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# To construct or to reveal? Network analysis as formalising communication

**Wigand, R.** (1977). Some recent developments in organizational communication: Network analysis – A systemic representation of communication relationships. *Communications, 3*(2), 181–200. https://doi.org/10.1515/comm.1977.3.2.181

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**Abstract:** Social network analysis was forged from a need for bottom-up analysis that looked to the specific interactions between individuals rather than a top-down focus on larger abstract social systems. It started via graph theory, progressed through communication and sociology, and now infuses the very platforms we use for modern communication systems. While networks represent a powerful tool, they also have power in their own right as systematising devices. It is not only academics who have learned from networks, but also platform maintainers; Facebook, X, and LinkedIn are all networks of data representing people after all. With advances in modelling and visualisation, we should ask not only what the networks can tell us, but also whether the networks constrain us and our communication. By reviewing Rolf Wigand's 1977 piece "Some Recent Developments in Organizational Communication: Network Analysis – A Systemic Representation of Communication Relationships," we can reflect both on the advances in networks in the last 50 years but also the consequences of these advances for political polarisation, misinformation, and governance.

**Keywords:** social network analysis, network performativity, communication platforms, network visualisation, social media

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# 1 Introduction

Networks, Barry Wellman said, are a paradigm rather than a methodology (1988). Fifty years ago, Rolf Wigand wrote an article taking stock of this emerging paradigm and its potential for organisational communication (1977). The article itself was an early note from Wigand in what would be a career defined by networks and the datafication of communication. In this early note, we see the emergence of a focus on communication networks derived from behavioural traces or reported sentiments, one that would take computational power to fully realise.

Wigand's article opens with a claim that to study communication it can be sufficient, in many contexts, to look not to the function of communication but to its forms. He then makes the claim that "[the] problem is, however, that a specification of how to find parts or units of formative process' has not been adequately established and constitutes today one of the major issues in systems theory" (1977, p. 181). This sets up a framework in which network analysis is seen as an attempt to overcome the challenge of how to study the form of communication to better understand the communication process.

Fifty years on we can look back on Wigand's provocation and take stock of this answer: Has network analysis, as envisioned here, helped effectively to study the form of communication? For many the answer is a resounding yes. Networks have not merely been a useful tool but an exploding paradigm of approaches to map, model, and intervene in communication (Lazer et al., 2009). My answer, however, remains slightly more guarded. While network have become a remarkably pervasive feature of the study of communication, both as metaphor and method, I fear that their success could blind us to their performative power rather than their analytical rigor.

To suggest that networks have performative power, I mean that they do not merely describe the communication in a social system but rather shape it. In this I am not simply suggesting that specific network structures constrain or enable specific forms of communication. That is certainly well established. I mean that by treating networks not as an analytical abstraction but as a specific mode of communicating, networks therefore have power (Hogan, 2021; Healy, 2015). To make this more concrete consider social media as performing specific conceptions of what is a communication network. Each platform has slightly different arrangements, whether we focus on:

– *The nature of the relation*: Consider symmetric mutual friends on Facebook or LinkedIn versus asymmetric follower-followee relations on X or TikTok.
– *The visibility of the relation*: For example, this includes affordances to view another person's online status, learn if they have viewed your profile, and determine if you have friends in common.

– *The control of information between relations*: This can vary via newsfeeds, dedicated layouts, or regulated API access. Newsfeed algorithms are platform and time specific while still communicating relevant social information.

What was in Wigand's time an academic pursuit to formalise the environment has become a structured means to regulate and mediate the flow of communication between separate physical spaces via the World Wide Web. In fairness to the method itself, network approaches–and specifically social network analysis–have had an incredible run with sustained academic engagement on many fronts. However, confronted as I am as a methodologist of social networks, I have become acutely aware of the difference between the networks that exist in some pre-determined state in the mind and the networks that exist as data.

To consider networks as analytic objects or performative ones, I explore this in relation to Wigand's prescient article on two themes: (1) specifying a network as an object, and (2) considering the visualisation of networks. Thereafter I make some slight reflections on the future of the field relative to the claims made in the paper.

## 2 What is a network?

Historically networks emerged via graph theory, going back 250 years to Leonhard Euler's solution to a problem that stumped residents of the city of Konigsberg, then located in the country of Prussia. Residents wondered why it seemed impossible to cross the seven bridges in one loop without doubling back on any bridge. Euler initially dismissed the problem as trivial, but it stayed with him, and he used graph formalisms to explain the answer (Shields, 2012).[1] In the twentieth century scholars increasingly saw the potential of a shift to the formalising of relations as data. Early scholars such as Moreno (1941) and Bott (1955) sought to use precise measurements of relational structures to create a sense of comparability. While friendship might involve all manner of unique sensibilities and historical contingency, we can still typically assess whether there is a friendship or not between any two school children. And as such, we can then build up a picture of the friendship structure of a school, asking what features lead to some children being popular, some being marginalised, or some clusters of children being especially likely to befriend each other (Bearman et al., 2004; Valkenburg et al., 2006).

