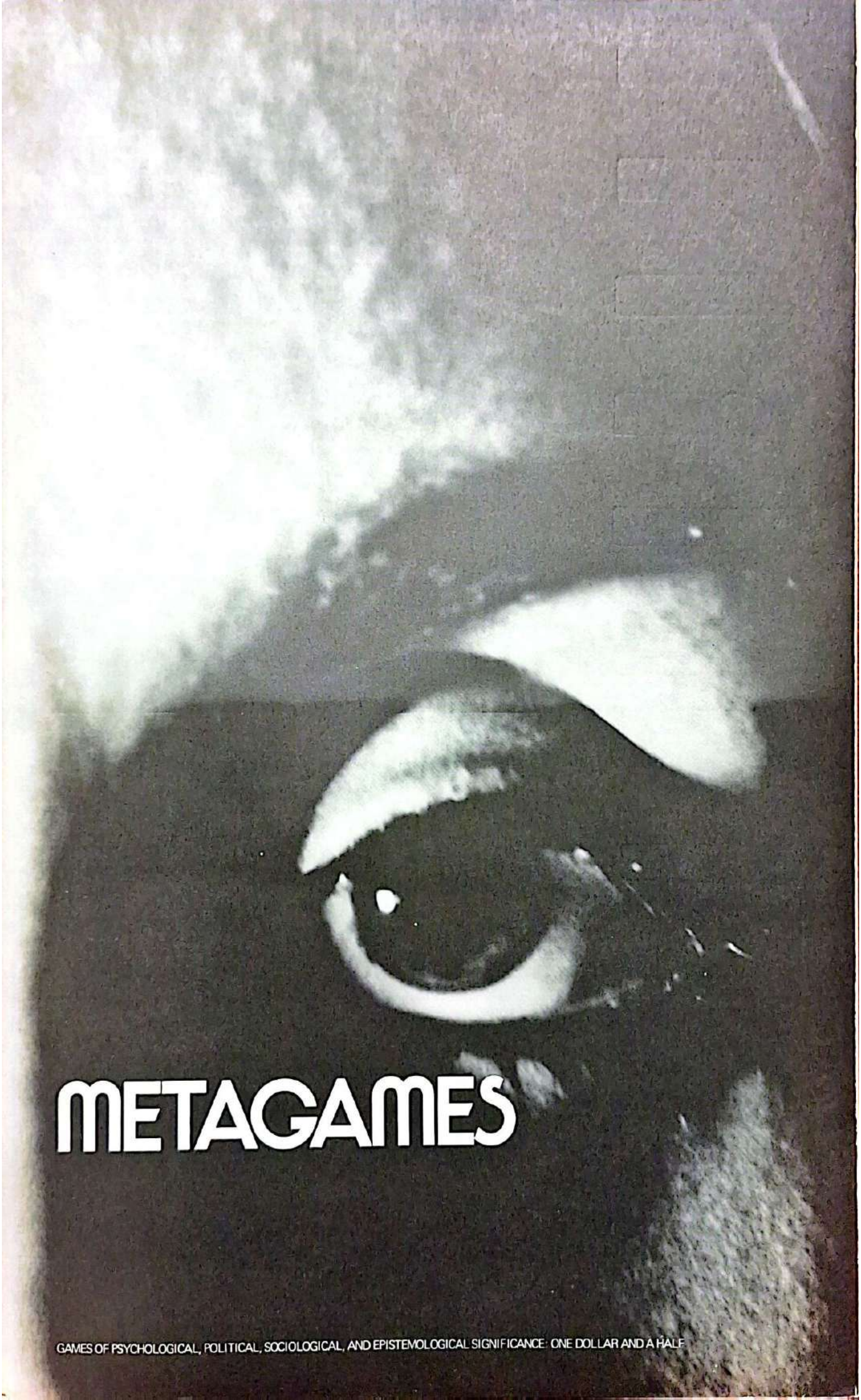

METAGAMES

GAMES OF PSYCHOLOGICAL, POLITICAL, SOCIOLOGICAL, AND EPISTEMOLOGICAL SIGNIFICANCE: ONE DOLLAR AND A HALF

What we refer to in English as knowledge is signified by two words in Greek: *gnosis* and *episteme*.

Gnosis refers to sense knowledge. It derives from *gignoskein*: to know, think, judge, and from *gnōmōn*: a judge or interpreter. A gnostic is concerned with such questions as what is that which remains constant?, what is its essence?, what is its form?.

Episteme refers to the acquisition of a skill. It derives from *epi* (above) plus *histamein* (to stand). While we *under*stand in English, we *over*stand in Greek. An epistemic is concerned with such questions as how does it work?, how is the structure?, how is the process?.

Perhaps a feeling for these two types of knowledge can be generated by looking at some of the derivations of the key words associated with these concepts, form and structure:

form	structure
deform	destruct
inform	instruct
conform	construct
reformulate	reconstruct

The dichotomy in early Greek philosophy precipitated from schools defending either *gnosis* or *episteme* as true knowledge, leaving it to Plato to synthesize these two forms and reveal their relationship as it appears in his famous parable of the cave. Men are chained in the cave such that they can see only their shadows. Reality for these men constitutes a description of the behavior of the shadows, and only when one of these fellows breaks free from his chains and discovers that the shadows are formed by the obstruction of the sun's rays does he understand the relationship between the men and the shadows.

With Platonic spirit, this class endeavored not only to concentrate on what was said but also the observable processes by which the content was generated. Scribes took notes on the content and meta-scribes took notes on the accompanying interpersonal interactions. Portions of the descriptions and metadescriptions can be examined on this page.

The idea of generating a series of games arose from the desire to produce something that was both interesting and enjoyable which embedded the notions we had been discovering throughout the semester; that is, to reflect upon what had been said and reveal processes of human interaction.

We wish to extend our deep appreciation to Gordon Pask and Humberto R. Maturana for their invaluable criticisms and advice, and of course our mentor, Heinz Von Foerster, who serves to show us the possibilities of being human.

Steven Sloan

Steven Sloan

Scribe

After a few remarks by the Chairman, Sandy proposed the creation of a 'game box' as the class project, since most of the groups seemed to have an interest in this general area.

HVF then announced his coming trip to Europe, and explained the timetable that was passed out to the class. He stated the possibility of the game box being produced by the American Container Corporation, and suggested that the games should deal with problems–be teaching games, using 2nd-order concepts, if possible. He felt that Gordon Pask might be able to suggest some game structures for the teaching games, when he came to class.

Steve demonstrated the game he had talked about last week, explaining its possibilities in generating language between people.

