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Networks and persuasive messages

Abstract. The concept of persuasive technology focuses on the idea of persuasive messages. Human beings are subject to multiple messages through multiple channels. Humans often respond based on roles that are learned and modified in their social environment. A way of talking about these roles is social networks. This paper discusses some familiar roles, ways of measuring these roles based on social network analysis.

Introduction

One of key aspects of “persuasive technology” is the concept of a persuasive message. This paper examines the concept of a message and networks of messages. Networks can be used as part of the description of the target and source of a message. It has been previously argued that network awareness, having knowledge of how networks affect behavior and perception, combined with knowledge of the networks in some part of society such as an organization or region, is important for innovation and productivity[Steiny and Oinas-Kukkonen, 2007]. This paper expands on this by introducing the concept of “social context.” While the idea of location in social structure is not new, the difference here is that this paper talks not just about abstract location in social space, but the more concrete realization of it in communication networks based on cell phones, social networking software, IM, email and other new technology is. I argue that the ability to observe and measure these networks can give insight into the user’s behavior, attitudes and worldview and provide a context for persuasion to take place.

Persuasive technology

Persuasive technology, or *captology*, is a way of talking about interaction of individuals with technological artifacts or with other individuals mediated by technological artifacts[Oinas-Kukkonen and Harjumaa, 2008]. The term *persuasion* is defined as ‘non-coercively changing an individual’s attitudes or behavior.’ Persuasive technology is technology that is specifically designed to persuade people[Fogg, 2003].

The term persuasion is not without controversy and “a lively debate has existed for centuries over the defining characteristics of the term *persuasion*”[Miller, 2002]. Social psychology assigns a number of variables to persuasion [Petty and Wegener, 1998]. They divide them into the broad

categories of source, recipient, message and context. This view of a messages is a similar to one used in information theory and transformational grammar and is based on a view of humans as “physical symbol systems” [Simon, 1996, p. 21-22]. In this view, each individual is a CPU of sorts, a node in a network that is passing on or responding to messages.

In the physical symbol system models, both the persuader and the persuaded input and output symbols. In addition, other symbolic messages are being input to the “system.” In this context persuasion can be described simply. Machine A outputs symbol string X on input L. Machine B sends a message M to A that causes A to be reprogrammed. After this the input L to A causes the machine to output string Y. A message that causes the output to change can be called “persuasive” and one that doesn’t “not persuasive.” This type of thinking defines an entire experimental paradigm. Since test subjects are thought of as inputting and outputting discrete symbols, input can be carefully defined and controlled and the output carefully recorded and monitored. However, it does easily take into account the multiplicity of the messages that the person is receiving. In the machine metaphor, it is possible that congestion and prioritization could cause some messages to be lost. It is also difficult to know the source of the messages because in the physical symbol system model, memory is considered external to the control unit. Since the operation of the system is guessed by its behavior, we cannot be sure when memory is accessed and that is added to the “messages” the control unit is dealing with.

An example would be a “program” like smoking that depends on the “memory” of withdrawal to keep the person smoking, but countless women quit cold turkey when they find they are pregnant. They have the same “physical dependency” as anyone. It might be said that their “attitude” towards the withdrawal symptoms changed and they seem unimportant in the bigger picture. But, unimportant compared to what? Possible harm to the fetus, social stigma and many things they have never experienced. It is difficult to know what “messages” that the physical symbol system is acting on. If we reverse engineer them by using selected inputs and observing the outputs. A problem with this approach is that we have no way of knowing if the same program is running or different programs with the same output.

Context

The idea of “social context” is introduced as an analogy to “geographic context.” Today, most new cellular phones have GPS chips so the phone knows where it (and therefore the user) is geographically. This has led to the idea of “context based services” for cell phones. These could be used persuasively. For instance, it might be able to persuade people to have better health by detecting that they are on the way home and reminding them to stop at the gym. It could be used to locate children; people can advertise their location for meeting others, and countless other purposes. The idea of context both lets users know where they are, but also lets others know where they are if necessary.

Much of what we experience in the world is mediated by our social relations and language. Abstract “things” like organizations and even physical objects like drinking glasses require our active interpretation. This point of view is characterized by persuasion researcher Daniel O’Keefe:

Persons live in a meaningful, made-sense-of world. The meanings that persons (individually and socially) construct provide the basis for conduct. Thus it is only by understanding the everyday social actor’s perspective that one can come to understand the actor’s conduct, and hence the researcher’s task is to describe the actor’s point of view [O’Keefe, 1993, p. 228].