**1** The answer was because the nodes had an odd degree (three or five bridges to each island) meaning that each node could not have a necessary even number of trips into and out from the island.

These formalisms did not necessarily emerge from direct contact with graph theory, but over time, the influence of graph theory became increasingly pronounced. In the 1950s we see a pivotal piece by Barnes (1954) followed by foundational work by Cartwright and Harary (1956), and the notable publication of Harary's *Graph Theory* (1969) only eight years prior to Wigand's article.

Within sociology this work took root in Harvard under Harrison White and led to scholars such as Mark Granovetter publishing *The Strength of Weak Ties* (1973) based on Cartwright and Harary's insights and Stanley Milgram publishing (with Jeffrey Travers) studies on the six degrees of separation (1969). These were with a more sociological frame, but the theories tended to rest on communication patterns. Within communication, this work was taken up through Everett Rogers (1962) and his students and collaborators, exploring information diffusion, with a line of sight from Rogers through (among others) Peter Monge and Noshir Contractor (2003) to computational social science (Lazer et al., 2009). Also, we see networks emerging from Katz and Lazarsfeld and the two-step flow of communication (1955) with a clear line towards modern concerns about social influence and misinformation.

Looking to Wigand's article we see a keen attempt to stabilise this approach through the definition of a network and a reference to these schools of thought. He first considers the relation with reference to work by Harary in graphs and Heider (the proponent of balance theory that was the bedrock of Granovetter's theoretical framing). Yet in the article, as is common, there is somewhat of a conflation of relations as either aligned "interior perspectives" or relations as "conduits of distinct information signals."

I say "interior perspective" here to refer to a person's own perspective of others, activated in some context (either socially or through measurement). We care deeply about these interior perspectives in everyday life (e.g., "he loves me, he loves me not") and in research (e.g., "with whom do you discuss important matters"). Such interior perspectives are contingently manifested as relations through behaviour (e.g., observing who actually talks about important matters). But these manifestations are not the interior perspectives themselves. They are, as some have called them, "traces."

In the article Wigand frames this as such: "Relationships can take on various forms of interaction such as in face-to-face communication, telephone calls, communication via memoranda, letters, etc. The more interaction exists between two members of a social system, the stronger is their communication link" (1977, p. 183). Here he takes a formalist view that communication produces the social system but leaves it a little uncertain how much to consider quality versus quantity, and how context intervenes (where many short conversations with a store clerk does not necessarily lead to a strong tie even after many years).

Nonetheless, within the article Wigand still produces a compelling blueprint for what is required in a social network study, noting it requires:

- "a definition of the social system;
- definition of the network type to be investigated;
- the identification of the respondent;
- the identification of the respondent's contact(s) or contactee(s);
- determining the strength of the link between the respondent and his or her contact(s)" (1977, p. 184).

Returning to the tension between performative and analytical work, these are also the base ingredients of a social media platform. It has an overall framing, creates profiles, identifies contacts or contactees, and uses social signals such as likes, shares, or frequency to establish tie strength.

This creates a new dimension for academic interest and societal concern. The interest emerges from simply how amenable social media spaces have been to network analysis. And the concern emerges from the very formalist notions of communication systems advanced herein by Wigand–if we can understand the function of communication through its forms, then what happens when we can determine rather than merely describe the forms? This happens when platforms shape newsfeeds or determine who can and cannot speak (or who is or is not promoted in the newsfeed for any user).

## 3 Considering the visualisation of relations

In the 1970s visualisations were severely limited by the need to be hand drawn or imputed in a computer in some careful way. Few algorithms or frameworks existed for this sort of data visualisation. Wigand refers here back to Moreno but also to other theorists of graph theory. In this area, Wigand's piece has been considerably superseded by history.

To anchor the discussion, consider that it was not until two decades later that we saw the greatest advance in network layouts, the Fruchterman-Reingold approach of arranging nodes iteratively based on metric distance (1991). This approach has been particularly useful in laying out large scale networks like those found of blog traffic (Adamic and Glance, 2005), and Twitter followers (Lee et al., 2021). Because of the scale of computation involved, with each node moving slightly to accommodate the position of each other one, this would be frightfully challenging or tedious to work out by hand. Yet with computational approaches we have been able to usefully reveal social network structures from co-citation patterns to friendships in

schools (c.f., Newman, 2003). In light of these advances, we might revisit Wigand's original concerns about visualisation.

Below are six constraints that Wigand had noted. For each, advances have been made, suggesting the promise of this approach as well as the challenges we faced prior to computer-assisted layouts.