Back to HVF who referred to the two kinds of questions we could ask Gordon Pask: a) notational; b) epistemological. He himself would deal with the first type and Pask could discuss the latter. He went on to speak about what was going on in the class–whether he should start off from the reality question of last week, or return to the epistemological concepts he discussed two weeks ago. He wanted us to be constantly alert to what he was saying and to question him..... Then, a digression about the difficulties the meta-scribes were having.....a reference to communication as a Two-Brain problem. In reply to a statement by Charlie that 'Communication never breaks down, you only say it does when you don't get the response you expect', Judy responded with a dictionary definition of the word, and, after a brief comment on its inadequacy, HVF started to distinguish between form and structure. He carried this into Pask's models as different ways of knowing: 'How, why and what refer to three different ways of relating things.' From this statement HVF led into a discussion of the cause and effect relationship between two things, and the problem of which one comes first.

Metascribe

Almost forgot to start writing. Chairman mumbled a few notes about the directories he handed out, then led into Sandy Baron's presentation on creating a 'box' of 'goodies' at the end of the semester. Many possibilities.

New room. Very old-fashioned and comfortable, in 218 Ceramics Engineering Building. The class is quiet and relaxed. Sandy turns the floor over to Heinz.

Heinz once again has some suggestions about projects. Takes centre of floor and explains timetable handout. He mentions his forthcoming trip to Europe and I begin daydreaming. When I returned, he was still talking about the schedule of projects for the class.

I can't figure out why we all sit in a circle and pay attention to whatever happens in the middle. Is this biological?

Heinz is talking about games which would be designed and possibly produced by the American Container Corp. He addresses us to 2nd order games–learning of learning, etc. Suggested Gordon Pask may help. I know now I'd like to contribute something to the box. I think Heinz is getting disappointed with the nonaction of the class. I'm getting nervous. Are we able to deal with the subject of dealing with things? I feel a bit disoriented.

Heinz is up again with some questions about Pask's paper, especially notational questions. More object matter.
Why don't we cut off all discussion in the object language? This is the fourth meeting and we are still a class and still talking about knowlegable topics.

Heinz is talking about vague things.
I think he is giving the nonsense lecture we suggested at the last meeting. No, I take that back. He is...People are dropping their jaws. One girl is asleep. People are getting jittery. Cigarettes are being lit. People are receptive. I'm not sure anything is being perceived or communicated. Al Oberrotman is trying to pick up on somethin. Heinz is saying nothing to the topic he is supposedly talking about. Charles DeCoster threw a thought on communication. Judy Suess picks it up with him. Heinz shut up for a while.

It would be interesting to know if all the meta-scribes who were at yesterday's meeting where it was proposed that Heinz give a non-lecture as an experiment to see how long the class would sit and take it, realize themselves that this is now being done or are the meta-scribes themselves wrapped up in the object language....if this is after all, the nonsense lecture and I am not the mistaken meta-scribe. People are waking up and going to sleep on different levels. This is now a straight lecture on cause and effect.

Heinz is acting strangely. He is not talking with his usual vigour and clarity. He's hesitant and unsure. Alan Oberrotman questions something he says. A simple reply. Another question from someone else. Questions on the object matter are popping up.

A lecture followed on effect and cause.
We took a break.
I'm tired.

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Electrical Engineering 272, 490; Biophysics 491

The Departments of Electrical Engineering and of Physiology and Biophysics offer each semester general topic courses (EE 272, EE 490, and Biophysics 491). Since electrical engineering owes its existence to a large extent to discoveries in physiology (Luigi Galvani, 1737-1798; Allessandro Volta, 1745-1827; etc.), I proposed to the students of my section of these courses to coalgulate into one class in which we would discuss recent discoveries in neuro-physiology, particularly those in the Central Nervous System which may be associated with a general concept of computation. A holistic point of view was taken, and the discussion moved from sensation to perception and cognition, and finally to problems of language and communication. The interaction situation of a "game" was recognized as a useful paradigm for the understanding of human cooperation.

In order to explore their grasp of conditions that constitute a "game", the students decided to try their hand at creating themselves various solutions to this problem. The result of these experiments is this volume.

While the students worked independently, in singles or in groups, the responsibility for letting these results be seen by a larger audience rests, of course, solely with me.

Heinz Von Foerster

Heinz Von Foerster

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What game is reality?

Most certainly not solitary.
One needs somebody else to play it.

Who says *there is* somebody else? Who says
there is anything else but "I" and my thoughts?

It is clear that the senses aren't sensing a "world".
There is no color: there are only electro-magnetic waves.
There is no sound: there are only variations in the air pressure.
There is no heat: There are only a bunch of fast moving molecules,
etc., etc. Moreover, sensory receptors do not transmit the
physical cause of their activity, only the intensity of the cause.
They transmit only "how much" but not "what".

Worse, there are even no objects, for to have objects they
must have properties (for instance, saying "moo" and
giving milk). But such properties are not "out there",
as we have seen. Whatever they are, they must be "in here",
somewhere within one's skin.

What game is reality?

Despite all this,
most certainly not solitary
as the gentleman
in the bowler hat
is now to demonstrate.

He insists that he is the sole reality, while everything else
appears only in his imagination. However, he cannot deny that
his imaginary universe is populated with apparitions that are
not unlike himself. Hence, he has to grant them the privilege
that they themselves may insist that they are the sole reality
and everything else is only a concoction of their imaginations,
their fantasies, dreams or nightmares. On the other hand,
they cannot deny that their fantasies are populated by
apparitions that are not unlike themselves, one of which
may be *he*, the gentleman with the bowler hat!

But this is a paradox. For he who assumes to be the
sole reality, he shall be somebody else's imagination who,
in turn, insists that *he* is the sole reality.

How to get out of this, and where does it lead?
It leads to an "out there" that can be witnessed by
somebody else, that can also be known by another.
This is *con-scientia* ("together-knowledge", consciousness).

Now, what game is reality?

First, there must be at least two players who want to play it.
They create a large board with lots of objects on it which
they agree to call "The World". Then they put themselves
on this board and invent a set of rules for the objects.
These rules they agree to call "The Laws of Nature".
If, during the game, it turns out that the rules they applied
in creating the objects don't jive with the rules they
invented to play with the objects, they either ignore
these objects or change "The Laws of Nature".

Now they can play. The goal of the game is for both to agree
on how they, themselves, shall move on the board, even
under disagreement. It is clear that "A" can win only when
"B" wins, and *vice versa*, for if "B" looses, "A" is lost, too.
Then reality disappears and the nightmares begin.

PEOPLE'S LANGUAGE
a movement

Morpheme (mor' fēm), n. (Gr. morphē, form; + -eme as in phoneme), in linguistics, any word or part of a word, as an affix or combining form, that conveys meaning, cannot be further divided into smaller elements conveying meaning, and usually occures in various contexts with relatively stable meaning. (Webster)

The English language provides implicit commitments for its users which are communicated without regard to the intent of the user if one is not award. But awareness of the drawbacks of the language is not sufficient to insure that messages are communicated with original meanings. Further, until it is realized that language is not denotative the notion that information is transfered from speaker to listener as data is transfered in a computer, will persist. However, when it is recognized that language is connotative and not denotative and that the listener creates information, it becomes the function of the speaker to consciously orient the listener by providing a context for what is said. Only by specifying the context do words take on meaning that can be shared consensually by both speaker and listener. Only by interacting cooperatively can a language be arrived at in which the actions of both speaker and listener are subservient to the maintenance of both.

