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Studying IT and community
Methodological, ontological and epistemological approaches

Abstract

In this paper, I offer a summary of an information technology (IT) case study that involved three different approaches: social construction of technology (SCOT), social capital, and diffusion of innovations. Although these approaches first appeared highly different in theoretical and methodological terms, I began to see overlaps during the analysis phase of my study. These overlaps were further emphasized as I began to reflect on the epistemological and ontological similarities that the approaches share.

The first section of this paper offers the reader a summary of my case study. This summary is then followed by a detailed examination of each approach where I discuss the limitations and advantages of these approaches, along with the epistemological and ontological similarities that they share.

IT and community: The case of connected kids

My case study took place in Troy, a small city in upstate New York that rests on the side of the Hudson River.¹ Although it was once a city at the forefront of the Industrial Revolution, Troy has recently experienced an economic decline that has affected all aspects of the city's life: store fronts lie empty, over half the residents live on 'low' to

¹ As a number of publications have been made regarding this research site and project, I have opted to maintain the actual names of the city and technology. A reader can gain more information on Connected Kids by visiting <http://www.rpi.edu/~zappenj>.

'moderate' incomes, and the industries that once drew fame to the city have not existed for years.

In contrast to this decline in Troy's material wealth stands the city's local university, Rensselaer Polytechnic Institute (RPI). Located about one mile away from Troy's City Hall, the RPI campus holds a wealth of resources, many of which are related to information technology.

This contrast between RPI and the city of Troy has caused friction over the years between students and the local residents. Students tend to avoid the city altogether, preferring to drive to nearby malls and cinemas. City residents refer to RPI as the 'school on the hill', and often think of the RPI community as a powerful, rich, yet closedoff and distant neighbour.

In reaction to these multiple divisions that separate RPI and the city, RPI Professors Teresa Harrison and James Zappen began speaking with members of City Hall about the possibility of building an information technology infrastructure that could serve the interests and needs of the Troy community. In the summer of 1999, these discussions culminated in the idea of an online information system that would distribute information on the city's youth and family services. This idea emerged from a problem presented by the municipal government: the lack of communication and collaboration among different youth service agencies. This lack of communication resulted in many agencies duplicating the services of their neighbours. Through creating an online information system that would distribute up-to-date information on youth services, the city hoped local agencies would be better informed, more willing to collaborate with one another, and thus reduce the duplication of services in the community. As will be seen in the following pages, however, the city's hopes were not the only ones influencing the technology's development.

Since this early conceptualization, the technology has gone through a number of phases. Teresa and James have encouraged community members to participate in focus groups and design sessions, and have allowed these sessions to shape the design and functionality of the technology. Although not yet finished, the current technology is referred to as the Connected Kids Project. Connected Kids will be a web-based database

system that will allow local youth service providers to input information about their agencies' services. This information will then be broadcast over the Internet through a specially designed web interface. The intended audience of this system includes children, youths, parents, and the service agencies that serve these populations. These different audiences have all participated in shaping Connected Kids current look and feel.

Studying connected kids: Research design and re-design

I began studying Connected Kids in 2000. I had originally seen Connected Kids as an opportunity to study the role information technology played among community members. Such an interest would have involved a research design where data were gathered at different points in time, namely, before and after Connected Kids' completion and use within the community. In the early phases of my research, however, I quickly began to see that the design and development of Connected Kids would take longer than I had originally imagined. Gathering pre and post-data on the potential users of Connected Kids thus became an uncertain option. In spite of this disappointment, I began to see the process of designing and building Connected Kids as an attractive area for inquiry: As Teresa and James were opening the design process to a wide community of potential users, I could see that the social interactions surrounding and involving Connected Kids were complex. Thus, I began rethinking and reshaping my original research proposal to include additional literature reviews and research questions that focused on the social aspects of technology design and diffusion. In the end, I found I was studying Connected Kids through three different theoretical and methodological approaches: SCOT, social capital, and diffusion.

My research involved three rounds of interviews: February 2000, May 2000, and June 2001. I attempted a panel study, although many respondents dropped out of the study and new ones replaced them in the three different rounds. Over the course of the three rounds, 37 respondents were interviewed: 29 came from not-for-profit agencies, two were professors, one was a city official, three were city employees, and two were county employees. For all three rounds, all respondents were interviewed using a loosely-structured script. During the third round of interviews, all respondents except for Teresa

and James were also given two questionnaires to fill in. Respondents would often share additional sources of data with me: email correspondences, transcripts from meetings, and organizational documents. These pieces of data were also included in my analysis.

Although multiple methods were used, my three main instruments of investigation were the interview script and two questionnaires, and each of these three tools were originally intended to coincide with each of the theoretical approaches: interviews for SCOT, a questionnaire for social capital, and a second questionnaire for diffusion. In the analysis phase, however, the results from each of these methods began to support or provide insight into the one or the other approach. This blurring of findings, along with details of each approach, will be discussed in the following sections.

