

Organizational systems versus network organisation

The interdisciplinary and intersectoral round-table discussion took place as one of the working groups of the preliminary meeting on « Exploring the Network Alternative » which was held at the University of Concordia, Montreal, Quebec, Canada, 18-20 November 1976 (see report on pages 352-355).

The purpose of the discussion was to examine the problem of clarifying the concepts associated with « network ».

The orientation was provided, in part, by background documents which drew attention to the increasing use of « network » in connection with « people-groups » and certain kinds of inter-organizational activity, as distinct from various conventional uses such as in « social networks » of individuals (which are a special preoccupation of a certain school of sociology). Orientation was also provided by informal presentations from Dr M. Vidyasagar (electrical networks and grids), Dr R. M. Chen (automation control circuits), Dr P. Dansereau (biological and ecological systems), and Dr Joseph Fiksel (networks as mathematical objects). A case history of a network of individuals and groups based in New England was presented by Marc Sarkady (Another Place), complemented by a presentation by Linda LeClair (American Friends Service Committee) on one of that network's particular concerns, namely to campaign against the establishment of a nuclear plant in the area.

The extracts presented here focus on the main theme of the discussion during the round-table: as to whether there was any real distinction between a « system » and a « network » and, if so, what that distinction was, particularly in the case of networks of individuals, groups and organizations. (This point was also explored in the group on « Complexity » during the meeting of the International Foundation for Social Innovation, Paris, March 1977. The summary report by R. P. Dubarle is included in this issue, pages 369-372).

The transcripts have been edited by one of the participants, Anthony Judge, without submitting a draft to the original group. Speakers are not identified by name for this reason (and also because not all speakers could be identified from the tapes). **Known speakers**

are identified by bold letters A, B, C, D, E, F, G and H. Unidentified speakers are labelled by the letters X, Y or Z, as appropriate. The editor is however responsible for the final wording since discussion of related themes has been omitted as well as detailed exploration of some points. The original participants, and others, will be invited to make further comments in the light of this report.

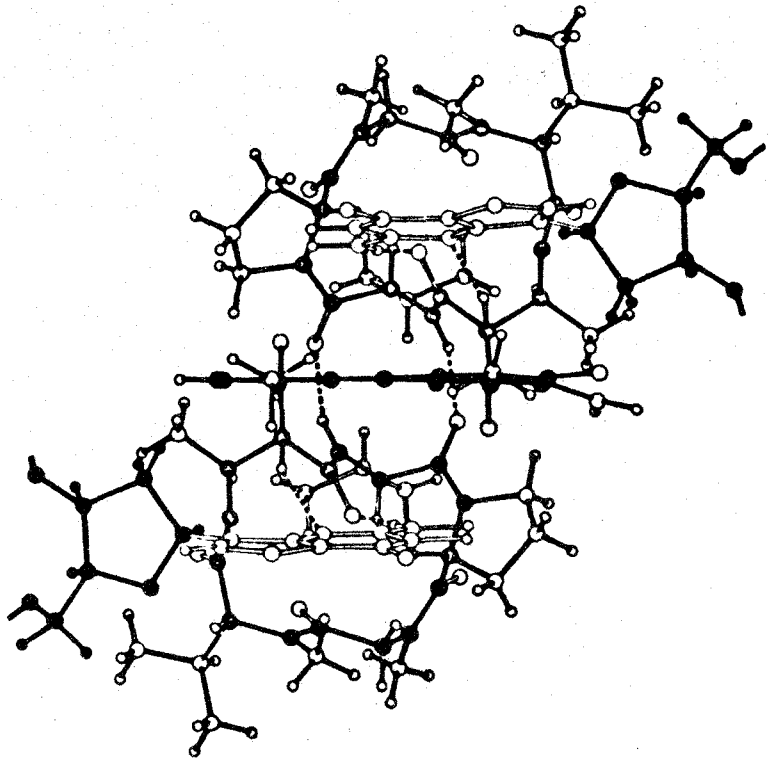
It may be asked why it is necessary to adopt the space-consuming method of reproducing the (almost) verbatim statements made during the discussion, rather than a synopsis, which would normally be adequate. The answer is that it is in fact the original statements which best reflect the current « informed confusion », the relevance of unexpected insights, the avenues which could be explored, as well as the provisional nature of any conclusions at this stage.

