Questions from University at Buffalo students in COM500, Fall 2008

Dr. Woelfel's responses are in red...

1: How has Galileo changed over the years? It seems in early readings to be more of a theory or way of thinking and it has now developed into a program of analysis. Can you explain how it is best used?

Justification: Just trying to better understand what Galileo is.

Galileo theory grew out of my attempt to understand how science works. In the beginning, I just did what I learned in grad school, but I could see some things worked better than others. Well-measured variables, for example, worked better than categorical scales such as Likert scales. I began to understand what needed to be done, but the social science toolkit lacked the necessary tools, so, over the years, I either made them or had them made for me.

2: The articles on the site use Galileo to study interpersonal, organizational and intercultural communication among other things. Do you think it can be used to study any type of communication issue? Is it only used with networks? Was it designed with a specific purpose in mind?

Justification: I think it's great to have a tool that has such a variety of use, I was just wondering if it has any limitations or if there is a best use for it.

All tools are limited and Galileo is no exception. It requires an understanding of how science works and not many social scientists have that.

3: How do you account for cognitive processes and consciousness in the network analysis? This is mentioned in the general theory article.

Justification: It seems that networks are based on more tangible factors. I'm interested to see how cognitive processes fit into this.

In my view, cognitive processes are what networks do. Most scholars tend to think of networks in terms of their effect on the individuals in them, but sociologists like myself are more interested in the network as a whole. Networks are devices that process information; they can detect, store and retrieve patterns of information. The flow of these patterns through the network over time is what I mean by cognitive processes.

4: Is Professor Woelfel the first thinker since Mead (Interactionist theory) to articulate a network theory?

Justification: It appears that his paper on network theory is seminal rather than derivative.

As a sociologist, I believe that the source of ideas is the society, not the individual, so I can't accept my ideas as originating with myself. The network model is implicit in the sociological perspective, I think, and follows from my early research on the effect of significant others on the attitudes and beliefs of individuals.

5: Do you see your network models as static nodes or rhythmic flows?
Justification: The flow of energy you speak of in your theory paper appears to be related to the ancient Greek concept of "rhythmos" or flow. If "rhythm" as used in modern Eurhythmics theory (Jacques-Dalcroze) pertains to the "quality of movement," it seems your use of the term predicts you will explore the quality of the energy flows themselves. Yet focusing on the nodes, rather than the nuances of flow between them, seems to bypass the very intent of your Newtonian-tinged formula of "energy in space as a function of time."

Good insight. The theory definitely focuses on rhythmic flow. Each paper, of course, has a specific focus but overall my work focuses on the overall network and not on the individual nodes. Cognitive processes take place in the network of interconnected nodes and only tiny fragments of these processes pass through any individual node. These tiny fragments are the cognitive processes ("thoughts") of individuals, which are generated by, and are consequences of, the overall system wide processes. This idea is already clearly articulated in Durkheim's notion of collective representations and conscience colectif.

Catpac, Listiac and my other neural network technologies are results of this thinking: the patterns in any ongoing flow of information are detected by the network, not the nodes. Consider a stadium filled with people who hold a cardboard square, black on one side and white on the other. According to a prearranged plan, selected individuals hold up the white side, while others hold up the black. The result is a pattern that can be read from the sky – perhaps "Go Bills! – but no individual need have any idea what the overall pattern says.

6: In what ways is your theory of measurement simpler than that used by the majority of scholars in communication?

Justification: Your paper on the *Foundations of cognitive theory* suggests that simplicity is a fifth requirement for ensuring that variability of observations because of ambiguity does not occur. It appears that the communication community has not yet fully accepted your measurement ideas. I wonder if the community perceives them as simpler or even too simple. If so, I wonder if they see this as the theory's strength or weakness.

As Einstein says, every theory should be made as simple as possible, and no simpler. Simplicity is only one of the requirements, and, given that the other four are met equally, the simpler model is preferable, but simplicity cannot be the sole criteria. My brother's General Theory of Causality – "it's either that or something else" – is very simple, but useless.