Approach #1: The social construction of connected kids

SCOT theory shows how social forces, composed primarily of social actors, surround a technology and shape that technology's design and development. These actors are seen as inhabiting their own social worlds, which are defined as social groupings formed from unique belief systems, organizational affiliations, and/or common activities (Clarke, 1991). These social worlds guide actors' interpretations of a technology's intended purpose and use while placing different demands on the technology's design and development.

These actors and their corresponding worlds are also seen shaping and influencing one another: As they come into contact through various boundary objects, i.e. activities, objects, or beliefs that cross worlds' boundaries and bring worlds together, these actors and worlds influence one another, and thus influence how each interprets and shapes the technology (Fujimura, 1992; Star and Griesemer, 1989). In addition, actors are constantly interacting with the technology at its different stages of development and use; thus actors form interpretations of a technology through interacting with that technology and with one another. This constant interaction among actors, worlds, and technology forms what

some SCOT scholars have called a 'seamless web' of activity: the social and technological realms become symmetrically linked within a network of interaction and mutual shaping.

SCOT studies tend to use a range of qualitative methods that include loosely-structured interviews, snowball sampling, and participant-observation. This consistency in approach emerges from the theory's ontological contention that boundaries between social actors and technology are blurred, and such blurring of boundaries runs counter to the inclination for quantified measures. In addition, distinctions between social worlds are also seen as arbitrary and difficult to locate with any precision (Klein, 2001); the idea of using a quantitative approach to locate and measure these interactions among actors goes against SCOT's fundamental views.

I chose SCOT theory as a framework to help guide questions and methods pertaining to Connected Kids' ongoing development: I had realized early on that Connected Kids would take a long time to develop, as Teresa and James were committed to building Connected Kids through a participatory process. By choosing to engage members of Troy's community, Teresa and James were exposing Connected Kids to a range of social forces. SCOT theory provided me with a vocabulary and set of analytical tools to study this process.

I was particularly interested in how the different actors participating in Connected Kids were interpreting this technology, and whether these interpretations were influencing Connected Kids' design and development. Teresa and James had opened up the design process to many of these same community members through a series of participatory events: focus group meetings, design sessions, and user-testing sessions. This participatory aspect to Connected Kids' development afforded, what seemed to me, an opportunity to study a number of interesting interactions: social actors interacting with each other, with Connected Kids, and the mutual shapings that could result from such interactions.

To research this social shaping of Connected Kids, I conducted three rounds of interviews over the course of eighteen months. The respondents I chose to interview were employees of youth-service agencies, which included schools, local government agencies, not-for-profits, and the project leaders, Teresa and James.

My method for choosing this sample needs some discussion in relation to the SCOT literature. Many SCOT scholars opt to use snowball sampling, a method whereby a researcher initially interviews one participant in a technology design project, and asks that participant to nominate other actors relevant to the technology's design, development, or use (Bijker, 1997; MacKenzie and Wajcman, 1999). Through a series of nominations, a researcher uncovers a sample of individuals relevant to the technology. Other scholars either forego this method or complement it with a more analytical, structural approach: the researcher attempts to analyze power structures and/or other structures surrounding the technology's design and development. With this structural perspective in mind, s/he interviews respondents that reflect or represent these particular structures (Klein, 2002).

My method for deciding whom to include in my sample of respondents was based largely on seeing which actors were actively involved in Connected Kids, either through attending meetings or participating in an email list created and monitored by James. In doing so, I actively ignored certain social worlds and actors that were mentioned to me by respondents as individuals and/or groups relevant to the Connected Kids project. For example, many of my respondents mentioned children and parents as important actors for this technology project, yet I opted not to include these groups in my sample as I wished to wait until these groups became directly involved in Connected Kids. My reasons for waiting rested on my desire to watch how Connected Kids interacted with the community. If I spoke with actors who were not involved in Connected Kids, I felt I would be intruding upon the process by providing information about Connected Kids, and thus potentially affecting actors' interpretations prior to them forming interpretations of their own. These non-sampled actors were, nonetheless, included in my analysis of the relevant social worlds and actors surrounding Connected Kids. Thus, I allowed the structure of Connected Kids meetings to determine whom I interviewed, yet the respondents' nominations of other relevant actors guided my final analysis of whom to include in which social world.²

² Bijker (1995) discusses the problem of missing social actors/worlds, and he recommends that researchers use their judgement on how to handle this. Further, he notes that the method of falling the actor is not perfect, and should thus be seen more as a heuristical tool.

