

This helps to explain Gans' urban villagers: people in strong-tie networks based in microneighborhoods composed of a few blocks each, and very few weak or bridging ties holding the larger West End together. It also helps us reconcile the varying definitions of weak ties and strong ties. The two types of ties are relative, not absolute, and depend on scale. For Wellman and many others, strong ties were kin and friends, weak ties were acquaintances and co-workers. The community he looked for and did not find was East York; what he found were personal networks ranging for the most part across metropolitan Toronto, on the basis of the phone, transportation, and work and home mobility. For Granovetter, strong ties were "see twice a week or more" and weak were "see once a year or less."

### *Social capital to obtain resources*

Putnam's book (2000) was very much taken up by the media, policymakers, and scholars, some of whom took issue with it. Lin (2001) catalogs those who have refuted Putnam for his method. He himself takes a different approach, both theoretical and empirical: first laying out a theory of social capital which is more precise than Putnam's usage, and then concluding with a look at new information technologies, more specifically, cybernetworks, as an explosion of social capital.

Lin (2001) discusses social capital against a background: capital (Marx 1887/1938), human capital (Schultz, 1961; Becker, 1964), and cultural capital (Bourdieu & Passeron, 1970/1990). He defines social capital so as to be measurable, not confounded with its effects, and explicitly based on social network theory: "resources embedded in social networks that can be mobilized when an actor wishes to increase the likelihood of success in a purposive action." (Lin, p. 24) He identifies four

controversies within the social capital literature and gives his answers. First, is social capital a collective or an individual asset? It can be seen as both, he says, but you cannot mix it up with trust or norms, which are collective assets only. Thus Lin comments: "Divorced from its roots in individual interaction and networking, social capital becomes just another trendy term to employ or deploy in the broad context of improving or building social integration and solidarity." (Lin, p. 26)

Second, Lin asks if social capital arises from closure or from open networks. He credits Granovetter (1973) with establishing that weak ties bring resources too, and summarizes what is generally accepted, though not always proven: dense networks, or bonding ties, help preserve or maintain resources and are activated by expressive action, while bridging ties help with searching for and obtaining resources and are activated by instrumental ties. Third, does social capital include all social structural resources that generate returns? Not according to Lin, or the researcher risks definitional fuzziness where the cause and the effect are the same. Fourth, is social capital measurable? Yes, and Lin briefly discusses two classes of measuring instruments.

Lin lays out a seven-part theory of social capital with three assumptions upon which this theory is based. First, the assumptions (Lin, 2001, pp. 56–58):

Society is hierarchical and pyramidal with respect to resources: there is a top and a bottom, and the top is smaller than the bottom. Different resources show identical or similar pyramids.

Interactions are more likely at a similar or identical level in the pyramid.

Two driving forces are the maintaining of resources and the gaining of better resources. For the former, expressive action is the means and the end, it is stabilizing, and it tends to take place between homophilous ties (that is, ties between two people who are alike in some way). For the latter, instrumental action is the means (and not the end), and rather than stabilizing it aims at change, and tends to take place between heterophilous ties.

Lin's seven propositions follow (Lin, pp. 59–73):

1. Social capital pays a return—improves an actor's outcomes—and is therefore worth investing. Accessing social capital is a function of one's position in the hierarchy, the nature of the tie, and the location in a network.
2. Strength of position: higher in the hierarchy means better social capital.
3. Strength of strong tie: strong ties serve better for expressive action.
4. Strength of weak tie: weak ties serve better for instrumental action.
5. Strength of location: closer to a bridge is better for instrumental action.
6. Position, tie and location all interact; thus the resource differential across a bridge influences the strength of the location near a bridge.
7. Structural contingency: at the top of a pyramid, there is not much further to go, so instrumental action is not as worthwhile. At the bottom of a pyramid, there are so many people and so many homophilous ties that instrumental action is not as possible. The middle of the pyramid is where social capital can best serve for instrumental action.

With this as his operating framework, Lin then uses the data on growing Internet use worldwide, together with a case study of the Falung Gong movement, to argue, "There is clear evidence that social capital has been on the ascent in the past decade: in the form of networks in cyberspace." (2001, p. 211) He further points out that those not online are at an ever-greater disadvantage, cut off from this explosion in social networks and social capital.

The concepts of bonding and bridging social capital refer to a community's capacity for accessing resources within itself (bonding) or outside itself (bridging). Under-resourced communities are said to depend on bridging social capital (Putnam, 2000) similar to strong and weak ties (Wellman & Berkowitz, 1988); yet it has also been asserted that social networks entirely within these communities muster valuable resources and demonstrate a level of self-sufficiency. This is particularly true for social change, as studies of the U.S. civil rights movement have demonstrated (Morris, 1984). Others have theorized that such communities mobilize both bonding and bridging social capital (Orr, 1999). Again, we arrive at a basic question: Where, when, and how does a community rely on bonding social capital and, similarly, on bridging social capital?

### **Community informatics**

As previously stated, community informatics emerged as a field of research in search of theory. In our analysis above, it is clear that rich theoretical content is available in the related theoretical frameworks of social networks and social capital. How do the relationships between people serve as the basis of social life? How do our social relationships differ in importance? These theoretical questions are central to understanding technology in communities. Specifically, the issue can be broken down

as how a community starts to use information technology for its purposes, and how it sustains that use. What social networks are important? What kind of social capital?