I don't have a theory of measurement – I accept the definition of measurement used in physical science and engineering without modification: measurement is comparison to some standard. What is called measurement in the social sciences does not meet this definition.

Every scholar at some time in his/her career has to decide whether to be a soldier or a scholar. I've chosen to be a scientist, and don't worry about convincing others to adopt my model. I suspect Communication as a discipline will never rise to the level of science, but that the subject matter currently studied by Communication will be taken over by scientists and engineers in the future as they expand their horizons to those topics. Or not. Que Sera, Sera.

PS: Were you a Marxist when you wrote the 1982 Yugoslav paper?

To some extent, all sociologists are Marxists, since he's one of the founders of sociology as a discipline. From Marx we understand that most aspects of individual life are determined by social structural factors rather than the naïve notion of Adam Smith that individual rational behavior drives social organization. But I've never been a political activist of any kind – I'm just a scientist. I wrote the paper while I was a Fulbright scholar in Yugoslavia…

7: (re: *Hiding the world with bad measurement*) What is the equivalent of a functional metric system then for social scientists?

Justification: Sure the likert scale has limitations, but what is a better system?

There is only one measurement system in science – comparison to some standard. Social scientists, such as S. S. Stevens, Suppes and Zinnes, and others have argued that social science requires a different form of measurement. The burden of proof, of course, rests with the affirmative, and nearly a hundred years of Steven's four kinds of scales have failed to produce much in the way of useful results. That's why our theories are so chaotic. We have created a social reality but it is a confused and incoherent reality.

8: (re: *Hiding the world with bad measurement*) The study (though proving a good point) is weighted unevenly. The comparison to change and celestial objects as compared to what a social scientist measures are not equivalent. Measuring the size of something, like you can with a ruler, is not the same as measuring an emotional state or a personality trait. How do you rectify the difference?

Justification: Even if a 'metric' scale did exist for social science, I would assume it to be

cumbersome- what would be the measure? a numerical based scale? could it be based on colors- like could I feel 'greenish yellow' today, the equivalent of a 23.6 out of a possible 37 for emotional contentedness? Suggesting and noting the deficiency is well and good, but I would think that to try to generate a finer scale would be ineffectual as people tend to respond in 'extremes' . look at professor evaluations- I'm sure professors are either the best, the worst, or the exact middle- with little variation from those 3. I don't care what scale you put that on, I bet people will carve it up into such a narrow range of options.

I don't agree. There's no difference between measuring how I feel today and measuring time. If you think there is a difference, what is it? Of course precise measurement of human variables will be cumbersome. Science is difficult. My experience has been that those social scientists who think measuring physical variables is inherently easier than measuring psychological and cultural variables have little or no experience measuring meaningful physical variables.

The question of whether students will bunch evaluations of faculty if provided with precise scales is decidable by observations--but only if precise scales are provided. If you continue to use the five point scales, you'll never know, will you?

9: (*Assessing people's perceptions of forests*) How does this study shake out when analyzing western people?

Justification: instead of using tribes, I bet a sampling of persons from Appalachia as opposed to Manhattan would yield interesting results. From my time in NYC I found many people fabricated a false sense of closeness to nature (fake nature as I call it) who did not value conservation so much as presentation. I'd be interested to see which group has a more realistic view of conservationism for areas outside of their immediate vicinity.

A good question. I don't know the answer, further research is needed!

10: What are your thoughts about studying college retention and attrition from a communication network perspective? How would you differentiate a communication network from a social network?

Justification: Not only have you done a lot of research regarding communication and social networks, but you have also studied the role of significant others in regards to educational attainment and achievement. I am interested in looking at social support networks in regards to college retention, and I am wondering why it has not been looked at more in a quantitative sense.

I suspect that the largest factors determining students' performance in college are interpersonal. I suspect that the difference between social networks and communication networks is that different communities of scholars call them by different names. In sociology we referred to networks as "social structure" long before the term

"social networks" was coined and long before the discipline we call Communication was founded. The terminology I would have used would be to say that any individual's performance in college would be mainly influenced by the expectations of his or her significant others. You might refer to them as nodes in his/her social network. Le meme chose.