In addition to the interviews, I was given access to email documents and transcripts of focus group meetings held during October 2000. These meetings were organized by Teresa and James for purposes of gathering input and feedback from the youth-service community regarding Connected Kids.

Analysis and results of SCOT data

Through analysing the data gathered, I developed six distinct social worlds that were influencing Connected Kids directly or indirectly. These worlds included (a) Rensselaer Polytechnic Institute (RPI), (b) Local government, (c) private funding agencies, (d) youth, (e) parents, and (f) not-for-profits. Below, I summarize each of these social worlds, the roles they played in Connected Kids' ongoing development, and how they interacted with one another.

The technical institute: RPI

The most powerful social world influencing Connected Kids' development was that of RPI. RPI held technical resources and a skilled student body that permitted much of Connected Kids' hands-on design and development to take place. Access to these students and resources was gained through Connected Kids' two project leaders, Teresa and James, who were faculty members at RPI.

Teresa and James were also highly influential in the early conceptual phase of Connected Kids. Through discussions with local government officials, Teresa and James established the main purpose for Connected Kids, i.e. an online database distributing information about youth-service agencies. In addition, Teresa and James were developing Connected Kids in a participatory fashion, which was a deliberate choice on their part. This decision to open up the design process to participatory practices had profound effects on the direction that Connected Kids took. In particular, Connected Kids' interface, content, structure, and intended audiences were all largely shaped by the sort of input and feedback that community members gave Teresa and James.³ Finally, Teresa

³ Teresa and James have discussed these influences in some of their writings. For instance, Harrison, Zappen, Stephen, Garfield, and Prell (2001); Harrison, Zappen, and Prell (2002); Teresa and James (2003)

and James, through a series of grant-writing activities, acquired funds for Connected Kids that allowed for further resources, time, and talent to be dedicated to the Connected Kids project. These funds and added resources allowed for more community participation to occur, thus further influencing Connected Kids' final shape.

Local Government

Teresa and James originally teamed with local government officials in brainstorming the purpose of Connected Kids. Local government, which included both city and county offices, saw Connected Kids as a possible tool to help not-for-profits better coordinate their services for youth. Such coordination was seen as improving the quality of services in the area, as well as potentially saving the government money. In addition, the municipal government offered funding for the Connected Kids project and played a role in diffusing information about Connected Kids to the local not-for-profit community. Local not-for-profits turned towards these government agencies and actors for funding, and thus interacted with these actors on a regular basis. Through these interactions, news of Connected Kids was disseminated, and this process probably influenced the way not-for-profits grew to understand and become involved in Connected Kids.

Funding Agencies

Teresa and James wrote a number of grant proposals to different funding agencies in search of resources and money for Connected Kids. Each grant proposal held particular criteria for awarding funds, and these criteria influenced the path Connected Kids took. For example, the largest grant awarded to Connected Kids came from the National Science Foundation in the spring of 2001.⁴ This award provided the Connected Kids project with funding for 3 years, thus allowing for the hiring of additional student designers and programmers, and multiple participatory design sessions with community members.

⁴ The National Science Foundation is a large, national funding agency of the US government. The Foundation is seen as the largest government funding source academics and researchers can turn towards. Further information of the National Science Foundation can be found at: <http://www.nsf.gov>.

Youth

In the eighteen-month time span of my study, youth were often discussed as important end-users of Connected Kids, yet they were not directly involved in the design of this project. During the October 2000 focus group meetings, many not-for-profits spoke of the need for including youth in design meetings, and comments I heard during my interviews with many of these same participants reflected these sentiments. Even though these youths were not actively voicing their needs and desires regarding Connected Kids, many of the not-for-profits working directly with youth spoke for this social world and made suggestions of what these youths' needs might be. Thus, although the youth were not visibly present during the course of my research, other actors spoke on their behalf. These comments regarding youth inspired Teresa, James and RPI student designers to make changes with regards to Connected Kids interface. In addition, Teresa and James held later design sessions, beyond the scope of my study, which involved youth from the local community. Future research will investigate the extent to which these youths' opinions affected Connected Kids.

Parents

Similar to youths, parents were a much-discussed social world, but one that was not directly involved in the Connected Kids process. As with youths, not-for-profit actors often voiced their opinions of what parents might need and want from such a technology, and these actors' discussion may have influenced the project leaders decision to hold later design sessions just for parents of the community.

Not-for-profits

Not-for-profits were the largest social world covered in my analysis, and they represent a powerful shaping influence on Connected Kids' development. Although this world's influence was important throughout Connected Kids' development, it was mainly seen during the October 2000 focus group meetings. These meetings were designed by Teresa and James for gaining the input and feedback from not-for-profits on an early prototype of Connected Kids. The feedback gained from these focus groups influenced the

designers' and developers' ideas for Connected Kids' interface, functionality, and intended audiences.