The idea of a “point of view” can be interpreted in the light of symbols, with emotions and visual images also acting as messages. In this light, “point of view” would imply that the actor is receiving different messages based on the context. It can be difficult to know the message the actor receives. One way of learning the actor’s point of view is to ask her. Unfortunately, our impressions about how we will act are not always the same as how we do act. O’Keefe gives several examples where the self reported effect of persuasive messages did not result in any measurable change in behavior or attitude. In other words, people said they had changed because of the message but the change could not be measured or verified. O’Keefe’s observations can be stated simply that the machine thought it was reprogrammed, but it wasn’t.

Roles

A role is both a location or a position in a network and the common sense view of a social role. The idea is that the a person has a socially determined role and that interaction is not so much with the person that inhabits the role, but rather with the role. For instance, a police officer is a role that commands certain type of respect and behavior. It is difficult to locate a role in the

physical symbol system model, at least its part in the manipulation of the symbols. A role is a higher level construct that is overlaid.

Erving Goffman looked at human interaction as play acting. In every situation we are trying to discover our role and how to play it to our advantage. The same string of symbols can have different meaning depending on the context. For instance, someone may yell at someone threaten to kill them, but no one minds because they are acting and the action takes place on a stage. The frame changes the meaning of the communication[Goffman, 1959, Goffman, 1974].

Siegfried Nadel [Nadel, 1957] wrote an influential book, *A Theory of Social Structure*, that looked at all of social structure as “networks” of roles. He differentiated between recruitment roles, those which people fill without their control; and achievement roles, which people work to achieve. In addition, he differentiated between sequential role, roles which we take one after the other; and correlative roles, roles within our in-group; and autonomous roles, roles with others. Finally, at the highest level there were roles with authority, a step that created a hierarchy in his view of social structure. Harrison White reanalyzed Nadel's ideas.

Our obvious course as analysts is to recognize distinct networks for different general types of messages (though within each type there will remain many priority choices, and so on), and to grant that concrete persons are imbedded in various combinations of such abstract networks. Integration of the different types is defined by the usage of real time. at the concrete nodes, their allocations of real time among types of networks [White, 1973, p. 46]

White points out that “.. as social scientists and everyday people we tend in talking about social organizations to adopt very quickly some particular abstract cultural perspective in which people are replaced by actors in role frames” [White, 1973, p. 45]. It becomes difficult for us to see people in other than the roles we expect them to play.

White and his students at Harvard analyzed roles within organizations using empirical data such as detailed records of movements of clergy Methodist ministries of the US. They coded these movements to discover regularities. Initially they theorized that the movement could be predicted by attributes of the occupants of the roles. As one role was vacated, another would be filled. Ultimately they showed that the best way to view the mobility was to consider the roles and the individuals separately [Breiger, 2005, White, 1970]. Conceptually, there are a finite set of available roles, much like rent controlled apartments in Manhattan or hermit crab shells[Chase, 1991]. In order for someone to move in, the slot has to become vacant. Conceiving of organizations as fixed slots with people moving between them helped make models that accurately reflected the behavior that was observed. Their models showed that role structure needed to be taken into account to

accurately describe people's behavior so human behavior needs to be considered as influenced by a network of influences.

Cause

In social science it can be difficult to determine cause and effect. For instance, there is an assumption that beliefs cause or, at least, guide actions. Doug McAdam did a long term study of the participants of Freedom Summer, a part of the US Civil Rights Movement. Young, white college students from the North went to the South to register black voters. It was a dangerous activity and a number were beaten and even killed. By interviewing the participants and carefully analyzing the patterns of their relationships he showed that strength of belief in the cause was not a predictor of involvement, but that involvement could be predicted by the number and intensity of ties to others who went [McAdam, 1986]. On the one hand, this might call into question the entire idea that a "persuasive message" but at the least it points to an additional way to test our theories of causality. In *Identity and Control*, Harrison White talks of our experience of the world as "accountings" or "stories." He is suggesting that we generally generate causes (in some sense following Hume [Hume, 1993]), something happens to us and then we explain it. These explanations are "what really happened" from our point of view. His claim is supported by experimental psychology and brain research:

...people have no direct access to their nonconscious dispositions and motives, they must construct a conscious self from other sources. The constructed self consists of life stories, possible selves, explicit motives, self-theories, and beliefs about the reasons for one's feelings and behaviors. [Wilson, 2004, p. 73]

Our stories about what happens and what happens seem to get blurred together and the stories must be constructed using language and elements available from the social world of which we are part.