In the following section we will describe the nature and origins of community informatics and then analyze the research literature that is beginning to coalesce around the theoretical foci of social networks and social capital. The purpose of this section is to elucidate what scholars of community informatics have suggested about the relationship between social capital/social networks and community technology, and to point up an opportunity for further inquiry, an opportunity that the study seizes upon. The section will first define community informatics, and then discuss the roots of community informatics, the main ideas, and those studies in community informatics that use the concepts of social capital and social networks.

### *What is community informatics?*

Community informatics is a field both of study and of practice, although the concern here is primarily with the former. As a new field, it is variously defined, but Loader has described it as navigating the interaction between *transformation* as expressed in information technology or IT, and *continuity* as expressed in a local, historical community (Loader et al., 2000; cited in Keeble & Loader 2001, p. 4). This is a specification or subset of the field of social informatics: “the interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts.” (Kling, 1999) The case study is perhaps the predominant research method to date, with scholars often engaged alongside practitioners as designers of community technology.

Where social informatics historically has most often concerned itself with organizational settings, particularly business and government, community informatics looks at a third terrain of social activity, the community. The concept of community and the tensions within that concept when contextualized in the nascent information society form the core ideas of community informatics. The challenge of defining and explaining community is not a new one. With the last major wave of U.S. migration from country to city, the fate of community within the metropolis occupied a generation of scholars, who themselves referenced the scholarship of those who had earlier grappled with the migration to cities during Europe’s industrialization (e.g., Tönnies, 1887/1957). Community is variously defined in the social sciences and has been examined in many of its guises in community informatics literature. It may refer to a population living within certain geographic boundaries (local community). This definition is bolstered by the fact that planning and the flow of funds are channeled according to those boundaries and political battles are often fought within these jurisdictions. Especially early on, various cities implemented community IT projects (for a comparison of four cities, see Guthrie & Dutton, 1992).

But there are communities within these local communities, as for instance the communities of interest that contended—the homeless and their allies, and local business and real estate interests—within Santa Monica’s Public Electronic Network (Rogers, Collins-Jarvis, & Schmitz, 1994). Furthermore, there are communities that do not share a geographic locale, most dramatically the diasporic communities that have taken to the Internet to maintain close ties with people far away, for example Trinidadians (Miller & Slater, 2000). From these examples it is evident that community may refer to people with a shared identity. It may refer to people with a shared interest or activity (communities of interest, communities of practice), as for instance the work of Bishop, Mehra, and Smith (2001) on a community IT tool for African American women working on health issues. It may also refer to a gathering of people in cyberspace according to shared geography, identity, or interest; Rheingold’s two books on computer networks (1993) and on cell phone networks (2002), respectively, come to mind. Wellman (2002) has more recently advanced the concept of networked individualism, whereby every individual and his or her ties represent a distinct personal community, more or less place based. Benjamin (2001) used a recursive definition of community—“people living in a geospatial area who define themselves as part of a community”—in order to analyze why some telecenters succeeded and others failed to attract local involvement. This definition has a history in ethnography and acknowledges that communities are quite often self-identified or socially identified.

There are tensions and overlaps between these various communities. The field of community informatics, by looking at the interaction between transformation and continuity, between digital technologies and community, is building up a picture of what community looks like and how it is evolving as we move from the industrial to the information age. Below we will review those community informatics studies that make use of the concepts of social capital and social network and present one way to make sense of the apparently disparate case studies that are all grappling with the same interaction.

It is worth mentioning that, for scholars in community informatics, the scaffolding of the field features two particular processes that have contributed to the drawing together of English-speaking scholars via conferences, proceedings volumes and at least one journal. The first of these two processes is the series of seven Dimensions in Advanced Computing (DIAC) conferences sponsored by Computer Programmers (later Professionals) for Social Responsibility since 1987; this has generated both proceedings volumes and edited books (most recently, Day & Schuler, 2003; Schuler & Day, 2004; and Schuler, in press). The organizer, Douglas Schuler, is a cofounder of Seattle Community Network, has launched and operates an undergraduate program in community informatics, and authored *New Community Networks: Wired for Change*

(1996). The second process has been anchored in Teesside, England, where Brian Loader and others have generated a flow of authored or edited work (Loader, 1997, 1998; Loader & Hague, 1999; Loader & Thomas, 2000; Keeble & Loader, 2001; Loader & Dutton, 2002; Loader, van de Donk, Nixon, & Rucht, 2003; Loader & Keeble, 2004), at least one conference, and the quarterly journal *Information, Communication and Society* (since 1998), all while guiding several community IT projects.

Other contributions towards building the field include (1) the work of Gurstein (2000) defining community informatics and bringing particular attention to work in Australia and Canada, (2) conferences organized by him and others from England, Australia, and the U.S. via the Community Informatics Research Network, and (3) the somewhat more broad but still highly useful conferences of the Association for Internet Research (annual since 2000) and the journals *First Monday* (launched 1996), *The Information Society* (1981), and *New Media and Society* (1999), and most recently the *Journal of Community Informatics* (2004).