These focus group meetings were an opportunity for Teresa and James to influence not-for-profits' understandings of Connected Kids. Many of the not-for-profits attending the meetings had little to no knowledge of Connected Kids, and the meetings provided these participants with additional information about the motivations, goals, and ideas Teresa and James held. Later interviews with not-for-profit actors showed me that many of these actors had adopted, more or less, the view of Connected Kids presented to them by the project leaders.

The focus group meetings also gave not-for-profit actors a visual manifestation of Connected Kids. Seeing this prototype gave these actors something to which they could react, form firmer opinions, and gain clearer impressions. Finally, the focus groups permitted these actors to speak with one another and influence one another's opinions. Through providing a multiplicity of interactions among the social actors and the emerging technology, these focus groups provided an important opportunity for Connected Kids' development. They also provided an important space in which actors' views of Connected Kids could collide and merge with one another. Over time, through later interviews, I discovered that many not-for-profit actors had formed a consensual view of Connected Kids. That view consisted of Connected Kids helping not-for-profits to coordinate their services, help serve certain needs of each organization, and also to help parents and youths gain access to information on services and programmes in Troy. For example, I heard respondents quoting Teresa and James' view of Connected Kids as an IT that would help organizations in coordinating their services. In addition, I heard these same actors state that in using Connected Kids to coordinate, they would also be fulfilling certain needs of their own organizations; for example, they would be helping their clients receive the best services available in Troy.

Connected kids' role

Connected Kids also played a role in its own development. All social worlds and actors shaped their opinions and understandings of Connected Kids partially through reacting to

the technology itself. For instance, during the focus group meetings Connected Kids was seen for the first time in a material form. In doing so, social actors could react to the technology and form opinions about it.

The fact that Connected Kids was an information technology influenced actors' opinions. Many were positive towards IT and saw IT as helping their work within the agency and with youth. Thus, an IT that was being custom built for the youth of Troy spoke to these actors in a positive way.

Lessons Learned

This brief description of my SCOT findings reflects much of the theoretical and empirical literature pertaining to the sociology of technology. Actors and technology can be seen influencing one another, with this mutual shaping leading towards a more stabilized artefact. Yet my description also reveals some of the tensions of the SCOT approach, namely, the problematic nature of handling missing groups. Bijker (1995) discusses this problem briefly, noting that powerless groups of actors may escape an analyst's notice, as they do not have the ability to speak for themselves. If an analyst is able to identify these voiceless groups, s/he is still restricted in how well s/he can get to know them. Bijker's (1995) response to this issue is to see the SCOT approach as a heuristic, interpretive method. That is, that snowballing and following actors are techniques that help in the interpretive process of understanding technology development.

My own experience of not speaking directly with youths reflects some of these issues: youths were not invited to the table to participate during the time of my study, and I did not have access to their perspectives. Nonetheless, their presences was known, and an interpretive case could be made on their account. Such a solution is imperfect and clumsy, yet an understanding of how this group's influence was felt can still be ascertained.

Future research will continue observing these actors' and worlds' roles in shaping Connected Kids. In addition, future research will document how Connected Kids, once completed and introduced to the community of users, will influence relationships and practices among these community members.

Approach #2: Social capital

As mentioned, I was originally interested in exploring the relationship between information technology and community to see what role information technology played in community relations. I was particularly drawn to the community networking literature: This literature describes a participatory, democratic approach to building and using computer-networked technology. 'Community networking' thus refers to a community's intentional design, ownership, and use of computer-networked technology for purposes of strengthening that community's goals (Schuler, 1996).

The literature also discusses community networks as positively affecting a community's development through affecting that community's social capital. Social capital, in the context of this literature, refers to trust and reciprocity that flow through relationships among social actors: the better connected actors are in a group, or 'social network',⁵ the more the group as a whole benefits (Bourdieu, 1986; Coleman, 1990; Putnam, 2001).⁶ Community networks were seen as affecting the ties among actors through providing actors with a supplemental channel of communication. Actors who were already in contact with one another could have an additional channel through which to communicate and thus strengthen their ties with one another. In addition, actors unknown to one another could potentially form ties through use of the technology, thus extending the size of actors' networks (Blanchard and Horn, 1998).