This game provides one method for understanding the connotative and necessarily context bound nature of language. New words are formed and take on meanings that are generated through the interactions of the players.

Materials:

A pencil or pen for each player
5--3 by 5 cards for each player
A sheet of paper for each player

Instructions

1. A minimum of 2 players and possibly a maximum of 5 players.
2. Each player is given 5 cards.
3. Each player writes a morpheme on each of his cards.
4. The cards are collected, shuffled, and dealt out to the players.
5. Each player should have 5 cards, and is to create a word by joining at least 2 morphemes.
6. When a player makes a word he writes its definition on a piece of paper, taking care not to let any of the other players see it.
7. The first player to complete his word and its definition announces that he is "ready" to commence playing. He is now known as the definer.
8. He places his word in full view of the others and keeps the definition hidden.
9. Each player asks the definer a question regarding the meaning of the word. Questioning proceeds clockwise continuing until each player has asked three questions. The definer answers, trying to communicate the meaning of his word without actually using the exact words of his definition.
10. Following the questioning, each player (excluding the definer) states the definition he has arrived at.
11. Then the definer reads his definition aloud.
12. A discussion of the word and its definitions takes place. The new word and its definitions are written in the new dictionary.
13. The next player who has a word and its definition ready becomes the next definer and the procedure is repeated until each player has been a definer once.

Examples:

Morphemes: med, hypo, ex, tion.
Words generated: medtion - acting appropriately in a situation
hypoex - external communicative deficiency

Suggested Morphemes:

multi, epi, re, per, hyper, logy, ism, tion, ment.

PASK

I BELIEVE, passionately and irrationally, that it is good to evolve. Further, I am convinced, on scientific grounds, that mankind will continue to evolve if certain conditions are satisfied. Perhaps the most important condition is embodied in the substance of my prediction: that the man-made organizations of 1984 will be planned as living organisms.

The philosophy underlying my predicted world of 1984 is directly opposed to the idea of mass production wherein work is broken into units so small that anybody can perform the majority of jobs, and where, as a consequence, men become replaceable units directed by a rigid hierarchy of specialists. The whimsical environment I shall predict has little in common with the frightening image of a push-button society. But I feel that no efficiency is lost by delegating to automata the work of automata; to special computing systems translation between automata and ourselves, and reserving for man the hapless activity we deem creative and somehow worth while. It means that *we* must change our ideas of value, for the most valuable man may never do a stroke of conventional work. It means that the organization must pay for *creativity* or wisdom or humour, or many other nebulous characteristics currently taken on a more or less 'charitable' basis, rather than only tangible success. But that is not unreasonable. The organization is the extension of man. Since it is man-made, it is a part of man. We do not lose our personality in this organization but gain the dignity we rightly claim.

Now, what is a man-made organization? One is illustrated in Figure 1. This is an exhibition for allowing men to look at man-made organizations. Other man-made organizations are schools, businesses, societies, and languages. These involve human beings directly. Some, like vehicles, computers, calculating machines, and industries are used by man, though men themselves are not being organized. But all of them are vastly important in this respect. If we look for one feature which chiefly distinguishes man from the animals it is that, whereas the environment of an animal is determined by nature, man's environment is largely a thing of his own creation (Figure 2). It is a man-made organization imposed upon the world by the activity of his own species and because this is so, because man has insulated himself from the vagaries of nature, he can evolve far more rapidly than the beasts.

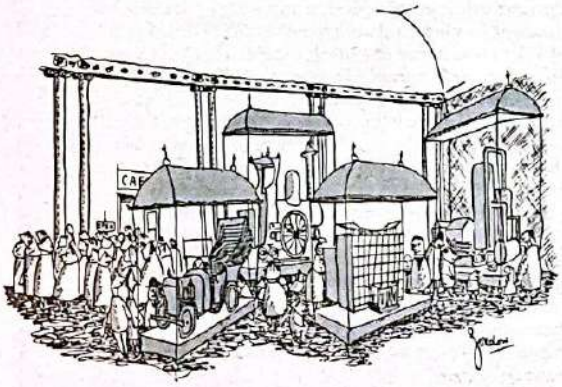


Figure 1. A man-made organization called an exhibition, which allows men to look at man-made organizations

Figure 2. Man's environment is largely a thing of his own creation

Advances in technology (new kinds of computing elements, and new methods of measuring and controlling human behaviour), are making it possible to realize a biological organization. Parallel developments in the harnessing of energy, rapid transportation, and improved production techniques will render this kind of organization essential. For, without a stable organization, mere ability to use up energy, move ourselves about very rapidly, or manufacture many commodities, is chaotic. An organization able to control our increasing technical resources must have the resilience, stability, and versatility peculiar to *living* things.

Creating Man-Made Organizations

Creating a man-made organization is like scientific inference reversed. The scientist makes use of his experience to guess at a pattern which seems to underlie the behaviour he observes. Then, to make his ideas definite he embodies them in a completely abstract 'model' which may be a system of mathematical equations or logical hypotheses. Finally, he tests this 'model' by experiments which are designed to expose the places where it is false and fails to correspond to reality.

A man, making an organization, has an abstract organization (which is the same thing as an abstract model) in mind. If it existed in the world, something or other desirable would occur; wheels would

go round or merchandise would be sold. The man applies control procedures so that this organization, which has a perfectly respectable existence in the abstract, is made to work in practice. But men have rather fixed ideas about the sort of control procedure which is admissible. A restricted outlook in this respect also limits the form and scope of the model which they hope to make.

The well-known control procedures boil down to applying hard-and-fast constraints or imitations, which give rise to a completely inflexible structure. Procedures of this kind have their advantages. They are readily described and repeated and, ideally, the same set of constraints always lead to the same result. In a steam engine, for example, the constraints that direct the energy of fuel combustion are embodied in the metalwork and because the constraints are rigid there is a close correspondence between the ideal model of a steam engine and the parts that compose its physical realization. A piston or a boiler has a definite and unvarying function, which is one stage in harnessing the energy of combustion. Further, the structures that perform the different functions of the machine exist independently of the transformations they effect. The picture is not altered a great deal by recognizing that, as in scientific observation, all real measurements are subject to uncertainty. The magnitude of the uncertainty is insignificant in the case of a steam engine, but if we build something as complicated as a chemical factory then this organization—the state of the process going on in the factory, can be predicted only in a *statistical* way from our knowledge of the ideal model we used in building it. The important point is that the form of relevant enquiry: the kind of measurement to make which might be 'concentration of *A* at point B: is well defined (we are merely unable to determine the exact 'value of the concentration' except by statistical methods, because it is perturbed by a number of variables we have agreed to call irrelevant). But living organisms are different. Observing them entails difficulties which have in the past given rise to a great deal of argument. When these difficulties exist we call the observed system a 'Self-Organizing System', and if the system is realized in the fabric of protein, which is the constructional material of man, we call it living.