It may also be asked, as was done during the discussion, whether the

differences, if any, are significant, rather than simply a matter of terminological preferences, current fads, or plain quibbling. Specialists from some disciplines may be quick to reply.

Those reading this report of a discussion between specialists from different disciplines, together with others interested in the social significance of such a distinction, may recognize that the matter is not so simple.

The issue itself is however very simple. Terms such as « international system », the « establishment system », or « the System » are widely used, whether by social activists, academics, or politicians. For some they have extremely negative connotations, and such people increasingly prefer to think in terms of « networks » and « networking », which for them represents a distinct method of organization (or minimal organization). Are they deluded and misinformed, or is there a real distinction between working in (or with) systems and working in (or with) networks?



A It seems to me that we're not struggling with two different things — content and structure — but with at least three different levels. We start with the assumption that there is something we might call a network or a network structure in various fields — in electrical phenomena, in political systems, and so forth. Each of those networks carries different kinds of messages — carries different content. At one level we can set aside whether it's a pro-nuclear network or an anti-nuclear network. The content of it is one level. Another is the structure of the network; what are the characteristics of structure how do they differ — morphology. Then there is a third level which we keep sliding in and out of and that is the epistemological questions that the whole thing raises. For example if in fact you have a vocabulary that you can use in electrical terms, can you transfer that to biology, or social networks without a whole set of assumed analogies — and so on. So it seems to me there are questions of language, semantics and epistemology at one level. There are questions of morphology at another level, and there are a whole set of questions about the character or substance of the network at another level.

My own interest is not in the content, so called, but in the structure, and also epistemology. We had Dr. Vidyasagar give us a kind of elementary lecture yesterday on the terms used in electrical networks, and to me it was interesting to see how well elaborated the vocabulary is. I would like to know what the parallel — if there are parallel terms — would be for biology, for ecosystems, for political systems. Might there in fact be parallel vocabularies for each of these fields, all of them saying different things? Perhaps I should say here that as a writer, a student of social change, interested in emerging political institutions and so on, my concerns are with analogies I might be able to fetch or borrow out of this discussion we have today...

... it's one of the law's oversights, an abuse built into the system. But we do what we can... The misfit network went to work; the crowds gathered, screeching their epithets, swaying to their adolescent, useless chants. (Robert Ludlum, The Gemini Contenders. Panther, 1977, p. 212).

B Could I come back to this problem of network or system — if one directs the way the network functions is it still a network? I'm interested in the flip. You chose **system** in your example, is this system embedded in a network? If we take the example of the anti-nuclear campaign, they were concerned with a system to handle that issue. The system was still embedded in a network and when the **issue** disap-

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pears the system will disappear as a system. The network may well remain. **C** I would think the reverse. A system as I see it is definable in terms of agency, source, process, trophic level. And this is unique to a particular trophic system. That same combination of elements does not repeat itself but goes through a series of variations. Within each ecosystem there is of course a network. Whether the network is contained in an ecosystem or extends beyond it, or whether it is auto-regulated or dependent and feeding out to other ecosystems is very relevant. To me **network is a sort of « in-ner-vation » of one or more ecosystems.** It may be two ecosystems will be so interdependent and the loops between them so small that that network will appear to have more cohesion than either of the two ecosystems, especially if they are indeed absolutely interdependent.

B Can we focus on a terminology or glossary? It seems there are reference books we could use to build this. There are some critical areas of terminology, such as « node ». I would be happy as a first round of a glossary to put down about 150 concepts and at another meeting to go through and decide on their relative **usefulness.**

A I don't think it is a question of which are more important and which are less important. I think you could map which concepts recur from field to field and which concepts are discipline-specific, then you could question the difference. I was thinking of more than one column, biological terms, mathematical terms, political terms, etc.

B I like the suggestion of « columns » and perhaps another column to suggest social implications. For example « maturity » of an ecosystem or climax — we don't have a feel for this in social networks, but it is well defined in ecosystems. What interests me in the notion of maturity is that there is a measure of how mature the system is which

is in fact related to the number of « links » between species at different trophic levels.