### *The roots of community informatics*

It is possible to identify four important social trends that gave rise to community informatics, and these have their reflection in the field's still-coalescing literature. These four trends are listed below, and they each have generated scholarly work that forms a foundation for community informatics, as we shall see: change in social structure: the network society changing, and even threatening, local communities; change in culture: the hacker ethic; changes in libraries: the community information systems; and change in social inequality: the digital divide.

The network society is changing and even threatening local communities. Today we have a society characterized by networks rather than organizations, flexible production with a flexible workforce, with an economy that is globally coordinated in real (or chosen, as with e-mail) time. A new space has been identified that contrasts with the space of place (geographic communities): the space of flows, that is, the sum total of all the communications and transportations flows that link the global, mobile network of human networks (Castells, 1996). The world's economies (east and west) took up digital technologies even as they experienced the economic crises of the 1960s and 70s; what has resulted is spaces of place that are threatened, because they are mostly bypassed, by the space of flows. In the industrialized countries, one can think of the U.S. Rust Belt or vast stretches of the North of England as thus threatened. Other spaces of place, such as Silicon Valley, California, have certainly been transformed, and yet even there the space of flows has left toxic dumps with which the space of place has to cope. As has been mentioned, local governments have responded with digital initiatives of their own. For example, in the early 1990s Santa Monica, California, made available to its residents free online discussion lists, accessible in public libraries or from home, and access to city officials (Rogers et al., 1994). Some years later Lagrange, Georgia, offered its entire population free cable Internet (Youtie, Shapira, and Laudeman, 2002).

An early reflection in academia of this space of place-space of flows, or network-communities, conflict was a 1996 colloquium that arose from a dialogue between two mutually exclusive groups in urban planning at MIT, one focused on opportunities for new technologies and the other on low-income communities. A record of this colloquium, which opened with a presentation by Manuel Castells, was published as *High Technology and Low-Income Communities* (Schön, Sanyal, & Mitchell, 1999). It discusses, but does not name, community informatics.

The hacker ethic is what Himanen (2001) calls "the spirit of the information age." He has defined the hacker ethic as the practice of building computers and writing code for the fun of it, for the creativity of it, and for the community-building. This ethic expressed itself in the origins of the personal computer in the milieu of the Homebrew Computer Club and in the production of Linux and other such software. It also expressed itself in projects where hackers joined up with others to produce such tools as the volunteer projects that built on PLATO, where by 1972 hackers and teachers were writing online courses for all levels of students (Woolley, 1994); Berkeley Community Memory, the networked public terminals installed in 1973 to provide an online bulletin board for all passersby (Felsenstein & Aboba, 1994); community technology centers (CTCs) such as *Playing to Win*, opened in 1983 by a math teacher in a Harlem housing project (Stone, 1996); and *freenets* or community networks (CNs) such as the Cleveland Free-net, which began life in 1984 as St. Silicon's Hospital and Information Dispensary, an online communications tool for doctors and patients (Bluming, n.d.). CNs and CTCs each developed into international movements, with associations, publications, and annual conferences for practitioners. Community technology projects emerged out of the grassroots—as in inner-city Toledo, Ohio (Alkalimat & Williams, 2001) and inner-city Wilmington, North Carolina (Mele, 1999)—and blossomed in both virtual and actual space.

Community information systems in public libraries came into being in the 1970s, when urban communities in crisis needed places for local information concerning where to find food, health care, housing, civil rights, legal aid assistance, and other local services that were available. In response, librarians began to build community information files as an appropriate extension of their local holdings. (Durrance, 1984) These files were collections of flyers, booklets, and directories to help people in need. When card catalogues were converted into online databases, in many cases the community information was as well. When these online databases became Web-accessible, in many cases these community information files followed suit, especially where links had been built between CNs and local libraries. In some cases libraries took over the operations of CNs, extending their activity from collecting

information for the everyday needs of individuals and communities to facilitating the creation of such information (Durrance & Pettigrew, 2002; Durrance, Souden, Walker & Fisher 2005). A library school professor at the University of Michigan helped shepherd the Association for Community Networking into existence; she organized her students into newsletter editors and eventually archivists for the movement, establishing the Community Connector (Durrance, 1994), an online resource for this movement. Today library or information schools are important sites in the US for community informatics teaching, research, and service.

The fourth and final social trend that created a foundation for community informatics was the discourse and the activity around the concept of the digital divide. As has been said, this concept emerged as a gap between those who access and use computers and the internet and those who do not. In the United States, the Department of Commerce was an early catalyst for both research and policy on this issue, launching a series of survey reports on the access and use by individuals of computers and later the Internet, and annual rounds of grantmaking (TIAAP, later the Technology Opportunities Program, or TOP) to communities and local organizations to support community IT projects. This federal initiative was rooted in the economic imperative to develop a market for computers and for e-business and to develop a skilled workforce via education and public provision of IT. Experiments such as TOP (Williams, 2006) were echoed by private and other public funders, including technology companies and even the National Science Foundation, which helped Playing to Win launch the now-nationwide Community Technology Centers Network. One could certainly say that the dot-com technology bubble fueled the digital divide discourse in the U.S., with corporations taking on local and national projects. All these influences created a big tent for study and practice regarding the phenomenon of stratification in information technology access and use.

