# The Need of Cognition for the Cognition of Needs

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## Cognitive Processes and Societal Problems

We know enough, today, about social problems and cognitive processes to make statements:

Social problems are interconnected with cognitive processes. Those who attempt to study and to answer the questions posed by one, sooner or later find themselves involved with the study of questions raised by the other.

Answers to so involved a system of interlocked networks of questions will be found only if it is made possible to complement existing theories and conjectures with concrete opportunities for the examination of both, processes and problems, for the observation of their real-time manifestations, and with the still outstanding step from sophisticated documentation toward effective and problem-solving explanation.

It is necessary to recognize that we who set out to study, and to act upon, cognitive processes and social problems are ourselves members of the set of our objectives. The time-honored distinctions, therefore, between theory, practice, fundamental and applicable research, development, etc., no longer hold, when the subjects are cognitive processes and social problems. In fact, all active attitudes, scientific and creative, must move simultaneously and together, none emphasized at the expense of the other, each emphatically appropriate at a given moment to a given observation or purpose.

The objective is the understanding of cognitive processes and the solution of social problems. We agree that each one of us approaches the objective differently. We wish to pool our capabilities without having to sacrifice this diversity.

Together with a steadily growing awareness of social problems the definition of the concept *social problem* has broadened considerably. Knowledge about society, acquired by the natural and the social sciences, could and should be brought to bear on this state of affairs. Of urgency is, therefore, specifically any work, theoretical and practical, which will bridge efficiently the wide gap between idea and implementation.

Current terminology, when referring to social discontent, contains words like *alienation*, *credibility gap*, *communication break down*, *generation gap*, *brainwashing*, *information distortion*, etc. These terms, although often correctly describing observed results, do not, in most cases, correctly identify the causes. All, however, converge in accusing a phenomenon which might be called: *negative communication.* Not communication, but the message, keeps breaking down.

Just as positive communication, so is negative communication indicative of social relationships, especially as these realities manifest themselves in language, behavior, conceptual use of words, articulations of opinions, expression of emotions, and intuitively preferred positions on issues like conflict, disagreement, fairness, prejudice, rights, privileges, power, poverty, justice, etc.

The content of communicative processes—the message—is generated by and dependent on numerous interactions of information with language, with knowledge, with images, with memory, with prediction, and more, both on the sender's and on the receiver's end of the channel system. Any malfunction in these interactions produces either unintended or undesired messages: negative communication. And negative communication causes, not only in the emotional domain, an increase of malfunctions in

interactions, thus producing more unintended and undesired messages.

This vicious circle, which indeed threatens to become a blind alley of life in our society, can be stopped; not however at the level of messages and communication, but rather where the interactions tend to malfunction. Interactions between individuals, groups of people, sectors of society, are less vulnerable to misrepresentations of facts and ensuing disagreements, than to misinterpretations of images and the ensuing cloud of alienation. It is for all participants and co-sufferers in the problem a clash of cognitive structures that had their origin far from any present conflict, and long before it arose.

More knowledge about the origins of cognitive structures in human beings will uncover some vital and hitherto unknown rules of the game called interactions, and it promises, therefore, to be the urgently needed but still missing link that could connect the theories of concerned science with such practice as would effectively benefit a very disturbed, if not even seriously damaged society.

Societal problems appear in every society. The society gives itself and its administrative and executive members the assignment to solve these problems. The problem will, however, not be solved

when the assignment is given and taken without confidence;

when the assignment is ill-formulated, open to conflicting interpretations, prone to be misconstrued arbitrarily;

when concerned sectors of society, be it in concert or in independent simultaneity, claim to be left in doubt as to whether the assignment is taken seriously, is being mishandled, has been refused, or is beyond the capability of the assigned members of society;

when for any one, or all, of such reasons mutual alienation separates precisely those strata of society that ought to be most responsive, mutually, in order to successfully respond to the assignment of solving social problems.

If the solution of a particular social problem appears to be a prerequisite for any attempt at the solution of many other social problems, then this solution may well be given the high priority status of a need. For any negligence, procrastination, or refusal—though ever so cleverly hidden behind pretexts quoting helplessness, ignorance, circumstances of times—will generate, inevitably, the reactive phenomenon called discontent.

## Requirements

*Alternatives*

Discontent is the manifestation of a conflict between two images, both, somehow, generated by a human being: my image of how "things" are (ITA) and my image of how I would prefer "things" to be (ITB).

Looking at this manifestation as one of mere existence, we have a report. Looking at it as a desire for some change, we have a problem.

On this level of discourse it is possible to enumerate the various procedures that, alternatively or in combinations, will either stop the report (the problem disappears) or solve the problem (the report disappears):

1. Remove the human being.
2. Change ITA until it fits ITB.
3. Change ITB until it fits ITA.
4. Change "things" so that ITB = ITA.
5. Stop looking.