To illustrate the point, consider a living cell or animal. Both it and the steam engine use fuel or food to perform useful work. But the engine survives regardless of its activity, while the cell must either be active or irreversibly dead. The structure of a steam engine is fixed, once and for all. But a cell adapts to survive changes in its environment, so that its components perform different functions on different occasions. Indeed, the materials constituting the cell are in a continual flux. Each bit of the cell left on its own will decay into elementary parts. To counteract this tendency the metabolism of the cell continually assembles raw materials from the environment into fresh components. The only thing that persists unchanged and of which we say 'there is a cell (or animal)' is the organization itself that determines the interaction between structure and function and between the cell (or animal) and its environment. Because of this, a cell or animal, or any other self-organizing system, is remarkably stable and versatile. Within wide limits it adapts to do the same job in varying conditions. It is, by nature, self-repairing, and, by nature, self-regenerating.

The comments apply equally well to other self-organizing systems which need not be made from protein and can, in principle at least, be constructed as man-made organizations. The difficulty with them is that we cannot represent a self-organizing system by a model of the kind we use to describe the steam engine and we cannot create them merely by laying down rigid constraints as we do when we assemble the mechanical parts of the steam engine. This does not mean that self-organizing systems are beyond the bounds of possibility, or even practicality, for in a rudimentary form the necessary constructional techniques have been developed. Indeed, the science of control and communication, known as *Cybernetics*, is largely concerned with this problem. So far, however, these methods have not been used very often.

Trends in Machine Design

There are two ways to build a dam that will stand up to variable conditions like floods and storms. One of them is well known—you build a very strong dam indeed. The other is not so well known and amounts to building a self-organizing dam—a rather fanciful realization is shown in Figure 3. You start off with a very bad dam that leaks a great deal. Then you set up an observation post, and you engage men who are given access to the dam so that they can patch it when it begins to leak. These men do not have the broad view which is necessary for anticipating where leaks will occur or whether flood waters are going to strain the dam, so this task is delegated to the observation posts. A man with a telescope looks out over the whole terrain and a man with a telephone calls for repair where and when it is needed.

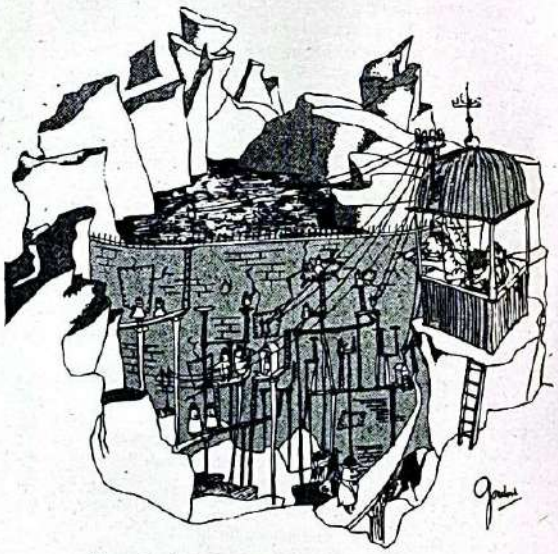
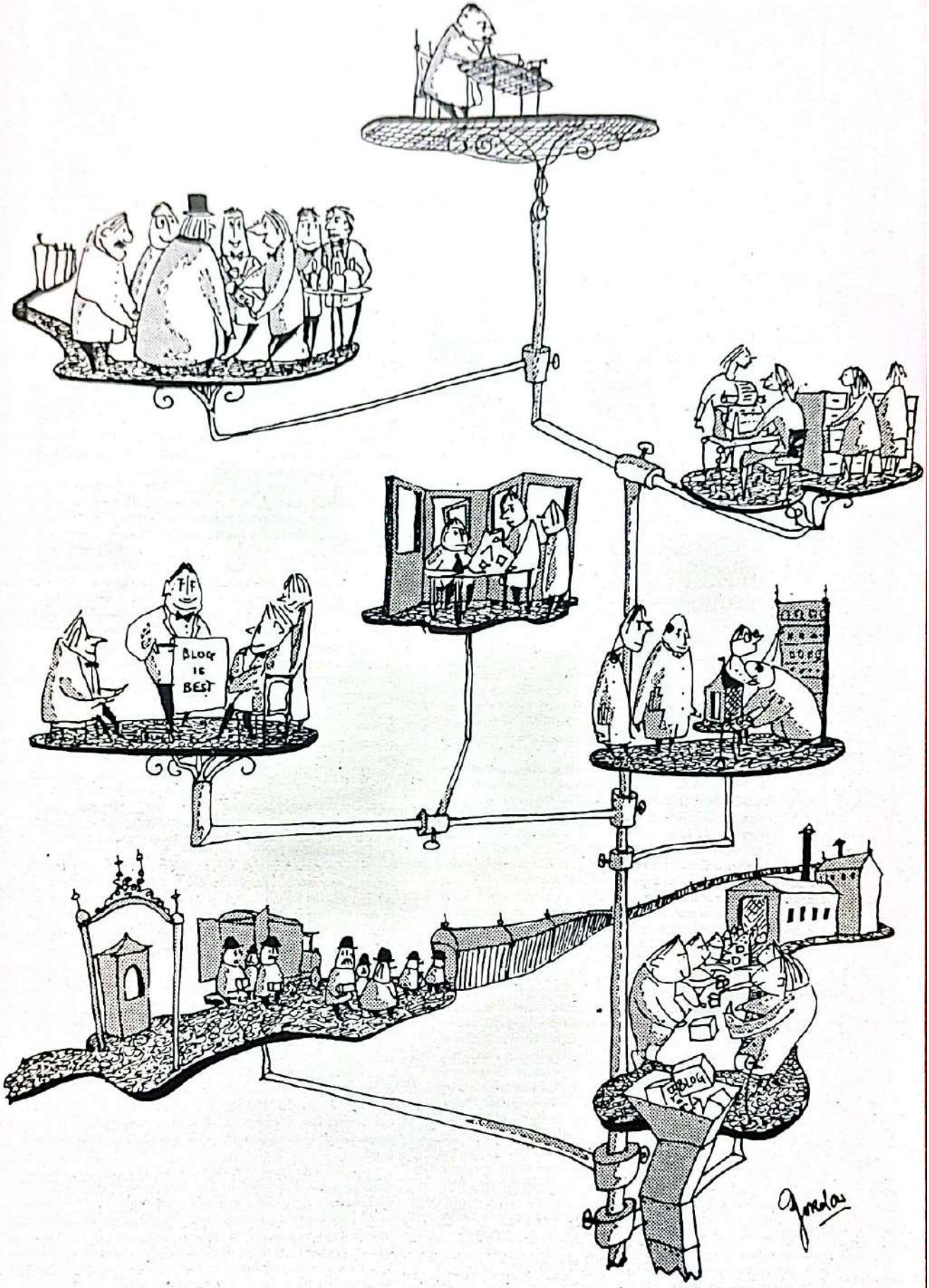