There is a well-connected economic network that for generations has plundered Indonesia's outer islands of their wealth, and particularly the Moluccans of their spices. It is a network controlled at the highest levels. (International Herald Tribune, 13 June 1977).

C A mature ecosystem is homeostatic and very largely self-regulated or else has long been associated with other ecosystems in a self-regulating complex.

B We jump immediately to the conclusion that this is what we would aim for in a « limits to growth » idea. If in ecology there is a sense of what kind of system this would be, one could gain one or two insights as to how it might be in a social system.

C I think what we are aiming for is better and more far seeing controls that will have to manage even more of the existing ecosystems of the planet.

B The interesting thing is « who manages » and whether it is still possible in this society to imagine some unique central controller who is managing the planet through various subsidiary controllers. This is no longer a viable model. We have to work with a network of controls of more or less the same level. We don't have recourse to an ultimate controller who could in fact make the system work.

Smith, 58, chairman of the Northern Economic Planning Council in 1965-70, masterminded a web of corruption... Mr. Taylor said the corruption system was operated through Smith's network of public relations companies...

C Natural ecosystems are harmonious but this harmony and stability, maturity if you want to call it that, has been achieved at the expense of efficiency.

The White House « on the assumption that the bill will pass, plans a wide network... of 600 businessmen... to be part of an elaborate network of government-industry relations ». (New York Times, 13 May 1974).

All natural ecosystems are relatively, rather inefficient. Take the Sequoia forest, it is doing a very poor job. Of course take down the Sequoia forest and put in Douglas fir and you'll get a tremendous crop in no time at all.

A But I think the point is still valid. If the measure of efficiency is how many Sequoia you grow, it would be a very efficient system. Well, what I've heard resonating in the background of this conversation is the idea of maturity, the idea of mature networks. What I begin to think is **maybe one can view a social system as a process of « growing networks »** and that one can even think in the form of « social agriculture » in which you are « artificially fertilizing » the society so that it produces certain kinds of networks. That's just the imposition of an agricultural analogy on sociology.

B I find that very interesting. I'm still troubled by this problem of network or system. **Do the systems fit into the network or do networks fit into the system?** I think it a problem because we run the risk of people saying well you can't use this word « network » when basically it's just a « system ».

D It seems to me that it's a choice of model **if you want to focus on loops, on exchanges then you're thinking about networks. If you want to focus on boundaries and demarcations then you think about systems.** The other thing I notice is that **people who think about systems seem to like to have a box that has one purpose, whereas people who think about networks have a feeling the network may have many purposes.** There are two ways of getting things done, you can set a purpose and then bring people together to work on that purpose, or you can go around looking for interesting people and bring them together and pat them on the back. In both cases you will have something happen, but in the one case you don't know what's going to happen — you have a feeling it will probably be good, because you've had some discrimination in whom you have brought together.

X **A network is a means. A network is exploited by a system.**

B You like the word network and I wonder how you see that in terms of people talking about establishment systems.

A I think that what he says is so and the list of suggested differences (see page 365) are essentially connotations. B Well this has consequences that if you want to build a systems model you are quick to define boundaries.

A You say the « systems » model. **Is it a different model or is it simply a different vocabulary for describing the same kinds of relationships?** Is there something that defines it? I think it's a valid issue for us to focus on. I need to be convinced that there's a real life difference, as distinct from a set of linguistic preferences, but I do not deny that there might well be. I want to be educated on that.

X A system can describe an organization or a manufacturing process. Can a network do the same?

C May I volunteer a definition? **A network consists of strands that ensure the cohesion of the system and/or allows it to tie up with other systems.**

D It may be that or a network may cross many systems.

C A network is the « innervation » of the system. It ensures circulation within the system and occasionally ties up with other systems.

The slave must surround himself every night with a network of string that would sound alarm bells if anyone attempted to approach in the dark. (Harry Harrison, Deathworld 2, 1964, pp 41-2).

A Bell Telephone and Bell Canada use both terms to refer to the Bell « system » and the « telephone network ». Now the Bell system is a social, economic and political organization. The network is a physical structure to them. That may be because the entire company is run by engineers.

D And it is a North American « telephone network ». The Bell « system » manages a component of the North American telephone network.