Researchers looked at a number of possible causes of obesity in a large group of people over a 32 year period. Their conclusion was that social network relationships were the best predictor of who would become obese [Christakis and Fowler, 2007]. This study brings up an interesting issue, which is the relationship between influence and persuasion. It is unlikely in most cases that people persuade others to get fat (though there are communities where this happens). The social context of the target of persuasive messages needs to be taken into account, and, in the Freedom Summer case, the location in the network was more important than the

messages. In the case of obesity, the source of the message is not obvious. We need a better way of talking about influence.

Social Network

The concept of “social” networks provides a way to talk about multiple messages and allows for abstractions like roles. Social networks are networks of people, groups, organizations that we identify as things capable of interacting with other things. These networks can be represented as graphs with circles as nodes and lines between the circles. The drawing in Fig. #1, David Krackhardt’s “kite network,” represents possible relationships. It is not hard to see that different people have different “positions.” For instance, Jane and Fred are next to each other, but Ida is a considerable distance from Jane. Edward is connected to many people, and if Gail were gone, Howard and Ida would be completely disconnected. Using this physical analogy we can talk of different contexts for the individuals, but, what does the drawing represent in the real world?

The short answer is that it is a map of a social network. Currently the idea of “social graphs” has generated excitement [Economist, 2007]. Social graphs are drawings of contact relationships between users in “social networks” like Facebook. Though Facebook is new, the idea of drawing out social relationships is not. It originated with James Moreno in the 30’s with his idea of a “sociogram” [Freeman, 2004]. A sociogram is a map of individuals who have some relationship with each other. His theory was that “social configurations” affected the psychological well-being of individuals.

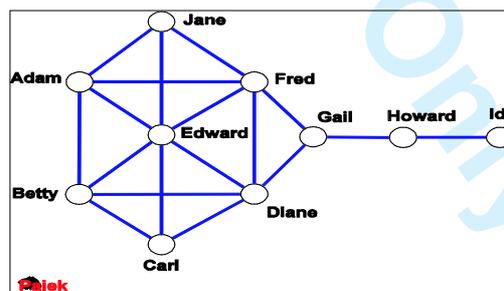


Fig. 1. Kite networks – David Krackhardt

A question that needs to be asked is: “do the patterns of relationships have any effect on individual attitudes and behavior?” Put another way the question is: “what are the sources of attitude and behavior?” Each node can be thought of as a physical symbol system, but the number and intensity of the messages will be different. Recall that persuasion can be considered to be

reprogramming of a node. Will multiple messages have more of an effect? Would a message from Howard to Gail prove more persuasive than one from Diane to Gail? Is it possible that Edward is so busy passing messages through that he does not have the resources to reprogram himself and thus be persuaded. What would help a persuasive message flow through the network and what would block it? In the nearly 80 years since Moreno first created his sociograms there have been countless research projects that help answer these questions, but social networks were mostly invisible. Now thanks to technology, they are becoming visible and can play a role in *captology*.

Though description of networks can become nuanced, with hundreds of ways of describing network or locations within networks, this paper will examine a few areas that relate to persuasion: diffusion, influence, roles and boundaries. Diffusion is the spread of innovations throughout networks, influence is network positions that are more influential in the spread of innovations, roles are positions where persuasive messages must be different, boundaries are area where persuasive messages need to change.

Diffusion

People learn from each other and we have increasingly complex organizations. In addition we adopt physical things that others use, a new cell phone, for instance. This process is called "diffusion." Diffusion through networks and society has been studied for a number of years. One aspect of it is the "innovation decision process" or the steps in its spread. .

knowledge (exposure to its existence, and understanding of its functions)

persuasion (the forming of a favorable attitude to it)

decision (commitment to its adoption)

implementation (putting it to use)

confirmation (reinforcement based on positive outcomes from it).[Rogers, 2003, P. 20]

Here "persuasion" is just an aspect of "innovation," but our earlier definition could include the first 4 items in this list. The innovations diffuse through a "social system." Recall that the networks of roles have been used to model "social structure". The terms "innovator," "early majority," are used to describe the rates of individual adoption. Innovation does not spread like a cold, from person to person, but through subnetworks or even disconnected roles [Burt, 1987]. The same message that might be persuasive in one context may not be, or even have the opposite effect, in another. These ideas help develop the concept of "social context." Innovators and influencers do not occupy the same locations in the networks and the content of the persuasive messages will need to be different.