Figure 3. A rather fanciful realization of a self-organizing dam

The same technique can be used in almost any machine design. Its advantages are a much reduced expenditure in mechanical parts (a cheap, leaking dam instead of a strong, expensive dam) and a much greater stability with reference to unexpected disturbances, for a designer cannot anticipate everything however strong he makes his structure. A trend towards these more versatile designs is already apparent. A self-organizing aircraft will change its form like a bird, to suit the air conditions. The strength of a self-organizing motor vehicle will not lie in rigid members but in relations between fairly delicate parts kept fixed by dynamic control systems. The Citroen design has already gone a long way towards this ideal and in the next generation of vehicles the functions of suspension, maintaining mechanical integrity, and propulsion will be bound together and, often enough, formed by the same components which will be put to different uses on instructions from a central control. For a structure like this there is not much point in talking in tidy, mechanical terms about separable parts of the whole entity.

Or, consider a pipeline and pumping station, which is a typical but lamentably inflexible way of moving fluid over long distances. A self-organizing equivalent might be modelled upon the heart and arteries of a mammal. The master pump (the heart) has a variable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capacity and rate. The distant parts of the pipeline (the arteries) are not passive elements. Their diameter and resilience is variable by instruction from a communication network that relates their behaviour to the conditions of the master pump and determines the variable characteristics of the master pump according to local conditions or disturbances (bursts and blockages) occurring at the extremities. In practice it is not true to say that pumping action is localized in the master pump. It is 'distributed' about the system, the master pump being where most of the force is most often exerted.

Overall, there will be a tendency to replace expensive, inflexible and fallible structural parts by dynamic systems and to replace brute force by modest and local forces controlled by a communication network that determines where a force needs to be applied. In a system like this the idea of specialized parts has only a limited validity. The next stage will be a practicable self-preparing system in which structural elements will be created by a synthetic process from locally available raw material. In such a system the idea of specialized parts will have no place.

'Thinking' Devices and Controllers

The comments made above about systems that transform energy apply just as well to computing and control systems that transform information. In this field the most inflexible organization is an automaton. Typical automata are mechanical dolls and the controllers used to organize an automatic factory. A computer, when 'programmed' (that is, when instructed by its user) to perform a well-determined computation, is also an automaton.

At the moment a more flexible automaton, called an 'adaptive system', is coming into use in industry. An adaptive system has two parts. One of these is an automatic controller, like any other except that its characteristics can be changed externally. The other part is an overall controller equipped with memory and other facilities and able to sense the long-term efficiency of the process which the automaton is directly controlling. The overall controller externally modifies the characteristics of the automaton so that they satisfy some criterion, such as making the system as a whole the most efficient controller possible with reference to this process. Now the adaptive controller is flexible but characteristically narrow-minded. True, it can make use of the experience it has gained but it cannot look beyond the limits specified by its designer. It cannot change its attention nor can it learn to reinterpret events in the way that we do when we acquire concepts.

On the other hand, a self-organizing controller or computing device is, in a possibly rudimentary way, capable of these gambits. Such a self-organizing system cannot be identified with a given collection of bits and pieces. Rather, it is a structure which evolves in a collection of undifferentiated components; for example, parts of a large computer. In this case the computer is programmed with evolutionary rules and the process of evolution means the construction of computing routines and the assembly of pre-existing but unassigned components such as positions in the computer's memory register (by contrast an automaton is designed according to a fixed model, whereas a self-organizing system, although it evolves obeying definite rules, is a structure that cannot be represented by a fixed model). As a technically interesting point a self-organizing system can evolve in more basic conditions. In one practicable arrangement evolution means the literal building of computing elements from the raw material of a chemical solution.

There seem to be two broad applications for these systems according to whether or not the rules of evolution determine that the device, when evolved, is capable of learning the same sort of concept that we learn or, at least, concepts that we find intelligible. If it is, then the resulting device is at an obvious advantage over an automaton if it has to live with, communicate with, and solve problems for, human beings. Such a system, as it evolves, will exhibit the same unfolding of logical behaviour which is demonstrated by a child as his brain matures.

The point is that we solve problems by methods which are far from the rational procedures suited to automata, but though irrational, these are often best for dealing with human problems. A radio repair man does not indulge in a logically exhaustive test procedure. He mends radios by hunch and intuition and stays in business longer than a comparable automaton would. Again, whereas a pattern recognizing automaton is easily fooled by human mistakes, a self-organizing system, with suitably human characteristics, is not.

Suppose, on the other hand, that a self-organizing system is able to learn concepts, but that these, however elaborate they may be, are not intelligible to us. Although it sounds odd, the idea is reasonable, for there are, after all, only a limited number of things that men are prepared to, or, if you like, are built to, perceive. Only a few events in the world seem ordered or coherent enough to be recognized, and it is conceivable that a self-organizing system will detect order or form in events which we regard as merely chaotic. Such a system would be useful in bizarre environments. In outer space, for example, there may be events which we would not regard as coherent but which are, all the same, important (since the survival of a space vehicle may depend upon their recognition and choice of a suitable course). A self-organizing system of calibre that differs from the brain and capacity perhaps greater than the brain has an obvious application.

But a self-organizing system has many disadvantages. It cannot (strictly speaking) be designed. Although we can locate the decision element in an automaton, we cannot say where, in a self-organizing system, decision takes place, any more than we can say where pumping takes place in a self-organizing pipeline. Decision, in other words, is a characteristic of the system as a whole and the boundaries of the system are continually changing. Even so, a self-organizing system is essential for the two applications we have indicated. To show this, let us use the same argument as a man who wants to make a conventional pipeline indefinitely sturdy. In terms of computing we propose to design a gigantic automaton which takes account of all the possible events it may have to deal with. The specification is immense but conceivable. The trouble is, that as the size of an automaton increases so does the chance of its making mistakes. Now it is true that these mistakes can be rectified statistically by modifying the original design. But you cannot get something for nothing. The modifications create a self-organizing system.

Man-Made Organizations in which other Men participate

People are always loathe to discard their tidy concepts of hard-and-fast organization. But they become obsessed with these concepts when men are the organized components. Town Planning, for example, commonly implies moulding people to a pattern, and management is often mistaken for the act of issuing directives. Maybe the prime folly is the so-called organization chart intended to depict the structure of an industrial hierarchy. At the top of it, as in Figure 4, is the Chairman, and beneath him a meshwork of delegated responsibility wherein communication occurs through special procedures and departmental heads.