Combinations that contain the first or last of these procedures may be implied in projects proposed and funded elsewhere.

Upon contemplating the three remaining procedures one immediately faces several requirements:

*Image*

The concept of "image" requires completion:

1. How are images generated?
2. What and who generates the image?
3. Through what process is an image conserved?
4. How does an image act upon the person in whom it acts?

5. What does an image do, generate, cause, in and to the person in whom it acts?
6. What are the necessary and sufficient conditions under which it would become possible
   (a) to conceive of "image" as a process, simultaneously *caused* by preceding processes and *causing* subsequent processes?
   (b) to create, for use by any observer, an adequate and appropriate formal representation of such a process, where the formalism allows for and satisfactorily indicates the dynamic relations and the flow-ambivalence of any such process?
   (c) to simulate the process and, eventually, to extend it, in an interactive man-machine system?

The question can no longer be whether images should be *tolerated* as arguments for behaviors, actions, decisions. The question is rather whether one can at last trace the images that unquestionably *are accepted* as arguments.

*"Things"*

The concept of "things" requires amplification:

Upon removal of the quotation marks, "things" should not only be all that is referred to in potentially verifiable statements, but also all that is referred to in potentially unverifiable statements.

Anyone's *image* of how "things" are (ITA) and the *image* of how anyone would prefer "things" to be (ITB), both belong to the "things" that are, regardless of whether the "things" referred to in the images are, or are not, referred to in anybody else's ITA.

Most, if not all, human actions can be interpreted as statements which manifest in movement, language, expression, etc., the actual state of the acting person's ITA and ITB. This interpretation, however, is made all but impossible by certain consequences of the human use of human actions. One consequence is of particular importance here: underlying all human discourse lurks a notion according to which the effective communicativity of discourse depends on its compatibility with a "factual reality" which is considered independent of individual images. Rational reasoning based on this notion tends to look down upon individual images, conceding to them a merely marginal and phenomenological placement of existence in "factual reality", if any place at all. In a context of cognitive studies for the solution of social problems such a notion still may generate most necessary, but no longer the sufficient, conditions for either research or concrete implementation.

The student of social problems and cognitive processes must be capable and equipped to observe, and then to present analyzable documentation of, at least, three "things" and their relations:

1. A person's ITA and the evidence which it includes and to which it is compatible at generation-time
2. The process by which (1) is modified until it becomes transferable to some form of manifestation satisfying the notion of compatibility with "factual reality"
3. The result of (2), in particular with regard to the traces left in it from (1)

Such an observer's capabilities and equipment together define the "cognitive laboratory" necessary and sufficient for the desired participation in, and the desired experiencing of, any process connecting the cognitive process in human beings with the social reality wherein the individual sees itself, and with the social reality which sees the individual.

So amplified, the concept of "things" will invite and encourage people of all walks of life to come to such a cognitive laboratory, to be observed, to observe themselves and others, and to learn how to articulate their ITA and their ITB with less and less compromise. Together, and as a continuously functioning system, the users and the lab form the interactive interface which connects, without representatives, cognitive processes with social problems, so that this connection becomes accessible to anyone concerned.

*Change*

The concept of change is to include its own ambiguity:

a. There are "things" that can neither change, nor be changed.

b. There are "things" that can change, but not be changed.

c. There are "things" that cannot change, but can be changed.

d. There are "things" that can either change, or be changed.

e. And then there are the "things" that continuously change, or continuously are being changed, or both, and simply never stay the same.

In keeping with what has been noted previously concerning *Image* and *"Things"*, the statements above may not reflect any knowledge of some "natural" states of affairs. They certainly, however, reflect part of the gamut of notions with regard to "change" as manifested by social human beings in reference to their ITA and ITB.

If my ITB implies to me that something ought to change or to be changed, I do not necessarily manifest, thereby, a social problem. A social problem becomes manifest, however, as soon as I, alone or with a group of people, begin to hold the society, of which I am a part, responsible for the impossibility to solve the conflict between my ITA and my ITB.

A society that knows but refuses to solve its social problems is a social problem.

In the attempt to solve social problems society has established links of communication between its members, such that some members represent society, and some members either are, or represent, the discontent. The result of any meeting of these two groups depends on various sets of powerful factors. The set that interests us here is among the most powerful and refers to the five statements listed under *Change*. The meeting will be fairly successful if the discussion deals with "things" on whose properties with regard to *Change* the participants can agree.

It can be fully successful only if the agreement is not due to some misunderstanding. If, due to some misunderstanding, no agreement can be reached, the meeting not only will fail in solving the problem, but will actually amplify it.