A prominent researcher in the field of diffusion, Everett Rogers, describes categories, from innovators to laggards partially as locations in networks. For instance, Rogers' description of innovators, is that

.. their interest in new ideas leads them out of local circle of peer networks and into a more cosmopolite social relationships. Communications pattern and friendships among a clique of innovators are common, even though these individuals may be quite geographically distanced. [Rogers, 2003, p. 282]

Only a small percentage of people are innovators. As the innovation gets more widely adopted the next group is the "early majority adopters," who are far more numerous and "interact more frequently with their peers " [Rogers, 2003, p. 283]. This type of relationship is what is commonly thought of as a "core/periphery" relationship with the innovation moving from the outside to the denser core of communication relationships. People in the center of an organization already have many contacts, status and have little personal incentive to change, people on the periphery of the organizations may interact less with others in the organization and have a smaller stake in the status-quo. Over time the environment will change and the people at the center might find that doing things the same way no longer works and something that was being done on the periphery works better. The history of Silicon Valley has seen a succession of industries and it continues to reinvent itself by this process [Saxenian, 1996]. An example of an industry where the core stayed stable is the US tire industry [Sull, 2002]. Persuading someone at the core of a network to do something differently will be different than persuading someone at the periphery and network analysis is a way we can learn who is at the core and who is at the periphery. But, individuals are part of many networks.

Structural Equivalence and Roles

If part of interaction is with a role, then there needs to be a clear way of talking about roles. Roles can be describe by patterns of relationships [White and Lorrain, 1971] called "structural equivalence." To compute structurally equivalent sets, a network map is converted to an NxN array with nodes as indices on both dimensions. If there is a link between two nodes, then there is a non-zero value in the corresponding cell, otherwise zero. If two rows in the array are the same then the nodes are structurally equivalent. This takes our intuition of a "role" and turns it into something that has specific mathematical properties This allows us to operationalize the idea of a role into something tangible.

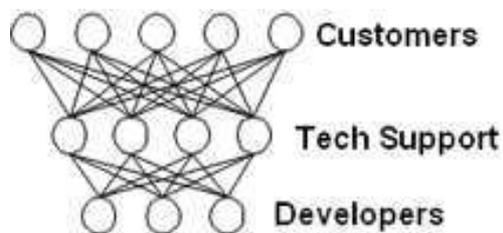


Fig. 2. – Structural Equivalence

were to be represented as an array, the rows on each level would be identical. There are many similar configurations in society such as professors, TA's and students; auto manufactures, auto dealers and customers. This type of pattern is called "structural equivalence" and research shows that people in the same "set" (who are at the same level) are often perceived as "similar" by observers [Michaelson and Contractor, 1992]. This observation is bolstered by a study by Ron Burt, from University of Chicago Business School.

Burt reanalyzed a study by James Coleman on diffusion of a medical innovation, tetracycline [Coleman et al., 1957]. He discovered that if he compared the hypothesis that the innovation spread by contact like a cold, to the hypothesis that innovation spread across structurally equivalent sets that structural equivalence was a far better predictor [Burt, 1987] of the spread of innovation. Though there is often homophily in groups, it make sense that CEO's would be more likely to adopt "innovations" by other CEOs than by lower level people. It is not clear how the information is transmitted, but structural equivalence provides a way of talking about roles that is measurable. The spread of innovations across structural equivalent sets does not require the members are in contact [Michaelson and Contractor, 1992]. Look at Fig. 2 again and you will see that the customers, the tech support and the developers do not have ties among themselves. We have ways of knowing a lot about what others like us are doing, through the media, gossip, conversation, stories and more.

Opinion Leaders

Another claim that has been made in researching the diffusion of innovation is that not all people are equally persuasive. There is a concept of "opinion leaders" or "influencers." These can be thought of as exceptionally persuasive individuals who have the ability to change the attitudes and behaviors of others. Rather than a specific personality type, it can be considered a special role that is relative to the group in which it is embedded. It is most likely that their influence is local. In diffusion of innovation research researchers have found that "interpersonal diffusion networks are mostly

It is not difficult to see in Figure #2 that even without assigning names to the nodes, the nodes on the top level have the same patterns of links to the nodes on the middle level and that pattern is repeated from the middle level to the bottom. If this

homophilous" [Rogers, 2003, p. 307]. Likewise, studies of social networks have repeatedly shown a tendency towards homophily [Granovetter, 1973, McPherson et al., 2001]. This means that they tend to be with people that are like them. A group may be disconnected from another and a message that has influence in one part of social space may have no influence in another. In fact, one group may define themselves as being different than another and the adoption of a behavior by one group may be a signal to oppose it in another. The point to keep in mind is that the influence can be looked at as a role within the group and not necessarily a quality of the individual.