Now it is not difficult to show, rigorously in a particular case, that the organization represented by this chart is completely unstable. If the industry really had this kind of organization it would have collapsed long ago. Thus, since the chart still hangs, the chart must be false. In practice, unaccounted leakages occur through friendly secretaries. Improperly perhaps, the Chairman has unrecorded discourse with the executives over lunch. So industry lives a wilful life despite the chart. But the wilful life is marginal and insufficient to control an increasingly powerful technology.

There are two possibilities. First, believing in the virtues of the chart you could replace the naughty secretaries by automata that must obey the rules. You could stop the illegal leakages. You could provide the Chairman, sitting in his stark Boardroom, with a spate of pre-

digested data, for according to the chart he is the seat of all decisions. But a flesh-and-blood Chairman would be impotent. The point is that *if* the chart happened to be right, and there *was* a well-defined nodal point of decision-making, what we need is another automaton, not a real Chairman.

But, in the great majority of cases, the chart itself is inept. The industry *is a self-organizing system* and, characteristically, decision-making is distributed rather than localized. Any decision whatever is coloured by the odd interactions and social by-play of the office, though this need not be recognized by anybody concerned: So we must resort to the latter of the two possibilities, and find some way of controlling the development of a self-organizing system (which presents the same problem as determining the rules for the evolution of a self-organizing system when it is used as a computing arrangement).

In this case the components are human beings and the control procedure is education. The academic knowledge these human beings acquire before joining the organization is, of course, important, but for the present purpose we are chiefly concerned with a mode of education that continues as the organization develops and differentiates. In a self-organizing system the components are able to perform a variety of functions, and some method of continual education, training and retraining for the different roles, is the real live mechanism that satisfies this requirement. Implicitly, people doing a job are still learning it and the process of education cannot be distinguished from everyday working or discourse. In so far as industry is a self-organizing system, it is learning to survive in its environment. If it is to survive in this capacity it must evolve.

I emphasize 'in this capacity' for some organizations can survive by the opposite process of becoming stereotyped and automatic. You could cite species of insect, for example, that admirably illustrate the point and indicate that the corresponding case, in an industrial organization, is a completely automatic and stereotyped factory. This is true. It is also true that most of the jobs in a factory are best done automatically. But in this case it seems to me that they should be handed over to automata that are suited to this kind of behaviour, whereas a human being, who of all things is a self-organizing system, is not.

Broadly, the contention is that man, as a self-organizing system, should live in a man-made environment which is also a self-organizing system and which is in this sense part of him. The condition is fortuitously approximated in harmonious societies and should be aimed for in any kind of planning. Further, we can infer the likely *appearance* of the organization from the present structure and the evolutionary history of man himself and, in particular, his brain.

The brain is a strange concatenation of primitive brains, more or less recognizable fragments of brains that used to dominate behaviour and which may have been the seat of a primitive conciousness. Amongst them are brains chiefly concerned with the business of maintaining bodily equilibrium with primitive sustenance and crude reactions to fear and food. In the present brain these are not functionless components. They actively participate with more recently developed structures in determining our behaviour. But, because we have evolved, we are no longer aware of the world at such a basic level. We do not ordinarily indulge in the 'thallamic' behaviour patterns of blind rage (the 'thallamus' is one of the primitive brains), still less are we aware of the mechanisms that control breathing or blood pressure. These functions are performed automatically (and, by definition of our kind, unconsciously), for man is preoccupied with the world of language and intellect and artistry. Unless, of course, something goes wrong with his breathing or his blood pressure, when they become, of necessity, significant issues.

So man, living in the larger organism which he has created, should be unaware of those functions, better performed by the automata he has learned to build.

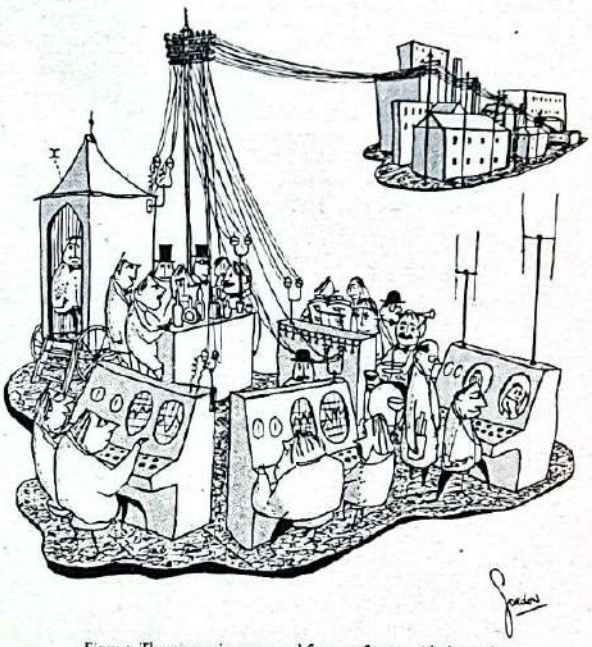


Figure 5. The automatic, unmanned factory of 1984, with the staff engaged in a mechanized business game

In Figure 5 I have assumed that the factory of 1984 is entirely automatic. There is no man in it, and unless something goes wrong no man will visit it. The rest of the picture is a fanciful image of what the office might look like. The staff engage in a continual mechanized game. The scene is not unlike an air-traffic control room and people make their moves and gain their information through display and control boards. Instead of 'air-traffic control', however, they are indulging in one of the 'business games' commonly used nowadays in training executives, and their play is a continual exercise in the running of the industry. The rules of the game and the amount they can gain by making different moves depends upon the state of the factory. Other rules might be determined by possible variations in the state of the factory. It is not difficult to convert the outcomes of the game into specific decisions which control the factory, and a self-organizing computing device would be used to relate the game played by man to the activity of the automata. The display and control boards are identical, for the intention is that any player may in some conditions assume any role. But to stabilize the play it is necessary to have some kind of overlooker, or umpire, who sees that people play fair. Out of respect, I have put the Chairman in the umpire's box (x). But, in fact, his job could be done by a very small computer. Especially if, as I am willing to conjecture, the statement 'the system is stable' implies 'the people are happy'.

PASK, Gordon
My Prediction for 1984.
In: Reprinted from PROSPECT, The Schweppes Book of the New Generation. London, Schweppes (Home) LTD and Hutchinson, 1962.

creature feature game

by assuming a different reality and interacting with other realities in a game, one may gain a better understanding of one's own.
to help facilitate the game, realities are broken down into traits or features. each player is dealt a degree of each feature (-,0,+ = hindrance, neutral, asset). choice of features is to be random (by shuffling and dealing them out). hopefully the players will invent and generate better ones. this game is only a beginning step from which players are to develop their own such games.
degree of feature controls the interaction between players and the universe (as defined by the universe symbols). ideally players will not initially see what degree of each feature others playing the game have and that the features of the other creatures will be found out during the course of the game by observing creature interactions with other creatures and with the universe.