When I learned about Connected Kids, I saw an opportunity to test this link between social capital and community networks. Although not exactly reflecting the notion of a community network, the Connected Kids project reflected many of the ideals and concepts of the community networking movement: Connected Kids was a participatory technology design project, its intended end-users and owners were

⁵ Social networks are described in greater detail later in the article. For now, a social network may be defined as a network of actors connected to one another through various types of relations

⁶ I am aware of the great body of literature surrounding social capital, and the problems with definition and measurement of this theory (see Prell, 2003 for a fuller discussion on social capital and measurement). For the purposes and constraints of the present paper, I limit my definition to a functionalist view of social capital, and thus, ignore the more cultural takes of social capital as discussed by such scholars as Pierre Bourdieu.

community members, and the technology was being designed to meet specific community goals (as opposed to earning company profits, for example). Connected Kids was not intended, however, for all community members, nor was it initiated and led by community members. These aspects of Connected Kids placed the technology slightly outside the category of 'community network', yet overall, I saw the technology's goals and spirit as reflective of my readings pertaining to community networks. Thus, I hoped the early phases of my study could focus on gathering base-line data on social capital and then, once Connected Kids was complete, I could observe any changes within the community and note whether or not such changes could be linked to the adoption and use of Connected Kids.

As noted, I soon realized that Connected Kids' development was taking much longer than I had originally hoped. Nevertheless, I decided to gather data on Troy's social capital as a means of gauging community members' relations with one another. Future research could then use this baseline data as a point for comparison.

Locating social capital: Multidisciplinary exploration

Developing measures for social capital proved particularly challenging, largely because the theory crosses disciplines and tends to get redefined according to the contexts of different research environments. Economists, organizational and management scholars, political scientists, anthropologists, and sociologists have all conducted research using social capital as a theoretical framework (e.g. Burt, 2000; Foley and Edwards, 1999; Knack and Keefer, 1997; Lin, et al., 2001; Putnam, 2001; Tsai, 2000). This variety of studies has generated a variety of methodological approaches: qualitative and quantitative, large and small scales.

In reflecting on my Connected Kids study, I realized that a small network of actors had already been assembled for me: a select number of people from local youth-service agencies were participating in the design and development of Connected Kids. These actors and their corresponding agencies had been invited to participate in the Connected Kids project through attending meetings, focus groups, and design sessions.

All of these meetings were organized by Teresa and James for the purpose of gaining these participants' input and feedback on the ongoing development of Connected Kids.

As a result of these reflections and reviewing the literature, I began to look into studies that focused on measuring social capital within social networks. My search led me to social network analysis. Social network analysis (SNA) maps the relationships between individuals, groups, or organizations to see what kinds of meaningful patterns emerge (Wellman and Gulia, 1999). In mapping out these patterns, the analyst looks at such issues as the quality of the relationships (Brass, 1992), the positions of actors within the network, and how both these aspects of the network affect the way information and resources flow (Wellman and Gulia, 1999).

For my study, I asked 33 respondents, all of whom were directly involved in the Connected Kids project, to answer questions on their relationships with one another. The 33 respondents were composed of school administrators, administrators and employees of the local youth-service agencies, and local government officials and employees. These questions focused on relations reflecting social capital concepts such as the frequency of communication, amount of trust, and the amount of reciprocity among the respondents. This survey was administered during a round of interviews in May-June 2001.

To analyze the data gathered from this survey, I calculated centrality scores for each of the 33 respondents. Centrality is defined by the number of ties an actor holds in a network. The more ties an actor holds, the more centrality s/he holds. Centrality is described in the literature as a measure for social capital: the more central actors are, the more access they have to resources, the more likely they are to be trusted, and thus the more social capital is associated with them.

The central actors in my data set proved to be ones from government agencies, which were in charge of distributing funds to the not-for-profit community. Thus, those actors who distribute the funds were the ones to whom others turned on a regular basis, perhaps in hopes of accruing future funds or perhaps to assure the lenders that the funds were being well-spent. This correlation between centrality and organizational affiliation reflected discussions found in the social capital literature. Coleman (1990) for instance, discusses social capital as embodied in organizations. For example, organizations can

deliberately structure networks of relations, and in doing so, create opportunities for reciprocity and trust.

This interpretation became complicated when I reflected on comments respondents made during my interviews. After completing the social network questionnaire, respondents spoke with me in an informal way about their relationships with the other youth-service agencies in Troy. Their descriptions showed me instances of reciprocity that I failed to measure in my survey, such as referring clients to one another's agencies and writing letters of support. These acts of reciprocity, moreover, seemed based on weaker social links: the actors involved tended not to interact much with one another, yet they were aware of each others' presence in the community and turned to one another as needed. Thus, rather than organizational affiliation, these ties were based on social knowledge gained through years of working with youth in Troy.

Methodological lessons learned

The above discussion shows how my SNA findings failed to fully capture the complexity and subtlety of the relationships among these not-for-profits. This fact calls for some reflection. Using SNA to explore measures of social capital was useful to me for viewing the map of this network according to a few variables: frequency of contact, reciprocity, and perceptions of trust. In getting this visual picture, I was able to see which actors dominated the network and how these powerful/popular actors were connecting with other actors.