Health promotion researcher Tom Valente at USC did a comprehensive study of different approaches to identifying influential individuals [Valente and Pumpuang, 2007]. Valente's group works with health promotion, an area where persuasive technology might provide real benefits. Of the 10 methods he evaluated, the most comprehensive is "sociometric" in which all of the respondents are asked to whom they go to for advice. This is a method that can be done much more easily with technology and overcome that it is "time consuming and expensive" because it has the advantage that it "may have high validity and reliability" [Valente and Pumpuang, 2007, p. 884]. There are reasons to believe that people who bridge between different parts of a network might be important as opinion leaders. A significant amount of research shows such people are more innovative [Burt, 2004, Hargadon, 2002, Obstfeld, 2005], they have better health [Cohen et al., 1997] and become more successful in a number of ways [Baker, 2000, Burt, 1992, Burt, 2005]. Excitingly, opinion leaders have high network centrality as well [Mehra et al., 2001].

Since, by definition, opinion leaders are persuasive, it is interesting to ask "is the persuasive power of opinion leaders due to their network centrality, or is their network centrality due to their persuasive abilities?" Evidence is that the role is a factor, so looking at persuasive messages independently of the role would be missing an important independent variable.

Social network analysis allows authors of persuasive technology to create multiple descriptions of the roles sender and receiver based on context. The roles of the sender and receiver are roles which can be discovered by structural equivalence. Opinion leaders are the people on the shortest path between others.

Separate components, disconnected networks, are important in persuasion as well, because often people form who they are, their identity, from group affiliation. A message from within the group has been found to be more persuasive than one from out of the group. In fact, the idea of "bottlenecks," "brokers" and "disconnected groups" are something that are common knowledge. But, as O'Keefe pointed out above, what we believe is going on and what actually is going on is not the same. Our perceptions of networks and their actual structure do not always coincide [Freeman, 1992, Krackhardt, 1987]. Thus, accurate measurement of the networks makes the analysis valuable. The data that is becoming available is making this possible.

Data sources and social networking

Social network data is difficult to gather and analyze. Some techniques go back to the 60's. There are many types of analysis. Useful graphical visualization is less than 10 years old. Some of the measurements are not computationally complex, but others require exponential time to process. As with many such problems algorithms can and have been developed that throw away improbably cases and reduce the computation time but often the solutions are not obvious.

Data is traditionally gathered by surveys of the type "who are your friends?" "Who do you go to for advice about your job?" "Who do you talk to more than 3 time a week?" and so on. These are error prone and researchers will find people who nominate someone as a friend and the nomination is not reciprocated. The researchers need to go back to the individuals and determine if it is a one way friendship or a memory error. This can be time consuming. Some of the most important things we can find about a network, like disconnect between groups or groups connected by a single gatekeeper are sensitive to accuracy. If a single link is missing the results can give a distorted picture.

Over the last few years there have been more and more papers analyzing network traffic by using traces from email and cell phones [Onnela et al., 2007, Tyler et al., 2005]. Potentially this can be done with social networking sites and IM as well. A question that arises is "how do these relate to each other?" One way to think about it is to remember that the real network is the people that communicate with each other. IM, cell phones, social networking software are all tools to make that happen more easily. In the past, it was only possible to discover a tiny amount of this communication. When Stanley Milgram did his famous small world experiment and discovered we are separated by 6 degrees of separation in 1967 [Travers and Milgram, 1969], no one had a good idea what the large scale patterns of connections between people were like. The idea of using computers for collaboration and hypertext, which are the roots of the current social networking software, goes back to 1945 and Vannevar Bush [Bush, 1945]. These developments are mostly independent of the social structure of the people using the software [Wellman, 1996].

A large company, say IBM or Oracle, could have a huge amount of communication. "Social networking" software is relatively easy to write and there is no reason that these companies could not have internal versions of something like Facebook. In this situation all of the data belongs to the company so they can use it for social network analysis.

Cell phone companies are already doing this. An Austrian cell phone company hired network researchers FAS Research to analyze their phone networks. The privacy issue was dealt with by giving FAS anonymized data,

with all the names converted to numbers. FAS identified customers with many connections into other networks, those with none, and those with few. Instead of offering all customers the same incentives (persuasive messages) they offered those with many in other networks price breaks so they would not defect, those with few in other networks incentives to bring the others into the network and those with no connections into other networks were offered no incentives. This is a simple example of using knowledge of networks, network awareness, as a way to craft persuasive messages.