Misunderstandings result, where the partners, alternatively or simultaneously, confuse *b* with *c,* or, meaning to speak of *d* find themselves talking of *e* or answer with *a* to a statement using *c,* in short: when people are unable to transfer their images undamaged into the linguistic domain.

Such meetings (and, most of the time, misunderstandings) are taking place by the hundred thousand every day, on all social levels, among any variety of partners one could name. The thickening cloud (nourished by scenes in the home, in schools, industrial plants, and offices; propagated by administrative and executive bodies of all kinds among themselves and when facing the whole or parts of the public) pollutes the social atmosphere, and is rightly called the phenomenon of alienation. More than by anything else alienation is caused by the inability of dealing with the *concept of change.* (Which is not yet equal to, or equivalent with, the *implementation of change*.)

All meetings of this kind ought to discuss at least three conflicts and their causes, and not just one. *A* imagines himself in a conflict caused by *B. B* imagines herself in a conflict caused by *A*. Both have to face up to the conflict between their images. If, instead of discussing the causes of all these conflicts, *A* disputes *B's* rights to her conflict and *B* retaliates in kind, then this leads to the usual deadlock, out of which there lead only two ways: indefinite postponement with mutual frustration, or mutual display of power with explicit or implicit violence. Both ways, unsurprisingly, alienate the participants of the meeting, not only from one another, but also from the issue which the meeting was to investigate.

## Towards a Cognitive Technology by Way of Heuristic Research

*Assignment*

Let us, for the sake of cognitive studies, distinguish between the engineer and the technologist: let the engineer's assignment be implementabil-

ity, the technologist's assignment be applicability. Both have to study, to design, and to produce—occasionally, even to create.

If scientists wish to examine the validity of a hypothesis, they usually provide a context in which the hypothesis can be shown either to maintain itself or to collapse. The scientist turns *technologist* in determining the applicable context. The scientist turns *engineer* in designing and implementing the experimental setup, the context.

Let us now, for the sake of the study of cognition, reassemble the assignments of the scientist, the technologist, and the engineer into one assignment given to one person: the cognitive technologist. If I am a cognitive technologist who wishes to examine the validity of a hypothesis, then I shall study the hypothesis until I am able to provide a description and a design for implementation of that context, that experimental set-up, in which this particular hypothesis will maintain itself.

### *Cognitive Technology*

Whatever my role and importance for the rest of the scientific establishment may be, as a cognitive technologist I am an indispensable member of any team that attempts to study cognition.[1] A few reminders will explain.

Cognition, in order to be studied, is said to be not the knowledge acquired but the process of acquiring knowledge. All knowledge, once acquired, turns up as a hypothesis which then either maintains itself or collapses in a given context. The process, however, by which this knowledge had been acquired maintains itself, regardless of the fate of its acquisition.[2] Furthermore one may state: the process by which knowledge was acquired is a context, a biological experimental setup in which the acquired knowledge was able to maintain itself, until it became a hypothesis to a testing scientist. It is, therefore, worthwhile investigating the following thesis:

Every hypothesis and, in fact, every statement either is, or represents, or contains, knowledge that was able to maintain itself in the context of the process that acquired it. Cognition, therefore, must be a member of the set of all contexts in which a given hypothesis or statement can maintain itself.

Cognitive technology is the scientific discipline which

1. searches for contexts in which hypotheses and statements can maintain themselves;
2. designs situations and facilities which allow for the demonstration and intensive study of such contexts;
3. studies the properties of these contexts and constructs models reflecting the results of those studies;
4. compares these models with other models reflecting the studies of biologists, neurophysiologists, biophysicists, biochemists, yes, even linguists, anthropologists, and last not least, psychologists and philosophers;
5. will eventually expose a preferred set of probable anatomies of cognition.

### *Heuristic Research*

It is now necessary to draw a significant distinction between the study of cognition and the study of knowledge. In theory, and with the help of carefully structured formalisms, it is possible to draw this distinction and to maintain it as rigorously as the theoretical equipment permits.[3] In practice, however, this is quite difficult. There arises a non-trivial problem, whose satisfactory solution may be one important step toward a valid description of cognitive processes.

The dynamics of a process communicate themselves to the observer only through the traces which the process generates in the observer's domain of perception. The observer forms an image of the process and its dynamics by "interpreting" the traces it left behind. In order to be available for interpretation, the traces must be *distinguishable.* Traces can be *distinguished* only if they are offset against an environment or background which is void of the kind of traces under study.