However, I found the largest limitation of SNA to be the fact that I could only visualize the network according to a few variables. I can (and will) expand my survey to capture some of the missing variables, but the fact that I had supplemented my SNA survey with interviews helped me to capture some information I would have otherwise missed. I had not asked all respondents to describe in detail how they related to actors on the list, yet information about these relationships surfaced in many of my interviews. This information led me to make additional interpretations of the ways in which these actors relate to one another.

Approach #3: Diffusion of innovations

My third and final approach to studying Connected Kids was the diffusion of innovations theory. Diffusion of innovations looks at the communication, adoption, and subsequent spread of a technology. The theory describes how technologies enter social systems, systems where actors and/or groups are tied together through interpersonal relations, and explains reasons for why social systems either adopt or refuse to adopt the technology (Rogers, 1995).⁷ Those actors in the system who have many ties to others within the system will most likely hear about the technology faster than others. In addition, actors in this system tend to influence one another's opinions about the technology. These interactions, over time, work to determine whether or not the technology will be adopted by the social system (Littlejohn, 1996; Rogers, 1995; Valente, 1995).

In addition to this emphasis on system structure, diffusion also takes into account qualities of the individuals within the system. Diffusion offers a listing of attitudinal variables that potentially affect the diffusion process. These variables pertain to the positive and/or negative attitudes actors have regarding a technology's perceived characteristics. These characteristics include the following: (1) a technology's perceived advantage for an actor; (2) a technology's perceived compatibility with an actor's current activities and/or practices; (3) a technology's perceived complexity for an actor, (4) the importance (to the actor) of observing a technology prior to deciding whether or not to adopt, and (5) the importance (to the actor) of trying the technology prior to deciding whether or not to adopt it. Thus, diffusion takes into account both individual level factors as well as structural factors that affect the diffusion and adoption of a technology.

As with social capital, diffusion theory has crossed a number of disciplinary borders. The theory has been popular among sociologists, communication scholars, engineers, marketing and business researchers, policy analysts, and political scientists (Calantone and Benedetto, 1990; Katz and Shapiro, 1986; Mintrom, 1997; Rogers, 1995).

⁷ Social systems can, in many ways, be seen as synonymous with social networks, and this similarity will be discussed in greater depth later on. The main difference with regards to Rogers' conception of social systems, as opposed to social networks, is that Rogers' emphasizes ties based on communication, whereas social networks can be composed of a variety of different ties, not just ties based on communication.

This variety of disciplinary interest has also led to a variety of methodological approaches.

I chose diffusion theory to study how and why this community decided whether to accept and use Connected Kids. Often diffusion studies take place at the end of a technology's development. Retrospectively, these studies analyze why or why not a technology was adopted by a community. Diffusion theory explores these questions through observing (a) actors' perceptions of and attitudes toward technology, (b) the roles actors play in a technology's diffusion, and (c) the structuring of the social system surrounding the technology (Rogers, 1995).

Measuring perceptions and attitudes for diffusion

To measure actors' perceptions of and attitudes toward Connected Kids and IT, I developed a questionnaire containing 27 Likert-scale items adapted from a previous diffusion study (Shim and Kotsiopoulos, 1994). These items measured perceived characteristics of Connected Kids and information technologies associated with Connected Kids, i.e. the Web and databases. My questionnaire also contained seven items focused on respondents' attitudes toward adopting Connected Kids. I administered the questionnaire during my final round of interviews in May-June 2001.⁸

Analysis and results

In SPSS, I calculated Pearson Correlation Coefficients among the perceived characteristics and the seven outcome measures for actors' willingness to adopt Connected Kids. A one-tailed test was chosen as a positive association was predicted in advance.

⁸ Social scientists have noted the potential problems of using Likert-scales for measuring respondents' levels of agreement and/or disagreement. Research has shown that such Likert-scales can result in 'respondent acquiescence', i.e. respondents simply agreeing with the statement without any reflective thinking. I piloted by questionnaire in May 2000 where I also asked respondents open-ended questions about their views on IT and Connected Kids. The results of this pilot suggested to me that sentiments and opinions suggested in the interviews were also reflected in the questionnaire. I therefore felt my questionnaire was adequately measuring these respondents' opinions and not leading towards biased results.

Results showed that actors' positive perceptions of Connected Kids hold, by and large, significant positive associations with actors' willingness to adopt Connected Kids. Actors' views of the other information technologies, i.e. the Web and databases, were not linked to their willingness to adopt Connected Kids. The fact that actors' views were positive towards Connected Kids, that these views coincided with their willingness to adopt Connected Kids, and that actors' views toward other information technologies held no relationship with their willingness to adopt Connected Kids suggested to me that these actors were perceiving Connected Kids as a unique information technology. For example, I knew from interviews that the project leaders promoted Connected Kids as a unique technology through their public meetings and focus groups with participants. In particular, Teresa and James spoke about Connected Kids as something specific for the youth and not-for-profits of Troy. Although respondents varied over what, specifically, this technology would end up being, all most likely shared the feeling that somehow Connected Kids was a more customized, 'made-for-Troy' technology. Respondents were therefore seeing Connected Kids as different from pre-made technologies such as the Web or email.