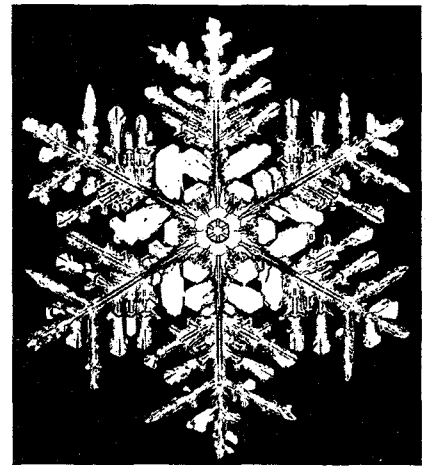
B I find that an interesting contrast. Because then for me the network is larger than the system. **The system is a way of controlling part of a network.**

A But they could be co-extensive.

X Or they could be the other way around.

A One big telephone company for all of North Americans and several in

A new microwave system developed by Bell Telephone Laboratories packs more telephone conversations into a radio channel... Use of the system in a complex telephone network was made possible by... the new system is expected to be in service by mid-1980 (Newsweek, 4 July 1977, p. 9).



Canada. But consider the question that was asked over here about a manufacturing system as producing an end product. Can a network work that way too? Maybe that will lead us somewhere. It has to do with time — with networks through time.

X Can I ask why it is so important to differentiate between a system and a network? Should the difficulty not tell us something?

B I think the reason why it is important lies in the fact that there is a whole literature and many organizations concerned with systems of one kind or another. And it seems to me that there is a whole other area of concern with networks. And the people concerned with networks are not necessarily served by, or interested in, what the people concerned with systems are doing.

A I think there is a real political difference in the two words.

D The unipurpose thing I think very important.

A And I think people react rather strongly in different ways to the two terms. We talk about system and they think the thing is imposing itself on them, whereas being part of a network that's always sexier.

X It may change with time.

A It might, but it seems that is the present political loading.

X What about exploiting the technology of systems then. A system does something, never mind the political implications. System has a purpose and a methodology. I think surely they overlap in many ways.

B I think that the advantage with networks though is that they are multipurpose. They are prepared to respond to a variety of conditions and problems.

X Systems can too.

B Only if we define them in advance, and this is the problem.

D Is it not a problem of connotation and emphasis?

X Again, it depends on who is describing the system and for what.

A I think we should spend more time on this as it really is the background to anything else we might discuss.

There is so much terminology linked to systems and if there is a distinction we have to make it. The telephone is a democratic technology as distinct from, say, broadcasting where you

... When another plant... failed, safety devices designed to protect against overloads shut the whole network down. Mayor Abraham Beame declared a state of emergency and called for an investigation. « We cannot tolerate in this age of modern technology a power system that can shut down the nation's largest city » (International Herald Tribune, 15 July 1977).

have a centralized information factory which pumps out an image. A telephone system — one of the problems they had was by law they had to provide service — they have to give it to anyone who wants it. They can't make political or other kinds of distinctions. What that means is they have no control over demand. The system is activated by the consumer.

X I would think there would be something more interdisciplinary about a network.

C Should we ask ourselves whether it is at all possible for a system to exist without having some kind of network as an inner structure? My answer would be no. **Any system has some kind of an interior network.** That is a minimal proposition as far as I am concerned. Now whether the network does and can extend to more than one system, the answer is of course yes it can. In fact, there would be very few systems that had a very self contained network not extending beyond their boundaries. This is almost unimaginable and certainly very exceptional.

A But what is the distinction?

C To me the network is some kind of conveyor of whatever is operative within the system; what I would call in my vocabulary resources, however understood, whether it's oil or information. It is still a resource and in order to pass from one state to another, to be transported and transformed by some kind of energy, it has to borrow the pathways of a network.

We were considering hierarchies this morning and I think there are hierarchies in a system, and there are bound to be hierarchies in a network. Some channels within a network are all-purpose conveyors and other channels are highly specialized and carry only one kind of information.

E For me a system is more defined and constrained than a network. Think of the distinction between a heuristic and an algorithmic process with certain restricted inputs and predictable restricted outputs. Heuristics are processes which operate on a whole class of things

with only partially predictable results. This may just be my yearning for a network to be very flexible, so that you never know for sure what's going to happen. I tend to think of a system as something predictable.