These four trends continue to influence and interweave with each other, and are reflected in a literature that emanates from many disciplines. They express the shifting definitions of community in community informatics and are examples of how transformation and continuity express themselves in these variously defined communities.

### **Community informatics and social capital/social network theory**

Social capital and social networks are the two theories that we are using to sift through community informatics scholarship and explore the question of community as it intersects with technology. O'Neil (2002) reviewed more than 30 studies of community technology and social capital emerged as one of the top three conceptual frameworks for evaluating such projects. Our search of the literature identified a group of scholarly studies, sometimes reported in more than one journal article, that make use of the concepts of either social networks or social capital. A number of them also use the Strength of Weak Ties theory.

This section will summarize these studies and what they suggest about the relationship between social networks (or social capital) and community technology, what they imply for future research. Each of the studies looks at the relationship between technology and community, conceptualizing community either in terms of social networks or social capital, sometimes using the language of both. The analysis is strong on description and narrative, but has not been thoroughly synthesized by equally strong work on general concepts and theory. Our objective is to construct a framework that will help explain theoretically this diverse empirical literature.

Each study defines community technology practically, empirically, as the particular technology project under study. These include:

1. Virtual communities, often called community networks (CNs), which are facilities in cyberspace using a website or other tools people can use once they get online.
2. Telecenters, also called community technology centers (CTCs), which are physical facilities equipped and staffed (often with volunteers) where people can use and learn computers and the internet, usually for free.
3. Cybercafés, much like telecenters, but more often for profit, charging fees, and perhaps providing some food with its PCs.
4. High-speed connections in local homes and a local community listserv.

The most elaborate instance of community technology in this review of studies is Blacksburg Electronic Village, which supported electronic discussion lists, gave grants for people to develop Web sites, provided server space, tech support, and high-speed public Internet access points. Williams (2005) studied IT use by community groups, where the technology use developed organically from group goals rather than arriving in the community as one project. But in general, all these studies are either of virtual tools (CNs), physical tools (telecenters/CTCs/cybercafés), or some combination of both delivered to the community. Hence it is possible to call them community technology.

It must be said that our review of the studies of technology in local communities and social capital/social networks relies on a particular conceptualization of the relationship between technology and society. Although in everyday language we are accustomed to speaking of the social impact of technology, technology does not itself cause social change. Rather, any particular technology—itsself a social product

—generates social affordances (Gibson, 1977; Norman, 1988). These affordances allow for certain possibilities and not others. Social forces then interact with the technology, often combining it with old technologies still in place. The results may reflect what designers intended, or what was neither expected nor intended (Merton, 1976; Tenner, 1996). In a social setting of relative stability and consensus, a technology may be adopted as intended; in a more typical social setting, characterized by social differences and conflicts that may themselves overlap, the results may be more surprising (Kling, 1980). Therefore, society shapes technology; technology also shapes society (MacKenzie & Wajcman, 1985; Bijker, Hughes, & Pinch, 1987).

The cases in these studies either focus on community technology shaping social networks/social capital or social networks/social capital shaping community technology, or a combination of the two processes. In the following pages, we will review them according to this categorization, summarize their findings with regard to strong and weak ties, and draw a framework by taking all the studies together. For clarity, the studies are listed at the start of each of the three sections in which they are discussed. (A table detailing each study is available from the first author.)

### *Does community technology shape social networks/social capital?*

The following studies examine the effect of community technology on either social networks or social capital: Kavanaugh, 1999; Kavanaugh & Patterson, 2001; Blanchard & Horan, 2000; Hampton & Wellman, 2000; Hampton, 2003; Hampton & Wellman, 2003; Tonn, Zambrano, & Moore, 2001; Ferlander & Timms, 2001; Ferlander, 2002; Ferlander, 2003; Kvasny, 2002; Meredyth, Hopkins, Ewing, & Thomas, 2002; Clark, 2003; Pinkett, 2003; and Pinkett & O'Bryant, 2003. All but two of the studies find that community technology does indeed contribute to social capital/social networks. Of those that explore weak ties and strong ties, only strong ties are augmented in one instance, in an Australian housing estate (what the U.S. calls a public housing project); only weak ties are augmented in two instances, in a Denver youth-serving telecenter and at the end of the Netville project in a Toronto suburb; and both kinds of ties are augmented in three instances, in a Stockholm cybercafé, at an earlier stage in the Netville project, and in Blacksburg, Virginia (where weak were augmented more than strong). An additional complexity is that each study defines strong and weak ties somewhat differently. These definitions are detailed below and in Table 2, also below.

In large part these are case studies, together representing fewer than 50 instances of community technology. Judging from Williams (2003), which used an empirical count in one city (Williams & Alkalimat, 2004) to estimate a total of 85,000 to 114,000 U.S. public computing sites, these 25 represent a tiny fraction of all the community technology projects in the world. Nevertheless, what exactly did they find?