The dilemma for the student of cognition lies in a particular ambiguity of the traces that the student perceives. Although they were left by a process of cognition, the student no sooner *distinguishes* them,

and they become traces of knowledge *within* the student, or the observed partner, or both. At the same time, the environment, or background, against which the traces were to appear in outline, is not void at all, but full of traces left by processes of cognition, except that these traces are *indistinguishable* for the observer and, therefore, face the observer as one distinctive trace of no-knowledge. The consequence of this imagery sounds perturbingly absurd: if the observer is to study cognition, then the observer has to turn to the study of knowledge with the determined effort to search for all that which knowledge and no-knowledge have in common. This means that the student of *cognition* deals with the same traces as would the student of *knowledge,* but interprets them differently. The student of *knowledge* will tell us that the traces exist and why they are still there, maintaining themselves. The student of *cognition* will tell us how they got there in the first place and why, be it successful or not, there is something that submits itself to the test of survival.

At this point, and in defiance of all apparent absurdity, enters the concept of heuristic research conducted by the cognitive technologist. The cognitive technologist assumes that every living organism needs to be aware of the conditions under which it can continue to be a living organism, continue to maintain itself. This state of awareness is sustained by a process that continually tests for conditions. These tests and their outcome orient the organism towards its "judgment" of the prevailing conditions. If, according to this "judgment", something appears to be amiss, then a search for the missing condition is initiated. The cognitive technologist, now, experimentally assumes that the process of cognition is either part or all of this search for the missing condition. The particular search itself will end as soon as the missing condition is found and implemented. Knowledge would then be the network of all traces left by the *halts* of the process of cognition. The process itself thus can not be observed when it has halted but only when it is in action, when it is in search, while it generates the conditions which the organism will accept or reject. In order to study the process of cognition in living organisms, the investigator must create an experimental setup of a model situation, wherein we can observe the process rather than the traces of its stops.[4]

This is a heuristic setup and the most applicable compatible model that could, by analogy, represent the subject and the objective of this research. A typical assignment for cognitive technologists is the task of imagining, designing, and constructing such a model, to teach people to use it, to use it themselves, and to apply it to the solution of problems and to the implementation of these solutions.

### *Wants*

If a problem wants to be solved then the solution of the problem wants to be made possible. An analysis of those two wants frequently leads to an understanding of the conditions (effort, time, budget, equipment) and dimensions (quantitative and qualitative) that might allow the satisfaction of one want to become applicable to the satisfaction of the other.

The process of cognition takes place not only in the people who study it but also in the people who either are or have the problems that are to be solved. If the study of relationships between cognition and problems is to become practically applicable as soon as possible, then the ranges and the domain of this study must be broad, of great variety, flexible, and as accessible as possible to all kinds of proposed solutions, problems, experiments.

What is required here, then, is accessibility in several senses and directions. The cognitive technological experimental setup must be large and flexible in order to be accessible to the high level of problems and the large number of people involved; accessible to parallel and simultaneous real-time simulations of environmental, psychological, neurophysiological, and social conditions; accessible to itself in order to actually self-organize into a crystal, or a network, or a circuit, or a model of a brain, whatever is wanted, so that crucial questions can be answered quickly, ambitious hypotheses be tested rapidly, and the vital link between theory and practice be efficiently established as early in the game as possible.

What emerges, indeed, is the need for a highly functional edifice of ample dimensions which, in the

eyes of the cognitive technologist, not only would contain the modular equipment that is to serve us in an immense variety of constellations, groupings, and interlocking permutations, but which as a whole, would itself be one of the modules in the experimental research design: a veritable house of heuristics (see notes 1 and 4).

It is proposed that careful attention be given to this emerging need, that a time be set when a first design of such a project might be met with encouraging comment and criticism, and that a plan be initiated that foresees and begins now with the preparation for the eventual realization of this far-reaching project.

Such a plan would be able to draw immediately on work done, or in progress, at many locations, where support and coordination combined with practical implementation and real-time observation would bring to useful fruition that which would otherwise ineffectively linger in theoretical limbo. All such work might function in the context of the mentioned plan as a module which, modulated with other modules of different structure and intent, would reach into regions of questions, answers, and conjectures, that, standing alone, it could not tackle.

No problem, be it an individual's, a family's, a community's or a nation's, no problem can be solved unless it knows how to state itself. The study of cognition on cognitive models and people and situations will give to the problems the voice and the word for the statement of need, and thus necessity. Knowledge alone is but a loop leading nowhere. To make it lead somewhere is the assignment given cybernetics by the cybernetician of the second order.

*Notes*


1. H. Brün: Technology and the Composer, in *Music and Technology*, 181-192. Paris: UNIESCO and LaRevue Musicale, 1971.
2. H. Maturana: Neurophysiology of Cognition, in Garvin, P. (ed) *Cognition: A Multiple View*, 3–23. New York: Spartan Books, 1970.
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4. H. von Foerster and H. Brün: *Heuristics: A Report on a Course in Knowledge Acquisition*, BCL Report No. 13.1, Biological Computer Laboratory, Department of Electrical Engineering, University of Illinois, Urbana, 1970.