11: Many of the questions from my colleagues involve getting a better understanding of Galileo. Unfortunately, my question is right in line with those of my colleagues. Is Galileo a measurement tool? What were the goals of the creation of the website?

Justification: Unfortunately, I could not open *The measurement of communication processes: Galileo theory and method* on my computer (it appeared as a .zip), so my question might seem ignorant, and I apologize for that.

The human brain works by clumping similar things together and labeling them so they can be considered one thing. Galileo is not one thing. First of all, it represents my belief that there is only one science and only one scientific method. Since the overwhelming majority of social scientists disagree with me, it was necessary to create all the measurement and analysis tools since they didn't exist in SAS or SPSS. So Galileo consists of a philosophical position, a method of inquiry, a set of measurement instruments and analysis software. All the above.

12: What is your best advice for new researchers as they attempt to critically evaluate research tools?

Justification: As I work on my literature review for Dr. Barnett's class, I am often stumped in regards to how to critically identify weaknesses in research measurements.

Don't believe anyone, least of all me. Do the work and make sure you understand. Don't take anyone's word for anything. If you don't understand it, understand that you don't understand it and work on it later. You have a whole lifetime to learn. Have no respect for authority. Study the history of your discipline and its relation to other disciplines. Disrespect disciplinary boundaries. Be radical, be rigorous, and be resilient. Learn who the original protagonists were and understand why they favored the views they espoused. Don't trust them. Ask questions. Email the people you're studying if you're uncertain. Ask for help.

When you go to conferences, skip the sessions, and try to meet people you want to learn from in the corridors; if there's an interesting paper you want to hear, ask the author to give you a copy. If there's a particular theorist or researcher whose work you want to know better, ask them to meet with you or catch them in the hall and ask if they've got a minute. Ask if it's OK to email further questions. If a famous person won't help you, he/she is often covering up something.

Go to conferences outside your field. Ignore disciplinary boundaries.

On a technical level, the best way to measure the precision of a scale is to compute its standard error. In general, the mean value of measurements made with the scale are accurate to within plus or minus one standard error. But of course, you can get a standard error of zero with a broken clock, eh? So you need to know how much information the scale produces. You can calculate this from the equation H=lnX/ln2, where H= information in bits, lnX is the natural logarithm of the number of possible outcomes of the scale (a five point scale has 5 possible outcomes, eh?) and ln2 is the natural logarithm of 2. If a scale is perfectly accurate, but produces no information, what good is it?

13: Since objects, attitudes and beliefs all change over time, how consistent is the Galileo System in terms of measurement?

Justification: If the Galileo System was used to measure potential election results by asking participants how they felt towards a presidential candidate, a problem arises because the participant and the presidential candidate are two objects that are constantly changing. The candidate is performing actions that yield positive and/or negative results various times in a single day. Furthermore, the participant could rate the candidate higher or lower on a scale depending on their mood at the precise moment. Accordingly, wouldn't the beliefs and attitudes be inappropriately measured?

A great question. Galileo was developed precisely to deal with process and change. To measure process you need a comparative standard that remains the same over time, such as the meter or second. “Strongly agree” doesn’t make it because it’s meaning depends on what you are agreeing to.

Of course, nothing in nature is completely invariant over time, but some things are more stable than others. Setting your standard measure of distance, for example, as 1/1000th of the width of the Nile River, obviously wouldn’t do, since its width varies substantially by season and by year.

After having made a choice of standard, we compare all other distances to that standard and do so repeatedly over time. In my undergraduate methods class this fall, for example, we measured the distances among the candidates, issues and voters every day for eight weeks. We can watch the candidates move closer to and further from the average voter’s position day by day, and even relate these changes to events on a day by day basis.

14: In reference to the Galileo System article, the second principle of the Galileo Model states that "all measurement consists of comparison to some standard" (2006) Is it safe to assume then, that an object does not have a measurement if there is no standard to compare it to? Are there such objects that exist(ed)?