Kavanaugh (1999; also in Kavanaugh & Patterson, 1998) asked, What is the relationship between computer networks, social networks, and civic engagement? Working in a small affluent U.S. city, Kavanaugh interviewed 10 people, each of whom was a member of a social network that had an online presence (Kavanaugh, p. 6) by means of the Blacksburg Electronic Village (BEV), and found that the information technology, especially e-mail and listservs, reinforced and extended social networks. Using the Internet to garner resources suggested that it was weak ties social networks, but data from seniors demonstrated that social support, within-group strong ties, were also reinforced and extended by technology. A related study (Kavanaugh & Patterson, 2001) asked if a community computer network was a way to build social capital. Considering again the effect of the BEV in the form of listservs, grants for Web development, server space, tech support, and high-speed public Internet access points, they carried out two surveys of Blacksburg residents (N=156 and N=320). They were not able to measure an increase in community involvement and attachment over the period that BEV had grown, but they did see an increase in community communication. They found that length of use of the Internet was directly related to (1) use of the Internet for social capital and (2) a sense of increased community involvement.

Blanchard and Horan (2000) surveyed 342 people in a mid-sized California city that was about to get a *virtual community* (i.e., a CN). Following Putnam's thesis (2000), they wanted to know if virtual communities could "compensate for a decrease in social capital due to a decreased participation in face-to-face communities." They also asked what topics would attract people's virtual participation. They concluded that people would indeed make use of a new virtual space and interact with their neighbors, building social capital by using child education resources, community bulletin boards, communicating with family and friends, and participating in government or politics.

Hampton and Wellman (2000) asked how living in a wired neighborhood affects interpersonal relations. They carried out a two-year case study of a middle-income suburban development in Toronto (Netville) where close to half the residents were provided with a high-speed Internet connection and a residents' listserv. They found that wired households evidenced more social ties of every type: strong, weak, instrumental, emotional, social, and affiliative. Their operationalization of strong and weak included three categories: host someone at your home or vice versa (strong); talk with regularly (weak); or the *knowing tie*, recognize someone by name. Based on a survey of 65 wired and unwired households, Hampton (2003) analyzed the end stage of the Netville project when the community had begun to fight the development project over house repairs and over withdrawing the high-speed Internet. He suggested that information technology only contributed to weak ties, defined as above. Analysis of participant observation and interview data (Hampton & Wellman,

2003) finds that a household's being wired was associated with and a causal factor in more weak ties.

Tonn et al. (2001) examined 40 CN Web sites based in a variety of communities and countries to see what are typical and cutting-edge features of CNs and how might they foster an increase in social capital. They looked for nine features they identified as fostering social capital as defined by Putnam: helping people be better citizens; fostering direct democracy; helping students interact with the larger community; letting citizens comment on proposed new developments; fostering barter and other alternative economics; building an "organic online community history"; bringing citizens together for mentoring; and paying special attention to seniors and low-income communities. Of the 40 CNs, eight appeared to have one or more social-capital-building features.

Ferlander (2002, p. 1) asked, "To what extent can the use of an Internet café increase social capital in a local community?" She found that community technology, namely a cybercafé in a disadvantaged and multiethnic Stockholm suburb, strengthens both weak ties (defined as ties to people emotionally distant) and strong ties (to people who are emotionally close). Her studies investigated the effect of use of two distinct community technology projects (an Internet café and a CN) on social capital in a local community. In another small survey, residents expected the CN to generate social capital (Ferlander & Timms, 2001), but it did not attract enough users to carry on, perhaps due to a requirement that all posts be in Swedish, and what might have followed from that, a sense of surveillance by system operators.

Kvasny (2002) studied a CTC run by the city of Atlanta to determine the relationship between participating in a technology-rich environment and one's life chances and examined the process by which technology reproduced social stratification. She defined social capital, after Bourdieu, as social networks that improve one's social standing, and found that community technology reproduced social stratification rather than fostering people's social development. Inner-city Atlantans were given what she called "light training" (p. 200) which would not help them move forward in career or in life. The CTC in fact acculturated them to a new setting for relative powerlessness and exclusion. She proposes that a different approach to community technology could instead boost participants' social capital.

A study by Meredyth et al. (2002) asks, "What is community?" in a heavily immigrant, impoverished, multilingual housing estate in Australia. These researchers found that community technology strengthens strong ties rather than weak ties. Their technology project was comprised of recycled home computers, subsidized Internet access, classes, a computer lab, and online community information. They define bonding social capital, or strong ties, as the links within distinct language or country-of-origin networks connecting residents to family and friends in a home country, and bridging capital, or weak ties, as local communication and exchange between residents. They found that the estate consisted of multiple bonding social capital networks with almost no bridging social capital or weak ties, and that the computer lab and the training (the rest of the project had not yet been rolled out), was used only for e-mail and exchange with the diasporic communities—and hence augmented only the bonding social capital.

Not only does this echo Gans' urban villagers, who were also recent immigrants, the study begins to bridge the two models we are discussing (social capital/social networks as they influence IT and IT as it influences social capital/social networks). Meredyth et al examine the social capital that preceded the community technology as well as that resulting from it. So, in a community where bonding ties predominate, community technology augments and extends those, but not bridging ties. The obverse is true for the other studies in this subset; when they examine people whose ties are mostly weak, community technology augments and extends those ties rather than the strong ties. Haythornthwaite and Wellman's finding (2002) may hold here: technology augments and extends what already exists, rather than making any dramatic change. Yet augmenting and extending what ties exist is often quite meaningful in and of itself.