PLAYING INSTRUCTIONS (this may take a while so please be patient)

1. arrange UNIVERSE BOARDS as desired and each player choose a homebase planet from which to start (see illustration)
2. arrange similar cards into stacks according to pattern.
3. shuffle the UNIVERSE SYMBOL CARDS and place them in a row face up. these are the white cards with symbols on them that match those on the UNIVERSE BOARDS. now shuffle the UNIVERSE FEATURE CARDS and place them face up left to right one on each of the UNIVERSE SYMBOL CARDS.
   UNIVERSE FEATURES are–
   a. BARRIER SPACES– spaces through which creatures of the state specified cannot pass and must go around. example– a mass cannot pass through a mass barrier, but can pass through a gas or liquid barrier uneffected.
   b. CONTACT SPACES– spaces in the universe on which if a creature lands, it selects a CONTACT CARD to determine where it is to move from that space.
   c. INTELLECT SPACES– spaces in the universe on which if a creature lands its intellectual state reverses. example– a non-intelligent creature lands on an INTELLECT SPACE and it becomes intelligent, and visa–versa.
   d. REPRODUCTION SPACES– spaces in the universe on which if a creature lands it reproduces another of its kind. the newly created creature begins its existence from the REPRODUCTION SPACE on which it was conceived.
   e. SUPPLY SPACES– spaces in the universe on which if a creature lands it is rejuvenated with new supplies that enable it to proceed through space for another supply interval of moves.
   f. PLAYER GENERATED UNIVERSE FEATURES– spaces in the universe that the players of the game would like to incorporate into the game, as well as additional symbols by which to designate them on the UNIVERSE BOARDS.
   now the universe is defined
4. shuffle each CREATURE FEATURE CARD stack and deal one of each type to each player.
   CRATURE FEATURES are–
   a. SEX– this feature designates the number of similar creatures necessary in order to reproduce (tri–sexual needs three, etc.) reproduction takes place when the required number of creatures occupy the same space. reproduction among similar creatures produces one more similar creature. reproduction among dissimilar creatures produces one more creature for each different creature. reproduction also occurs when a creature lands on a REPRODUC-

TION SPACE. SEX also defines the number of similar creatures that are needed to inhabit a planet. a creature can only inhabit a planet if it has landed on that planet the number of its creatures required for reproduction. one starts the game with the number of creatures necessary for the reproduction of one's creatures.

b. INTELLECT– this feature designates whether a player's creatures are intellectual or non–intellectual. INTELLECT refers to a creature's ability to choose how it is to move. if a creature is intellectual, then upon selecting a TRAVEL CARD it has the choice to move in the first or second way indicated on the card, or stay where it is and not move at all. the non–intellectual creature must move the first way indicated on the TRAVEL CARD. INTELLECT is reversed upon landing on a INTELLECT SPACE.

c. PHYSICAL STATE– this feature designates whether one's creatures are mass, liquid or a gas. this feature relates to BARRIER SPACES and to VULNERABILITY.

d. VULNERABILITY– this feature designates what creatures a player's creatures can be annihilated by upon the occurance of CONTACT.

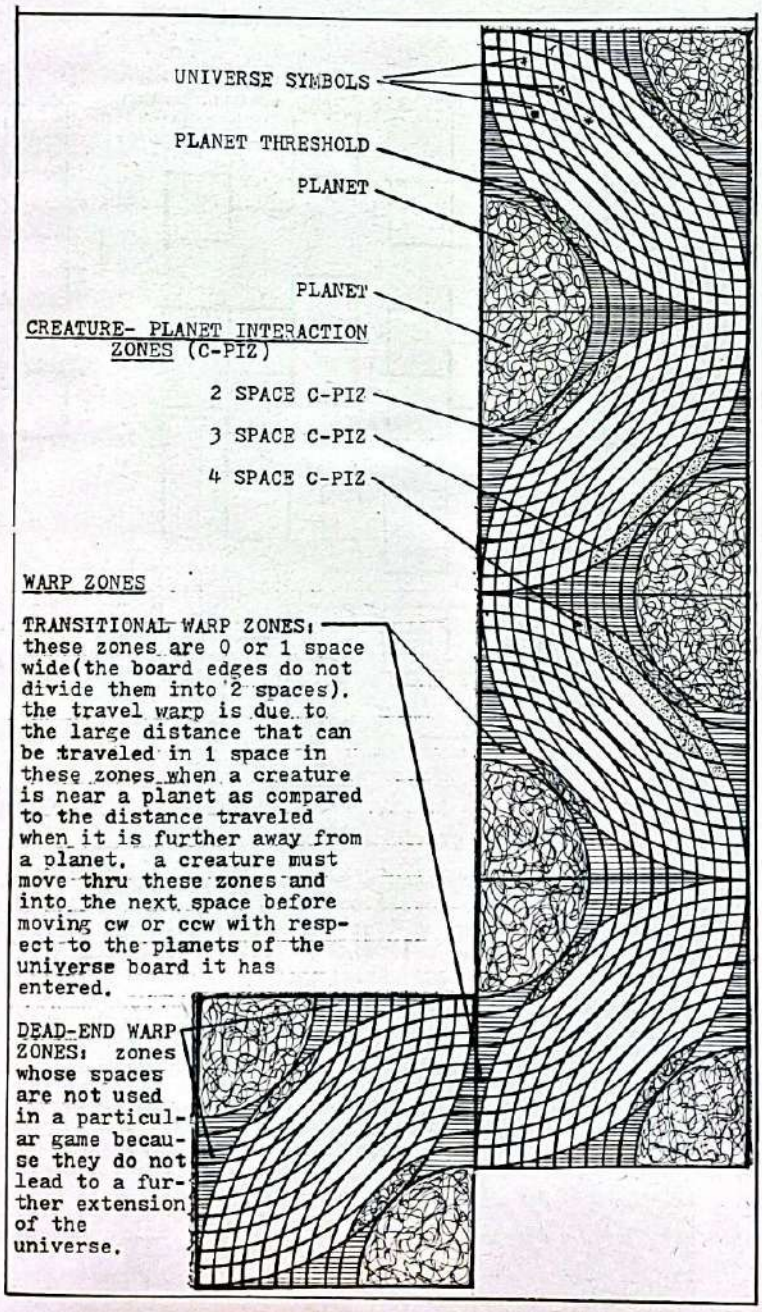
e. SUPPLY INTERVAL– this feature designates the length of time (number of moves) that a creature can be in space before having to be supplied. if it is not supplied within this interval the creature dies and is removed from the board. SUPPLY occurs (i) when a creature lands on a SUPPLY SPACE that is still able to supply it, i. e. if his homebase planet is still alive. (ii) when two similar creatures land on the same space, resulting in the death of one and the rejuvenation of the other. (iii) when two dissimilar creatures land on the same space and cooperate in supplying one another, resulting in the rejuvenation of both creatures. when supply is achieved, the rejuvenated creature has the SUPPLY INTERVAL number of moves with which to travel through space before it is to be replentished again. it might be helpful in remembering when creatures are to be resupplied if each player were to keep a record on a piece of paper, noting the MOVE NUMBERS at which each of his creatures must receive supplies or else it will die.