C It's predictable in as much as you know what is being carried and what mechanisms will stop or will forward the resource. There are all kinds of signals that say go and stop, or on and off. A network is full of on and off signals, whether you're dealing with a bulbous plant that has a rest period, or whether you're dealing with a bank that has opening and closing hours. There is a stop and go — now what activates the stop and go?



E Well I would talk about the banking system, because banks are among the most predictable, in their mode of operation.

A I suspect that you would find many bankers who would be very unhappy with your describing the system as predictable, when the money system...

E Yes, but I think that they're looking at a different system than I am. As a user of banks, I am looking at the surface manifestations of branches and transactions and things of that kind; so I think we're looking at different systems.

X You're looking at the mechanics. You can describe the mechanics and interconnections quite precisely because you build them.

A You don't build a solar system.

F And you wouldn't call a solar system a network.

A Well, OK, maybe that's a point that we can work on.

B I think that the predictability in something like a solar system, or an ecosystem, derives more from what we want to identify.

A Is that predictability, what we call predictability, isn't that really a reflection of a level of human mind, rather than some objective fact — until Newton we couldn't predict very well...

C There might be some natural factors — the predictability is high where the freedom is low. If there are few possible alternatives for a resource to engage in one or more circuits, then the predictability is high.

G It seems that you might be able to say that a system is a subset of a network, but that you might not be able to say it the other way around.

A We said it the other way around this morning — but I'm not sure that anyone is persuaded of either of those alternatives. As we said before, you wouldn't call a solar system a network. It seems to me a good place to begin to look for the distinction. Is the distinction simply a matter of predictability. It seems to me that it's always the human being that's doing the prediction, nobody else is doing it. How well we do that or how poorly we do that varies.

X Doesn't that fail for lack of interconnections — channels and nodes — channels of information flow within the solar system.

B Let's take that a step further. Assuming that we have an interplanetary society, in which communications were taking place between all the different planets. Those communications would in effect, as they patterned themselves, constitute a network, which would have a much more unpredictable component than the solar system as we know it now.

G Is it the difference between open and closed systems? That an open system is a network, and that a closed system we would not want to characterize as a network.

B I agree; but what bothers me there is that we're defining a network in terms of a system, and I'm not sure that it shouldn't be the other way around. When you said in your opening statement that a system has network as an inner structure, the network is inside the system; and then you add to that that few systems have self-contained networks...

C The system can be coherent, I think that was the term that I used, in as much as it has a network that irrigates its different parts, that allows it the distribution of resources that makes it what it is — whether it's a bog or a bank makes no difference. The network must in some cases extend outside of the system.

I think that a better example of the distinction we're looking for is the surface communication network. We take a map and there is a road, a network of surface communication; but it pervades how many systems — wilderness, farmland, industrial development and urban.

F Could one possible distinction be that the system could be goal-directed, whereas I don't think, at least so far, that a network can be.

D Well, the emphasis is there. Usually when you try to design a system, you

try and establish a hierarchy of goals, so that the system won't be conflicted within itself. A telephone network for instance can be used for thousands of purposes.

F ... so that it doesn't have a purpose or a goal built into it, whereas a system does.

D Or it may have the meta-goal of bringing people into communication; or there may even be a meta-meta goal of sustaining hope (which I suspect may be behind a lot of these systems here).

B What about the distinction we were looking at this morning between the Bell « system » and the « telephone network ». There in a sense the Bell system is managing the telephone network.

C That really could be an error in vocabulary, because something or other calls itself the Bell system. I would go so far as to say that rarely, if ever, is a network co-extensive with a system.

A I still don't see the difference.

D It's **two different ways of modelling things**. In system modelling you think a lot about boundaries and boundary conditions and about teleology and purpose, and the purpose of the components; and in the network you think a lot about what properties you're going to concentrate at nodes, and what kind of flows you're dealing with, and the rates of flows.

A But still they could in the end be identical. You could go into the process in one sense in the case of the system, looking for a goal or purpose, etc.; and into the network shooting for other things. There is no mutual exclusivity. You could come out with two things that look alike.

D If you improved your system model you might find that you'd have to use a model that had a network configuration. Or as you improved your network model, you might find that parts of the network had a lot of integrity and that they were mostly connected with themselves, and not much connected elsewhere. So you might as well put a wall around them and call them a system.