In an ethnography of a youth-oriented CTC in Denver, Clark (2003) asks how digital divide policy is actually practiced and finds broad gaps between partners and between policy and practice. She also makes use of Granovetter and of Oldenberg's concept of third places (1997) in concluding that young people's gaming and other typical teen online activities builds their weak tie networks, ties to a "wider circle of resources and opportunities than...through their family or peer contacts." (Clark, p. 109) Using Bourdieu, she concludes that these networks enable them to "do such things as find employment, locate housing, and otherwise function in society." (p. 109)

Pinkett (2003) and Pinkett and O'Bryant (2003) ask, "How can community social capital be increased and community cultural capital be activated through community technology?" They themselves install new home computers and high-speed Internet, and implement computer classes and community-building software in a housing development created by privatizing (selling to a tenants group) a public housing development. They also survey 58 heads of households living in the development. Residents were seen to expand their local ties and their access to information. Social networks were seen to become more dense, and ties stronger, for those engaged in the community technology project compare to those not engaged. These ties was measured as visiting other residents at home, as well as phoning, e-mailing, and recognizing them by name.

### *Do social networks/social capital shape community technology?*

Importantly, all but two of the studies report that social capital and/or social networks do indeed augment or otherwise influence community technology. Turning the model in the first set of studies around, reversing the direction of influence, the following studies examined the effect of social networks or social capital on community technology: Liff and Steward, 2001a, 2001b; Borgida et al., 2002; Kvasny and Keil, 2002; and Williams, 2005. Most of the previous set of studies considered community deficits in social capital, following Putnam, and asked whether community technology might reverse these deficits and improve the situation. The studies that consider preexisting social networks and social capital in the community, before the arrival of the technology project, take a point of view close to the asset-based community development model elaborated by Kretzmann and McKnight (1993), in which all communities have assets that can be mobilized to improve conditions. Taken together, they report that social capital is a powerful influence on technology. In fact, except for Williams (2005) they provide more evidence of projects suffering because of a lack of attention to the positive influence of social capital than of projects that mobilize social capital and see the benefits. Their research issues a call for better policy to help such projects take hold and succeed.

Liff and Steward (2001a, 2001b) ask how policy prescriptions guiding the establishment of telecenters stack up against practice. Analyzing a rural UK youth-serving telecenter, they find that rather than the prescribed strong-tie reliance, it is weak ties in a community that support the technology and help it serve the community. Both types of social capital bolster the technology project; weak ties help more than strong ties. The authors construct a network diagram of the telecenter and its board, staff, partners, and clients in order to illustrate this. In their view, weak ties are deemphasized in policy directives and often overlooked in practice, to the detriment of the community technology project. By strong ties the authors mean more intimate, multistranded, mutual ties based in kinship and the traditional community, and by weak ties they mean "boundary spanners," people who are in two or more organizations (Liff & Steward, 2001b, p. 322).

Borgida et al. (2002) ask what role social capital plays in addressing the digital divide. In a comparative case study of two rural Minnesota towns, each of which develop community networks that include internet service provision, they find that the town with more social capital evidences a more positive attitude towards the Internet and eliminates income-based disparities in computer and Internet use. This town develops its technology collaboratively with support from a local foundation and the Department of Commerce. The town with less social capital, which pursues networking via an entrepreneurial, competitive approach, evidences a more negative attitude towards the Internet and income-based disparities in computer and Internet use persist, and are even justified by locals. The two community networks in this town are set up by the municipal utility and a competing businessman.

Kvasny and Keil (2002) investigate responses by two municipalities to local digital divide initiatives and ask why they were less successful than expected. One is the city of Atlanta, with its string of city-operated telecenters, and the other is LaGrange, Georgia, which offered free cable Internet access, set-top boxes for Web access via television, and e-mail accounts to all residents. In both cases, disregard for existing social networks and social capital kept the projects from greater success. In Atlanta, existing social networks brought people into the centers, but their social capital was disregarded. In LaGrange, the absence of positive word-of-mouth across poor neighborhoods left people who were not familiar with the Internet uninterested and suspicious.

Williams (2005) investigates 31 grassroots community groups in disadvantaged areas of Manchester, England, using information technology and the social ties that support their IT use. She asks: "How and to what purpose do groups not expected to use IT—because they are formed from "digitally divided" populations—in fact do so? Who or what helps them use it?" The study incorporates key concepts from social capital and social network theory, with particular reference to the scholarship of Granovetter, Lin, Putnam, and Wellman cited above. She examines strong and weak ties and bridging and bonding social capital by focusing on where community groups sought and obtained help with IT. In this study, having more ties providing IT help—and more strong ties, more bonding social capital—was associated with more extensive ICT use by the community groups. Based on 25 measures of IT use, the groups fell into three categories: downloading (using computers and the Internet, particularly e-mail), uploading (maintaining a group Web presence), and cyberorganizing (helping others to become uploaders or downloaders), in order of breadth of IT use. These three categories align with group purpose (tenant groups, cultural groups, and social support groups), suggesting that community groups use IT in close alignment with group purpose, much as Orlikowski (1993) suggested for business. The 31 groups reached across real or perceived digital divides in accessing help with IT; the ties utilized were likely to be younger, white, more male, and more in the workforce. Williams uses both quantitative (statistical tests on closed-end responses) and qualitative (narratives extracted from interviews) approaches, and comments that social disadvantage is often oversimplified, not taking into account the phenomenon she uncovers: groups that reach across ethnicity, class, gender, and generations for skilled help, yet stay close to their strong-tie, bonding-social-capital networks, relying largely on people in their own communities. IT projects are advised to take into account the relatively invisible but active networks within disadvantaged communities.