Justification: An attempt to gain a better understanding of the core principles of the Galileo Theory.

Standards are all human artifacts. We make them up, and agree to abide by them. There are many, many objects for which we have reached no such agreement and these objects appear inscrutable to us. Even though society as a whole hasn't agreed to a standard, however, it is still possible to choose a standard all by yourself for a specific study--as long as you communicate precisely what standard you have chosen so that another investigator can also apply the same standard. When a number of such arbitrary standards have been proposed, we can meet and fight it out.

15: What are your thoughts in terms of the Galileo System and creating shared standards of comparison?

Justification: People maintain different opinions of how cognitive thoughts are measured. Thus, it would prove difficult for the Galileo System even with already existing measurements such as the Likert scale to create shared standards of comparison using questionnaires.

The world community of Galileo scientists numbers in the dozens. Within this group, common standards of comparison exist. If the group prospers and expands, so will the standards; if we crash and burn, we'll have to wait a while longer.

16: How would think that Galileo programs have to change or upload many times?

Justification: I think that the patterns of research or study changed through time changed. So, sometimes, this program couldn't cover all.

The Galileo program has been in constant development since 1969. The current version is Galileo Version 5.6, which will give you an idea of how many times it's been updated.

17: Can the Galileo programs analysis focused on emotional response?

Justification: The Galileo program focuses on human feeling and thought in studying cognitive and cultural processes scientifically.

One of the topics most frequently studied by Galileo methods is human emotion. Hao Chen is currently doing his doctoral research on emotion.

18: What is the basic knowledge to understand the Galileo model based on mathematical process?

Justification: Is it related to any other similar bases with mathematical process such as network base?
Galileo uses the same model as mechanics, which is the study of motion of points in space. The math is basically linear algebra, calculus, tensor analysis and Riemann surfaces.

19: What advice would you pass on to us as we either begin or continue to conduct studies in the field of social science? How might we avoid the concept explored in *Hiding the World with (Bad) Measurement*?

Justification: The concept addressed in this article, that of creating a study that actually hinders the subjects of the experiment from expressing the breadth of their knowledge, strikes me as a critical subject that we should learn more about so that we might prevent it from happening in our research.

Each of you has to decide personally why you're doing this. If you're looking to establish a nice career, you can't afford to be too radical, at least not at first. But I don't think that society at large is comfortable with the fact that the social sciences in general and Communication in particular haven't found out much of importance in the last hundred years and I suspect they won't put up with it much longer. So there's some pressure to get better.

Social scientists are often critical of society and its political and economic structures and processes, and frequently are even more critical of alternative methodologies. But, overwhelmingly, they are uncritical of their own assumptions, theories, and methods.

That means you have to know how science actually works and you can only find this out from actual scientists. Read the great scientists: Einstein, Mach, Bohr, Feynman. Don't read about them, read them. Be radical, because the social sciences will die if they don't improve radically. Be rigorous, because radicals are exposed to much harsher scrutiny. And be resilient, because you will get hurt from time to time.

If I were starting out today, I would use only real measurement, i.e., comparison to some standard. But I wouldn't argue for it, I would just use it. It's legitimate and when you show that it worked well by presenting small standard errors and good results it will be tough for editors to recommend you go back to the traditional junk. If you ever do a Galileo study, don't justify it. Many have been done and published in top journals in many fields so there's no need to take a defensive approach. Reviewers are deathly afraid of making a mistake and publishing something heretical, so they shy away from anything unusual. Don't call attention to your procedures.

20, Justification:

Often, if an article is published in an international journal in one language, it is not available for translation into another. If Wölfpak could be used to translate these pages, it could open the world of academic research on a new global level.

What impact will a program like Wölfpak have on the international sharing of academic writing? Has it been used for this purpose? Is it a program that students and researchers could use (i.e. is specific computer training required)?

Wölfpak hasn't really been released to the public yet, but we get to use it here at Buffalo. It depends on how my son Joe, the author, decides to allow it to be used. But I think it has a lot of potential for cross cultural understanding.