C The important distinction to my mind is that **the system generates resources, including information**. The network does not generate anything, it conveys, that's all it does.

A But if all a network does is convey, passively, what about human networks, or social networks, where each of the nodes — each individual as a node in the network — transforms the information flowing through it?

C No, it is not the network itself that transforms. The system is a matrix, and the network is the innervation thereof. So, at a certain point in the network, the network reaches to an area where, for instance, vegetable is transformed into animal material. There is a threshold which is crossed, a transformation that is effected; and a channel exists or does not exist or is blocked, or is on, or is off, which con-

veys this new information from one node to another.

A But translate that into human beings. If we're talking about a social or political network (we were talking about the experiments with message deterioration); or we have a political party. The political party is a network. It's not a party, it's a network. At one end somebody says, « Let's stop the building of this nuclear plant in New England », and that filters through the network. By the time it comes out the other end it may say « Let's help build that plant ! »

In consequence, apart from this network of relations linking up every kind of object (physical, metaphysical, mental, real and unreal in so far as they have « psychological reality »), the symbolic order is established by a general correlation between the material and the spiritual (the visible and the invisible) and by the unfolding of their meanings (J.E. Cirlot, A Dictionary of Symbols. London, Routledge, 1971, p. XXVIII).

C It is not the network that generates the information. It is the President of the Aluminium Company who says he wants to close the plant; this decision is made in the Executive Offices. He picks up the telephone and this already-generated-information is, through the wires, transferred as a message that the plant must be closed.

A You're still conceding in that case the wires of the telephone system as the network. I'm saying forget that. Let us take all the technology out of it. We've got a group of people who form an invisible college, who are interested in ecology before anybody else is interested in ecology. They telephone each other, and so on. Now in loose parlance we call them an ecology network. What's happening though is that as the information moves, through that system...

B Why did you say « system » ?

A OK... Well, the reason is that I'm still not convinced that there's a distinction — I'm still using the two terms tentatively, interchangeably, until I can find a good distinction. But what I am saying is that if we all leave this room, we would be a network on networks, whether we like it or not — a meta-net... Assuming that we don't use any special communications technology to communicate, what makes us different from a system. We decide that a network is a such-and-such; and then we have friends out there who are also interested in networks and so forth. By the time I go home and tell my wife what we talked about here, I will not deliver it to her in the form in which I received it. I will re-generate that information. It passes through me and comes out different. So that in that sense **the network is not just a passive**

conveyor, in the sense that a telephone network is a passive conveyor.

C The system is the community of presumably knowledgeable people who have gathered together. That is the system. The matrix is the round table. Suppose that we come out with a definition that we think is pretty good, and we decide that this has to be communicated to Professor so-and-so. We then borrow another network, using the telephone, to convey this same information.

A But in fact the message that passes through this node would not come out the way it went in. What I'm saying is that, even as in a human network, it's quite clear that if the individual humans are nodes in that network, those nodes are quite capable of generating, or re-generating, or altering the message; so are certain mechanical systems capable of doing that — of transforming the information that comes into them into another form.

G But only in certain ways. When you talked about the solar system as being predictable, what you were saying is that we can describe the way in which the parts are related. When we talk about the circulatory system, we can describe the way in which it operates, and for all intents and purposes we assume that all circulatory systems of all human bodies operate like that. And in that sense it's a static model — we can draw a picture of all circulatory systems for all people, and it's going to be the same for each one. But in a network we could never draw a picture of a network that would fit for all cases; so a network is dynamic in a way that a circulatory system is not.

B I feel the lack of inputs from other areas, from medicine, from topology or some specialized branch of mathematics. I can list 10 or 20 such areas which I would like to feed into this process so that we can just see what kinds of concepts we might usefully deal with. Work is required and that will be done in some sort of preparatory document for a future meeting or as a follow-up to this meeting. But what I would like is some feedback on how you feel about where we might go from here with respect to the terminology in question.

H I'd be happy to give you some input as a mathematician concerned with networks.

A I was just going to say. My own feeling is that the time is valuable and I would rather we spent the time on substantive discussion than on procedure for constructing the next meeting.

(This debate will be continued in the next issue of « Transnational Associations »).