These scholars' research establishes that existing social capital and social networks

are an influence on a local community's use of information technology.

*Do social networks/social capital and community technology shape each other?*

Finally, two studies by Kavanaugh, Reese, Carroll, and Rosson (2003) and Alkalimat and Williams (2001) examine both processes, social networks/social capital shaping technology, and technology shaping social networks/social capital. This research explores the model as below:

social capital/social networks → technology → social capital/social networks

where the arrows signify the process of shaping, or influence.

With regard to the first arrow, in the model, Kavanaugh, Reese, Carroll, and Rosson (2003) find that the people with more weak ties to start with increase their social capital the most. With regard to the second arrow, they find that community technology does, indeed, build social capital in the local community. In other words, the social networks/social capital that can take the most advantage of community technology is the weak tie, bridging type of social capital. Examining again the Blacksburg Electronic Village, Kavanaugh et al ask how strength of ties and Internet use influence what they call "community involvement and collective efficacy" (Kavanaugh et al., p. 265)—a concept close to local social capital. The Internet use that the study examines is specifically group use: organizational e-mail, listservs, online bulletin boards and Web sites. People with weak ties (members of more than one organization) boost their local community involvement and connections more than people without weak ties (members of just one organization), and they also use the Internet more for political purposes. Kavanaugh et al define strong ties as thick trust, bonding social capital, and intensive daily contact for support and mutuality within homogeneous and exclusive communities. They define weak ties as thin trust, bridging social capital, less personal, for instrumental purposes, information sharing, and linking homogeneous groups to integrate them into one social environment.

Alkalimat and Williams (2001) start out analyzing the social capital as an input into a telecenter in Toledo, Ohio (USA), but their findings lead them to an extended model. They define bonding social capital as support from members of the church that founded the telecenter, and from neighborhood residents, and bridging capital as support from local university staff and students and from local government agencies.

Bonding social capital is the fundamental resource that makes something belong to a community. Without this form of community wealth and legitimacy the organization is an artificial construct. Bridging social capital is essential in acquiring temporary resources and external support. Whenever bridging social capital is dominant the organization is in crisis and in danger of dying or being transformed as an extension of external interests rather than the interest of the original community and its bonding social capital.

They also find that sustainability is a function of whether the center produces its own bonding social capital that knits the local community more tightly to the telecenter itself.

*Weak ties and strong ties*

Studies that look at strong and weak ties, or bonding and bridging capital, are looking more closely at the shape and texture of the local community that is using IT. Here the definitions in Ferlander (2003) and Meredyth et al. (2002) exemplify a challenge in synthesizing the work on community technology and social capital. For Ferlander, bridging ties are what she calls "global," (Ferlander, p. 83) to people outside the local community, while bonding ties are to people within the local community. For Meredyth et al. it is the opposite: bridging ties are to people inside the local community but not of one's own language group or nationality, and bonding ties are to one's own language group or nationality, either local or global. The two studies develop their diametrically opposed formulations despite the fact that both look at multiethnic or multinational urban communities: just outside Stockholm with "28% foreign citizens born abroad or in Sweden or foreign-born Swedish citizens," (Ferlander, p. 8) and Atherton Gardens housing estate with 64% of tenants "born in Asia, predominantly Vietnam ...[and] only 14% of residents born in Australia" (Meredyth et al.).

In fact, as discussed earlier, the studies define strong and weak ties rather differently. (See table 2.) Hampton and Wellman operationalize the two (strong and weak ties) as a continuum, from strong to weak to knowing tie. In the sense of a "great good place," (Oldenburg, 1997) Clark's study of a telecenter in Denver describes weak ties as young people at the facility meeting people they would not otherwise. Alkalimat and Williams (2001) define bonding social capital as resulting from connections to the very immediate local neighborhood of the telecenter; bridging social capital as resulting from government and university connections. Williams (2005) uses several definitions culled from other empirical work. Table 2 below details how strong and weak ties and bridging and bonding social capital (if mentioned) are defined in each study.