21: How are the academic papers shown on this link related to the software package on the Galileo main site? Were all of these papers written using Galileo?

Justification: I think I have a basic grasp on the concept of the software being marketed on the Galileo site. However, I am confused about the listing of the articles. They are a diverse and interesting collection, and I would like to know more about how they relate to Galileo.

Galileo software was written to fill in the blanks where social science software such as SAS and SPSS leaves gaps. Many of the papers use some of the suite of programs in Galileo, and others don't.

22: How long had you had the idea for Galileo programs before you created it?

Justification: Was it a long time ambition or did you just work into it?

I'm not finished creating it yet! I've been working on it since I worked on the Wisconsin Significant Other project from 1966-1968. As it developed, I grew more aware of what was needed, and so my concept of the overall system changed – and continues to change – as I learn more. We're running a large analysis of the last presidential election now, and every day we discover ways to improve the overall system.

23. Did the "oneness" theory of ancient philosophers influence you or does it just help to explain your theory?

Justification: *Galileo as a cognitive system* article.

I spent parts of seven years at the East West Center in Honolulu, and learned a great deal from my Asian colleagues. Their thinking has had a very deep effect on me.

24. Do you think of new ways to look at networks because the ones that exist are inadequate? Also, do researches that use the theories that are widely used accept new ones?

Justification: The theory of intelligent network research is very interesting and I don't think I have read about it before.

Intellectuals are strongly disciplined as part of their socialization process and so are usually quite resistant to new ideas. I personally study only from personal curiosity and often find the need to improve existing methods or develop new ones. But I have no interest in persuading others to use my methods at all. I will, however, help anyone who does want to learn to use them.

25: Can the cyclical pattern of behavior in capitalist systems predicted by Marxian theory influence the communication process?

Justification: Different needs require different ways to reach its goals. The communication process will adapt and evolve according to objectives.

Marx's theory is a communication theory. What does "ownership" mean? It means that society believes your claim to property, and will act to protect it for you. So, if you try to seize my car, I can call the police and they, believing my claim is legitimate, will make you give it back. If my workers try to take my factory, the army, who believe my claim to be legitimate, will come and crush the workers.

But they will only do so if they believe my claim is legitimate. The intellectuals and fallen capitalists, in Marx's view, try to convince the proletariat that the owners' claims are not legitimate. This is a communication process. If they succeed, when the workers come to tear down the walls and the owners call the army, the army won't come.

26: How do changes in Labor profile from industrial to service provider affect communication process?

Justification: The way to communicate service (customized) is expected to be different from the industrial age (mass market).

I believe, from Marx's perspective, there is no difference. Control over the means of production is the only variable that matters in Marx's theory. Neither laborers nor service providers have control over their means of production.

27: What are next changes in communication process following the cycles of Marx behavior cycle?

Justification: I would be interested in understanding which phase we are currently in and how have communication processes changed along these cycles

I personally tend to think in terms of continua rather than stages. I believe that we have been most recently in a period of consolidating social capital and increasing aristocracy, although Obama's election might signal a shift back toward democratization. But I have very little to go on and might be completely wrong.

28: What theory did you have in mind if any, in the measurement of online communities in comparison with the offline groups?

Justification: Given the importance of theory to researchers, did you have a theoretical framework in mind? I am curious to know how it evolved in your book "Measurement of Communications".

That excellent research project was entirely the work of Devan Rosen, and I only provided a few tools to help out. You should ask Devan directly, because he's a very smart guy and eager to help. Email him in Hawaii and he'll be happy to hear from you.

[as a ub student you can access Devan's 2003 paper *Procedures for Analyses of Online Communities* at http://jcmc.indiana.edu.gate.lib.buffalo.edu/vol8/issue4/rosen.html]

29: What motivated you to take on the suite of Galileo programs?

Justification: Technological advances take time to evolve and stabilize. This software is now used worldwide in academic, political and private sector for research and measurement.