Measuring and analyzing diffusion structure

In addition to measuring perceptions and attitudes about Connected Kids and IT, I was also curious about the role social structure seemed to play in the sorts of attitudes and perceptions respondents were expressing. To do so, I used social network data on the frequency of communication among actors that I had gathered through my social capital survey (see section on social capital). As the diffusion literature discussed technologies diffusing through interpersonal flows of communication, I used my network data on communication to locate actors' positions within the network and then correlated these positions with actors' willingness to adopt Connected Kids.

Analysis and results

In UCINET, I located actors' centrality levels. As noted earlier, centrality refers to the number of ties actors have in a network. The more ties an actor has, the more central s/he is in the network.

As noted earlier, my centrality scores revealed two actors in the network as being more central than others. These two actors, Jane and Diane, worked for city and county government respectively, and their roles in these organizations put them in close contact with many of the youth-service agencies. In addition, both actors were involved in the Connected Kids project, and both had scored high on items measuring their willingness to adopt Connected Kids.

According to diffusion theory, central actors play a significant role in the diffusion process: they tend to be the ones that hear about the technology early on, and they often are among the first actors to adopt the technology. As their positions within the network tend to place them at the centre of many communication paths, these central actors are labelled 'opinion leaders'. An opinion leader is an actor holding many ties, and one moreover who communicates news about a technology to others in the network.

My findings regarding Jane and Diane coincided with diffusion's descriptions of opinion leaders and the roles they play in the diffusion process. Although Connected Kids is still incomplete, and thus I was not able to measure adoption within the community, these two actors' scores regarding their willingness to adopt Connected Kids, and their activity within the youth-service community, placed these two actors in important, strategic positions with regards to communication about Connected Kids. The fact that both were also positive about Connected Kids, and were willing to adopt this technology, further suggested that they might influence others in the network to feel positive towards Connected Kids and eventually adopt it.

In reviewing transcripts from my interviews, I found instances that seemed to support this view of Jane and Diane performing the role of opinion leaders. For example, Jane described to me an instance where she led a meeting where many youth-service agency representatives were present. In this meeting, Jane announced the Connected Kids project and briefly described her view of what this technology would eventually

accomplish for Troy youth and youth agencies. Her behaviour in this instance reflected Rogers' (1995) descriptions of opinion leaders: she was using her position within the social system to diffuse information about a technology. In a separate interview with Diane, I was told that Diane had visited many youth agencies to discuss their technology needs and see what the city might do to help 'bring them up to speed'. As with Jane, I felt that Diane's behaviour was again reflective of opinion leaders in that she was using her personal communication ties to discuss IT matters, and possibly Connected Kids.

Methodological lessons learned

My diffusion survey helped me see perceptions and attitudes toward Connected Kids as they relate to social structure and views regarding IT. The fact that Connected Kids was not being seen in relation to other information technologies was a surprise for me, and was not in keeping with diffusion theory. My social network data helped me locate opinion leaders through measures of centrality. When I compared these central actors with information gained from my interviews, I was able to further interpret whether an actor was or was not an opinion leader.

I had not expected, at the onset of my study, to use my network and qualitative data in this fashion. Originally, I had intended each theoretical and methodological approach to be kept separate from one another. The fact that all three approaches were brought together in this instance resulted from my familiarity with the data, and the level of comfort I eventually acquired over time in thinking from all three perspectives.

Bringing these three approaches together

I used three different approaches to study Connected Kids, each focusing on different dimensions of the same phenomenon. Social capital focused on interagency relationships and used social network analysis. Diffusion focused on perceptions of technology and roles in the diffusion process and involved the use of both a questionnaire and network data. Finally, SCOT looked at the social dynamics surrounding and involving Connected

Kids, the changing interpretations of Connected Kids, and it involved the use of qualitative methods. As I explored different research questions in the context of each approach, I sometimes stepped outside one approach and grabbed information and/or findings from one of the other two. Thus, in the social capital findings, my analyses of my social capital data were informed by data I gathered during my interviews, which were originally structured for investigating questions coming from SCOT. My diffusion results were also informed by my social capital results as well as findings from my open-ended interviews.