Without knowing the contents of an email message, it might give the wrong impression. Is it a gratuitous CC, hate mail, or a link of advice or friendship? This is also true with phone conversations and IM. Social networking software like *ing* allows users to create networks based on their interest groups and allows for more natural affiliation. This is something that is possible to do within organizations and, in fact, has been being done since 1979 with the birth of Usenet [Hauben, 1995]. From one perspective, each interest group is a separate network. If the networks are added together, we get a communication network, who talks to who, which is valuable in itself [Monge and Contractor, 2003]. However, the idea of a role is context dependent and the interpretation of a persuasive message will vary based on the role. An individual might be the head of household and her messages would be persuasive to her children, but at work she might have low status and simply perform assigned tasks. The way she would craft persuasive messages would be different in the different contexts, the idea we are all members of multiple networks, mentioned above. Ideally, persuasive technology would allow us to realize that people have different roles in different contexts and use that information for more persuasive messages.

The more network data there is, the more this can be done. It is easy to think of reasons for and against integrating more network data including better recommendations, collaboration, and health on the one hand and intrusion, unwillingness to share data and other realities on the other. Within organizations, it is not a problem. The fact is that the network data on people is growing and the opportunity to use it is expanded.

A Representative Case

A dramatic example of looking at the roles instead of the individuals to solve a problem in an organization can be seen in solving a labor dispute in a wood processing facility [Michael, 1997]. When a new management team proposed changes to the worker's compensation packages the workers did not accept and called a strike.

After a long period of stalemate, the management hired a communication consultant to analyze the communication structure among the employees.

They did not feel that the union representatives had communicated their proposal accurately to all of the employees. The consultant created a map of the communication about the strike by creating a survey asking each of the members of the organization to list their colleagues and rate how often they spoke to them about the strike on a five point scale ranging from “almost never” (less than once a week) to “very frequently” (several times a day). The consultant then used the values of 3 or above to create the map in Fig. 3.

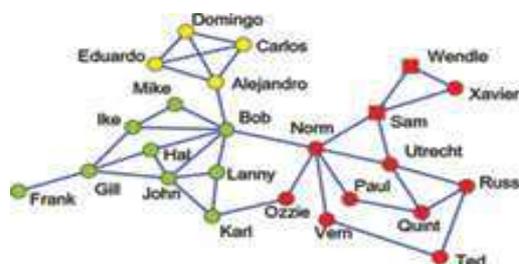


Fig. 3. Strike at a paper plant

The drawing shows a clear separation into three groups, the one connected by a single link to the rest at the top is the Spanish speaking employees. Alejandro speaks the best English of the group, and Bob speaks some Spanish. The group on the lower left is the younger employees and Ozzie is Karl's father. Bob owes

Norm for getting his job. However, it is clear from the picture that the younger and older employees do not have that much contact, with all information going through Norm.

The two nodes that are represented as squares, Wendle and Sam are the union representatives, but they rarely discussed the management proposal with most of the people in the networks. When Norm and Bob were brought together with the management and the situation was explained, the strike was settled in a matter of days.

In this case, the management was trying to create a persuasive message “accept the new plan,” but they were not delivering it to the right people. We do not know that the attitudes or mental models of the employees are, that was not documented in the article. We do know the social context of the union representatives and of Bob. In this case, that knowledge was enough to create the appropriate message. This is a simple example of how network awareness can help craft better persuasive messages. The way that the data was gathered was low tech, but new data sources are changing this. Social context and network awareness can be an important part of future persuasive tools.

Summary and conclusion

By definition a persuasive message needs a context. This paper argues that individuals are getting multiple messages and that their place in the communication patterns is part of who they 'are.' Social network analysis gives a way of defining context. The paper explains these properties and gives case studies of persuasive messages that became successful because of the better understanding of the context. While much persuasive technology focuses on dyadic interaction between the user and the artifact, This paper propose that behind the scene assistance would provide value. Just as a restaurant recommendation from one's cell phone would be far more valuable if it is in the vicinity of the restaurant, knowing a user's social location can enhance persuasive messages. New technology is making this possible.

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Donald (Don) Steiny is a scientist and businessperson who is devoted to seeing these issues more clearly so that we can make better guesses about our future. He writes and speaks on this subject both as an academic and evangelist.