I directed a research project at the University of Wisconsin under Archie Haller. It was the first research that identified adolescents' significant others and measured their expectations for those adolescents. As the project neared its scheduled end, we still hadn't solved the methodological problems associated with the fact that the adolescents had different numbers of significant others. No one knew how to analyze data with a variable number of variables per case. So we averaged the expectations of the significant others for each individual to create one variable. Surprisingly, this worked extremely well, but none of us knew why.

As I studied the equation for averages, and for changes of average given new data, I saw that the equation took on the form of a velocity. Puzzling! This implied movement through some space, but what space?

Having no pride, I began to ask everyone who might be expected to know. Charles Osgood of semantic differential fame was at Illinois – where I worked after I graduated from Wisconsin – but he didn't really know how it was done. His graduate student, Stuart Umpelby, was much more helpful, but he didn't really know either.

Some statisticians at SOUPAC – Illinois' Statistics Software group: Statistically Oriented Users Package – suggested using unstandardized factor analysis, which could be accomplished using SOUPAC. Gail Wisan tried this in her dissertation (available on the Galileo website) and it worked well, but later, when I moved to Michigan State and the Communication Department there, there was no SOUPAC, so we had to write our own software. Kim Serota, who later became one of the top market researchers in the world, started writing the first Galileo program in FORTRAN, then discovered a brilliant undergraduate named Richard A. Holmes, who then continued developing the FORTRAN code until his untimely death. Since then, many, many people have worked on the software, and work continues today. Mainly, as people work with the software on different studies, we change it to do things they need done. We only provide software that does things that can't be done by existing software.

In 1989, two of my good friends, Nick Stoyanoff and Scott Danielsen, were keen to start a private company to work in marketing and advertising research and so formed Terra Research and Computing Company. At this time, the software was repackaged and made commercially available. Although Nick and Scott have now gone on to be very successful in other companies, The Galileo Company, which was founded in 1973 to

control the rights to the Galileo software, continues to make the software available mainly to students and faculty around the world.

30: What part does culture play in established "belief"?

Justification: Established belief may have evolved over generations and been reinforced by the prevailing culture. In your articles, *Mass Communication & Belief Change* and *Belief change & accumulated information*, culture was not one of the variables tested. I am curious to know if culture plays a significant role or not in established belief.

That's a terrific question. A thick book wouldn't be enough to answer it. The two papers you mention are basically social-psychological, focusing on the structural impacts of society on the individual. On a properly sociological level, culture represents the collective attitudes and beliefs of society as a whole. The culture takes priority over individuals. Every hundred years or so, every individual in society is replaced, yet culture goes on pretty much unchanged. Culture is the "mind" of the world network of individuals, what sociologists would call "social structure." It is the source of ideas and the determinant of what individuals feel and believe.

31: How has the media's effects on society's attitudes and beliefs changed since your paper, "Media and Interpersonal Effects on Attitude and Formation"? What role has the internet played in this societal formation?

Justification: Different forms of media are continuously being produced and I am interested in the ways the media effects have evolved over time.

Boy, I wish I knew. That's one of the great questions of our time, and it can only be answered by much, much more observation.

32: Do you feel the media sets the agenda for how we think and behave or vice versa?

Justification: Several studies such as Innis (1950) suggested a cause-effect way of thinking ascribed by the media. Is it the media that forms our values, beliefs, and opinions or is it the other way around?

The media are just that – media. Information flows through them, it doesn't originate with them. I believe that the source of information is the collective consciousness, as did Emile Durkheim.

33: In regards to your studies on political communication, do you feel voters simply rely on their disposition system and vote out of habit and commitment to party affiliation?

Justification: Currently doing research on this and am curious for your opinion...

I think voting behavior is based on one's self-concept, which, in turn, is given by one's position relative to certain key concepts or "objects". What these are in any given

election needs to be established by research. I believe people vote for candidates they perceive as being closest to their own position in the space defined by those objects. We've done an extensive study of this year's presidential election. You can get all the information from me if you send me an email

34: It seems evident that one of the most popular survey tools in the social sciences, the Likert-type interval scale is a method with highly questionable validity and substantial measurement error. Woelfel's (2007) piece titled "Hiding the world with (bad) measurement" is only one such instance of a legitimate criticism. Why do you think that so little effort is directed into improving our measurement tools, especially in a time where technological, computational and theoretical advancements allow us to make the leap?