1. "The data input for sociograms does not allow for a multidimensional representation of the relationships among system members" (p. 185). While this is still somewhat true, layouts have now been able to layer various features as well as create abstract embeddings based on multidimensional features, using a bevy of tools from tSNE and UMAP (Kobak and Linderman, 2021) to point clouds in topological data analysis (Carlsson, 2014).
2. "The strength of a relationship is difficult to express and as N becomes larger, nearly impossible" (p. 185). This is also true and has persisted. When we show people physically nearby, it implies they have a stronger connection, but it is only in a proximate sense. Modern diagrams thus conflate direct tie strength and structural similarity (i.e., being connected to the same people).
3. "Sociograms may be of some use for the representation of the system that is relatively small. As N becomes 50 or larger, there are severe spatial limitations to represent the system two-dimensionally" (p. 185). This one is perhaps the most interesting, linking to limits described above. For hand-drawn maps this is probably still a reasonable limit, as graph drawing work has explored (Ware et al., 2002). Yet for computers, using force-directed layouts, we have seen graphs with thousands or millions of nodes coalescing into large coherent patterns.
4. "Few criteria, if any, exist that specify the length of a link or relationship, i.e., it is to be decided by the researcher whether the length of a link is to express the amount, frequency, duration of communication or a combination thereof" (p. 185). Wigand is here pointing to the challenge of layering specific descriptive data on to the diagram. How specific should each measurement be? We still do not have a clear way to address this except through some combined abstraction, such as cosine similarity on all these features at once or some factor analysis of these as independent measures. Thus, while networks represent the form of communication, the visualisation must represent some lossy abstraction of it.
5. "It is unclear how the analyst can specify the angles constituted by the incoming and outgoing links at a given focal node" (p. 185). This, like the link length has been solved in the force-directed case once we settle on what a link represents. In both cases, the algorithm solves for some best approximation of arrangement across all the nodes.
6. "With the availability of computers, the sociometric representation compares to being tedious, cumbersome and inefficient" (p. 185). Finally, here is a remark-

able claim given that computers have actually allowed us to revisit sociograms more effectively, both in the case of showing large whole networks (Boyack et al., 2005) but also as research tools for collecting network data (Hogan et al., 2016).

These points are oriented around the idea that one might have some direct map of measurement of relations onto the spatial arrangement, like three emails means a 3-cm line on the page. Force-directed layouts solve this by making the arrangement emerge from the network itself. That has allowed both scalable sociograms and sidesteps questions about length and angle. Yet, rather than computers replacing these tedious diagrams with some other form, they have found very comprehensible solutions for where to arrange nodes on the sociogram.

Yet as with the network as a data structure or set of communication constraints, there is also a performative element to visualisation. This has been noted with clarity about one classic visualisation of political blog traffic by Adamic and Glance (2005; see Foucault Welles and Meirelles, 2015). With its two connected orbs, one representing blue and one red, it seemed to presage and give shape to modern political polarisation. At first glance we see a mere presentation of the form. But does this simplification also not reinforce the notion of separate and polarised crowds of networked information (Himelboim et al., 2017)? We have evidence that changes in platform algorithms can indeed lead to changes in the structure of networks on the platforms (Malik and Pfeffer, 2016). However, we are still unsure about how this sort of network classification, found in academic insights and professional recommender systems, has potentially accelerated or exacerbated polarisation in communication networks.

## 4 Considering the analysis and practice of networks

Admittedly, little attention here was spent on reflection on the metrics Wigand used. These analytics foreshadow more sophisticated approaches and models. Within the field there has been a push to model entire social systems and learn the probabilities of any given set of friendships, various forms of influence, and jointly consider communication networks of multiple kinds. Again, perhaps in hindsight, much of this work is highly demanding computationally. The clean metrics and solutions provided by Wigand would only hint at some of the complexity that was to come with exponential graph models, stochastic actor-oriented models, relational event models, and topological data analysis.

Even if the metrics were primitive by today's standards, the logic of networks endures. Fifty years later, there is no doubt that social networks have had a significant mark on the field of communication, both directly and indirectly as mediated communication became the fuel for a boon in computational social science and then artificial intelligence. However, what remains are the measurement challenges. With all the messages on WhatsApp or all the Tweets on X, we still are at the mercy of the network as it potentially fuels sectarian violence, pushes propaganda, or recommends extreme and hostile content. We are left wondering whether a Facebook friend is a real friend, and how can we get information into groups or communities that might actively resist it (be it health information or messages about social cohesion). We wonder about the potential incel pipeline (Horta Ribeiro et al., 2021) or whether misinformation moves around the network faster than credible information (Vosoughi et al., 2018).

With network advances in psychology and cognitive neuroscience, we are learning that the brain is not simply "a network" of neurons, but a complicated multiscale information processing system (Viganò et al., 2023). Network as explicitly denoted relations between specific people might represent all of this, but certainly not perfectly. Every time we reduce the complexity of human social life to a single metric (even strength of communication) we might still get the form, but we do not always get the content. And with so much of social life mediated by network systems, these insights get feedback in real time, and not under everyone's control. Thus, whether the form is enough to determine the function of communication in such a complex set of semantics, histories, cultures, and media representing modern communication systems–that is still a research agenda for many years to come.

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