I found this tacking back and forth between comparing the three approaches' findings while also studying each approach's findings on their own to be a satisfying extension of the notion of triangulation. Triangulation, in the traditional sense, involves the use of three or more data sets to study a particular phenomenon. In my study, I used three theoretical and methodological lenses to look at aspects of Connected Kids and to gather different kinds of data: (a) Social capital and network analysis focused on ties and structure, (b) SCOT and interviews on interpretations and mutual shaping, and (c) Diffusion and questionnaires on perceptions of Connected Kids. These three offered separate results, but they also informed one another's findings.

If I were to step away from the theoretical and methodological divisions of this study, and instead focus my attention on qualities shared among all three approaches, shared ontological and epistemological views would emerge and cut across all three approaches. Ontologically, all three approaches view social phenomena in terms of systems. As Polkinghorn (1984) discusses, a systems view of inquiry places emphasis on how individuals are related to each other and arranged as wholes. Individuals are not seen as isolated components, but rather as inherent parts of particular systems. Theories that take on this systems view see that wholes have their own emergent properties, and that what leads to these emergent properties is not so much the accumulation of individuals' characteristics, but rather the arrangement (sometimes called 'structure') of these individuals in relation to one another. Individuals are seen, however, as having influence in how the system operates, yet this influence is balanced by an understanding that

certain qualities can only emerge through the interactions and relations of the individuals in the system (Polkinghorn, 1984).

Interpreting these three approaches through systems' lens thus shows how SCOT views technology emerging out of interactions among technical and non-technical elements, social capital sees trust and reciprocity emerging out of relationships among actors, and diffusion sees a culture's adoption of a technology as emerging out of the structuring of interpersonal ties. In addition, each theory considers how individual components influence the rest of the system. Thus, SCOT sees individuals as influencing one another's interpretations, social capital sees certain actors as potentially dominating the network through a disproportionate number of ties, and diffusion sees individual perceptions and past adoption histories as influencing adoption.

As systems theories, all three theories can also be seen as sharing similar epistemological outlooks. The received view of social science emphasizes the use of inductive and deductive reasoning, where scholars attempt to classify entities in reality in order to ascertain the relationships among these entities. In doing so, scholars strive to locate universal laws within a static world in order to make predictions. In contrast, systems theories see the world as a series of dynamic wholes. All entities are interdependent with one another, none can exist without the others, and through these interactions, certain qualities emerge that cannot be accounted for through analysing individual elements. Deductive reasoning cannot account for these emergent qualities.

Rather than using deductive logic to try to comprehend systems, the logic of dialectic gains access to these emergent properties.⁹ Dialectic logic, commonly associated with the process of thesis, antithesis, and synthesis, can also be seen as an example of this comparison of parts to the whole and back again to gain a fuller understanding of the social phenomenon. This tacking back and forth between parts and the whole is evident in all three theories described in this article. Through social capital, one looks at how individual actors relate to the overall social network; individual roles appear as the structure of relations is analysed. SCOT theory sees actors in relation to their respective

⁹ Hegel (1956 often quoted as the father of dialectic thinking. His work lead to Durkheim's (1964) notion of 'holism', and Dilthey's (1976) description and promotion of hermeneutics as a method of inquiry for the social/human world.

social worlds, and interactions among individual actors lead to the emergence of a technical artefact. Finally, through diffusion, one analyses how individual perceptions and attitudes coincide with the structure of the system. In doing so, one locates particular roles for actors and these roles are seen influencing the diffusion process.

Thus, in seeing all three theories as examples of systems theories, one is able to better see the ontological and epistemological assumptions influencing how a scholar employing these theories approaches his/her study. Studies employing a systems view do not, ultimately, lead towards prediction. Likewise, with their emphasis on dialectic processes, systems theories cannot make universal claims: systems views prevent one from hoping to uncover static relations among elements. Interactions within the systems are continually occurring, thus influencing and changing the individual components. As social scientists often hope to ultimately make generalizable, inferential claims, some readers will see these aspects of systems theories as serious limitations. Hegel (1956) as aware of these arguments against the dialectical method, and answered these arguments by noting that deductive reasoning was a more elementary stage of thought, whereas dialectical thinking moved beyond fixed categories to gain a more complete understanding of entities as fluid, dynamic, and interactive processes.

Conclusion

My research certainly does not offer the last word on IT studies, systems theories, or the use of mixed methods. My hope is that through a reflective portrayal of the three approaches used in this study, I have been able to offer readers a sense of how the different approaches stretched my views of the social dynamics surrounding Connected Kids, as well as how they supported one another in fundamental ways. My ultimate goal has been to understand how community members of Troy understand and influence Connected Kids and one another. In doing so, however, I took a number of methodological paths that needed to be brought back into focus. In reflecting on the similarities and differences of these three approaches, I am unable to say which approach

has served me best in understanding the dynamics of this community and their relationship to Connected Kids. Future research will build on lessons learned and continue observing Connected Kids through the lens of social capital, SCOT, and diffusion.

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