Justification: This discussion question suggests the idea that in social science, consistency and complacency with established pseudoscientific methods is preferred to a true and necessary reevaluation of the methodology we have been using in order to more closely align the discipline to normal science.

As a sociologist, I see culture as preceding the individual. The idea that human communication phenomena are not measurable in the same way as "physical" phenomena is a core cultural belief, and young people socialized into the discipline are socialized into these beliefs. There are two important subcultures: One subculture, the quantitative group, sees this as an unfortunate reality. The other, the qualitative group, sees this as a positive virtue, a proof of the sacred character of human beings and a symbol of their superiority over the merely "physical" scientists.

In the absence of precise measurement and analysis tools, these values are immunized against modifications resulting from experience. Of course, here and there evidence pops up that precise measurement is possible and even useful and some people's attitudes and beliefs are changed. But, since those people are located in an existing social structure, patterned information flows within that structure change the attitudes back to their equilibrium position soon enough.

As in any society, gatekeepers (priests, rabbis, shamans, and, in this case, editors) suppress heretical statements so that the culture is preserved unchanged.

35: The first time I had encountered the concept of networks with nodes and links of differing distances and strengths was in a cognitive psychology course, and it was used in the intra-individual representation of semantic concepts. Has the strong association of networks with cognitive science helped or hindered the advance of network analyses in increasingly disparate fields and applications.

Justification: A particular application of model can both popularize and legitimize it, but at the same time become so salient that it limits thought as to other possible applications.

Cognitive science is a latecomer to network analysis. Most of the heavy lifting was already done by sociologists, anthropologists, communication scientists, mathematicians, physicists and others long before cognitive science emerged as a discipline. Communication has played a much larger role in the formation of the social network literature than cognitive science, whose influence is not large. But I'm no expert on social network analysis, by any means, so I may be wrong.

On the other hand, Communication as a discipline has strongly borrowed from psychology, and it's psychological bias is a serious handicap to understanding communication. That psychological perspective is rooted in Aristotle. With foundational influences from Aristotle's Rhetoric and Psychology, Communication as a discipline struggles with any kind of sociological perspective.

36: One of the most interesting pieces on the website is titled "A cognitive theory of collective consciousness". The strong dominance of individualistic cognitive psychology and its assumptions makes us blind to the possibility of a collective consciousness, not only as a concept but one which can be validly measured. However one of the main difficulties with such ideas is that science is also primarily concerned with establishing causation – how can we establish that a collective consciousness is caused and furthermore that it is capable of causing an effect on individuals?

Justification: Network analysis seems an excellent tool that is able to describe with great accuracy a state of affairs in the world. Can it help us however determine why a certain state of affairs came about or predict how it may change in the future? What do we do with the problem of causation?

Scientists haven't believed in causation since the late nineteenth century. Einstein's theoretical work and a century of experimental and observational research since then have shown that not even the temporal sequence of events can be established as an invariant independent of the frames of reference of the observers, so that makes discussions of causality moot. Instead, science focuses on finding transformations which can transform the observations as experienced in one reference frame into the observations as experienced in any alternative frame.

Most social scientists, Communication scientists included, have not participated in the science of the 20th century and still hold to an obsolete model of causality.

But consider the following experiment, now repeated many times, and easy to do yourself: write a one-paragraph description of any arbitrary room. Make a Galileo questionnaire asking respondents to estimate the distances among the objects in the room. Read the paragraph to a group of people (the more people the more precise the results, but ten or so will do). After they've heard the paragraph read (or read it themselves) have them fill out the questionnaire. Then have each of them draw their conception of the room.

None of the rooms will be even approximately right unless there's a remarkably perceptive person in the room. But the picture made by the Galileo program will be correct. None of the individuals knows what the room looks like, but the collective consciousness of even a small group does.

This is what sociologists mean when they say that concepts originate in the collective consciousness and are only later communicated to individuals.