Object of analysis (citation)	Definitions of strong/weak ties	Definitions	of
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		<b>bonding/bridging social capital</b>
Community ICT package, Blacksburg Electronic Village (Kavanaugh 1999, Kavanaugh et al. 2003)	<p><b>Strong ties = bonding social capital</b> = thick trust = intensive daily contact, in homogeneous exclusive communities capable of exercising sanctions ... support, mutuality</p> <p><b>Weak ties = bridging social capital</b> = thin trust = less personal, links groups to integrate them in one social environment ... instrumental, information resources, increased reach. People who are bridges are members of 2 or more community groups.</p>	<p><b>Strong ties = bonding social capital</b> = thick trust = intensive daily contact, in homogeneous exclusive communities capable of exercising sanctions ... support, mutuality</p> <p><b>Weak ties = bridging social capital</b> = thin trust = less personal, links groups to integrate them in one social environment ... instrumental, information resources, increased reach. People who are bridges are members of 2 or more community groups.</p>
Listserv and high-speed internet in suburban Toronto development (Hampton 2003, Hampton and Wellman 2000, 2003)	<p>Operationalized three kinds of ties:</p> <p><b>Strong ties</b> = invited over, or invited over</p> <p><b>Weak ties</b> = talk to regularly</p> <p><b>Knowing ties</b> = recognize by name</p>	(concepts not used)
Telecenter in rural England (Liff and Steward 2001b)	<p><b>Strong ties</b> = more intimate, multiple bases for interaction, mutuality; kinship, traditional community ties; provide a range of resources in times of need</p> <p><b>Weak ties</b> = boundary spanning. People who are boundary spanners are members of 2+ groups.</p>	(concepts not used)
Computer classes as beginning of community ICT package delivered to Australian housing estate (Meredyth et al. 2002)	<p><b>Bonding social capital = strong ties</b> in small groups = e-mail and exchange with diasporic community</p> <p><b>Bridging social capital = weak ties</b> between many people = local communication and exchange between residents</p>	<p><b>Bonding social capital = strong ties</b> in small groups = e-mail and exchange with diasporic community</p> <p><b>Bridging social capital = weak ties</b> between many people = local communication and exchange between residents</p>
Youth telecenter in Denver (Clark 2003)	<p><b>Strong ties</b> not used or defined</p> <p><b>Weak ties</b> = those fostered in informal meeting places</p>	(concepts not used)

Cybercafé in Sweden (Ferlander 2003)	<p><b>Strong ties</b> = emotionally close</p> <p><b>Weak ties</b> = to people emotionally distant</p>	<p><b>Bonding social capital</b> = to similar people = local</p> <p><b>Bridging social capital</b> = to different people = global</p>
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**Table 2. Strong and weak ties and bonding and bridging social capital, as defined in the community informatics literature.**

## Conclusion

This examination of community informatics studies that use the concepts of social capital or social networks to examine technology in communities reveals that by and large they contain one of two conceptual frameworks for social transformation, asking one of two questions: Does community technology shape social networks/social capital? or, Do social networks/social capital shape community technology? In the first question, the technology that shapes the social networks/social capital can be said to represent the social engineering of that community. In the second question, the social networks and social capital that exist in a community can be said to represent the historical community, the continuity. Continuity and change are in fact both necessary for community technology. Change refers to the launching of a technology project and continuity to the sustaining of that project. Along the way, a project may morph, as in Clark's telecenter (2003), from a facility that offers training into one that offers online games and entertainment for teens; or from a single computer lab to a training project supporting a set of independent computer labs, as in the case of PrairieNet's East St. Louis, Illinois project (P. Adams, 2007); or from grassroots community networks to public library community information services (Durrance, 1984, 2002). The community network that failed in Skarpnäck, Sweden, created a change, but could not sustain it (Ferlander & Timms, 2001; Ferlander, 2002, 2003). The historical community, the locals, did not make sufficient use of it.

For a community to move into the information society and the knowledge economy—to surmount digital inequality—it appears to take both the establishment and sustenance of community technology. Examining social networks and social capital can lead to insights about the policy challenges surrounding the launching and sustaining of technology in communities. The role of strong and weak ties in those interrelated processes is not yet well understood. However, Kavanaugh's work (1999; Kavanaugh & Patterson, 1998, 2001; Kavanaugh et al., 2003) suggests that people who are members of community organizations constitute social-capital-rich nodes in a local social network that can use community technology and make it produce more social capital.

As technology has diffused, it is now possible to study local community uses that arise organically as community organizations pursue their goals and not only those uses that arise from a distinct project launched to serve people in a locale. Dovetailing with Kavanaugh's focus on community organization members as the Blacksburg Electronic Village project matured, Williams (2005) examines IT use by local groups in Manchester, England. Such groups may be almost invisible to outsiders as they are grassroots and volunteer-driven, but they arise from some collectively identified sense of community and represent a leadership network in their community.

In sum, the core ideas in the literature that has been reviewed here can be stated as follows: across a number of instances of community technology, technology use is directly influenced of social networks, and social networks are directly influenced by technology use. The two questions our studies examine fit together as a historical process. A community finds itself with some form of information technology, technology that has itself been socially constructed. Community factors are alternatively independent variables and then dependent variables in an ongoing historical process. It is essential to clarify how our research sequences technology and community historically. With a nod to the companion work of Simpson (2005), Gaved and Anderson (2006), and Anderson et al (2006), we conclude with the most summative observation: Such is the role of theory in guiding a field of research.

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<sup>1</sup>The open-source community model is now widely discussed and has been compared or applied to other social phenomena: cultural creativity (Lessig, 2004), curriculum sharing (Ishii & Lutterbeck, 2001), scientific journal publishing (Public Library of Science, 2003), the practice of science itself, and even the rise of Protestantism (Willinsky, 2005), to name just a few.

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