f. CREATURE–PLANET INTERACTION ZONES– this feature designates how creatures are to move when in close proximity to the planets. these zones are either attraction or repulsion zones. if a creature is dealt an attraction card it will be attracted onto a planet when it is the number of spaces indicated on the card from the planet (see illustration). if a creature is dealt a repulsion card it must move the reverse of what is designated on the TRAVEL CARD when it is within the proper proximity to the planet as indicated.

g. SPEED FACTOR– this feature designates how a creature moves with respect to the movement prescribed by the TRAVEL CARDS. it states how many times as fast as the TRAVEL CARD a creature moves through space. example– cw 1:3, indicates that the creature moves three times the number of clockwise moves on the TRAVEL CARDS it selects.

5. make the appropriate number of your own creatures, according to your creature sex feature and place them on your homebase planet. (use: kneaded eraser, clay, etc.)

6. shuffle and deal a PLANET LIFE CARD to each player. place the rest of these cards in a place where players will be able to take one at the appropriate times in the game.
PLANET LIFE– this planet feature indicates how long a creature's homebase planet is alive and for how long it can sustain its creature's SUPPLY SPACES. after the death of its planet a creature can survive in space by means other than SUPPLY SPACES, i. e. cooperation, etc. upon landing the number of creatures appropriate to inhabit a planet one takes a PLANET LIFE CARD to determine if the planet is alive. if the game has lasted longer than the number of moves indicated on the PLANET LIFE CARD then the planet is dead to that players creatures and they must continue their search for a living planet on which they can survive. once a player's creatures have left the dead planet they may not return to it as a living planet. other creatures may land on it and find it alive for them if the PLANET LIFE CARD they select indicates that the game has not lasted longer than the life of the



planet. when creatures inhabit a living planet, it remains alive for them as many moves as indicated on the PLANET LIFE CARD, i. e. upon inhabiting a planet on the 17th move, one takes a PLANET LIFE CARD that indicates a PLANET LIFE of 20 moves; the planet is alive for these creatures and will remain so until the 37th move of the game; at which time if the creature wishes to continue to survive. it will have to travel to another living planet, and so on.

there remain two EXISTENCE FEATURES of the game to be explained: time and movement

MOVE NUMBER– this existence feature indicates the passage of time during the game by the number of rounds of moves done by the creatures (players). it is by the turning over of the next MOVE NUMBER CARD after every round of play that SUPPLY INTERVAL AND PLANET LIFE is determined in relation to. these cards mark a creature's survival or death.

TRAVEL– this existence feature indicates the passage of a creature through space. passage through space is done via the spaces marked off between the planets on the UNIVERSE BOARDS. the direction and the number of spaces to be traveled by a creature is indicated on the TRAVEL CARDS. the direction of movement is either clockwise (cw) or counterclockwise (ccw) with respect to the planets which occupy the UNIVERSE BOARDS and to which the creatures are moving. this movement is done in the spaces concentric to the reference planet the creature chooses to move with respect to. a creature may change reference planets as many times as it wishes in the course of a move in order to land on the space it desires (watching out for barriers on the way). each TRAVEL CARD has written on it two possible moves. one may be a combination move involving both cw and ccw travel, this is considered ONE move. upon choosing one of the two possible moves for a creature to travel (assuming intelligence), the creature must move the entire distance indicated. one may not move two creatures with one TRAVEL CARD.

8. CONTACT is the one remaining interaction convention to be explained. CONTACT is the interaction of two or more dissimilar creatures. it occurs when they occupy the same space on the UNIVERSE BOARD. interaction must take place when the dissimilar creatures enter the same space. the entering creature states its desired interaction (annihilation, supply, etc.). the creature first occupying the space may initially co-operate or decline by taking a CONTACT CARD and proceeding as it indicates. if it takes a CONTACT 0 CARD it cannot move off the space and so must do as the other creature wishes.

9. players now determine the order in which they will move.

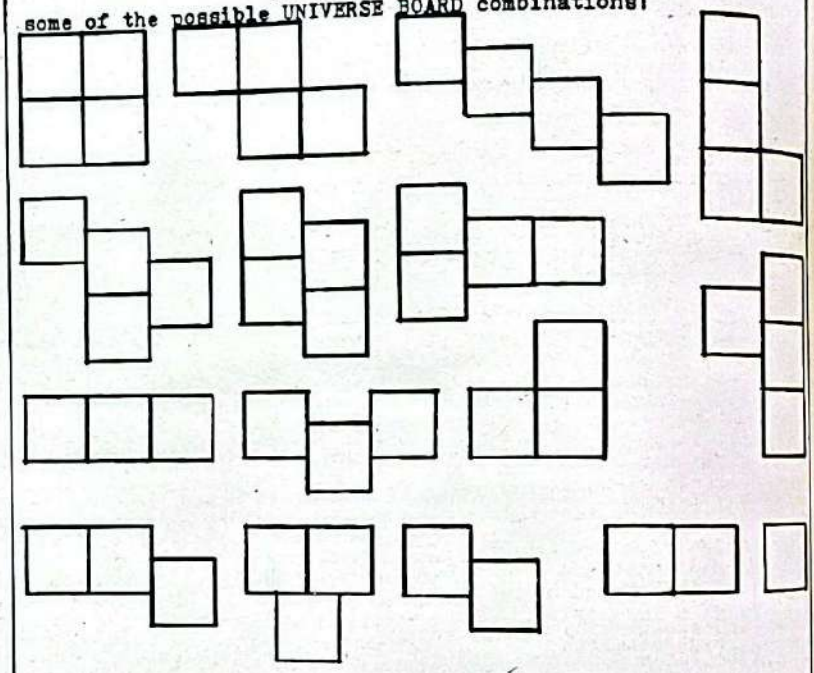
10. the player who is to move first turns over the first MOVE NUMBER CARD and places it face up next to the stack indicating the first round of moves is about to start. the player now takes the top card off the TRAVEL CARD stack and moves his first creature off its planet's threshold into space in the manner indicated on the card.

PLAY HAS BEGUN

if during the playing of this game problems arise, their solutions should be arrived at through the cooperation of the players to adapt these rules or to develop new and better ones. this is your game, play it as you wish. we have only sought to put down a few (?) suggestions on how it might be played. hopefully this game will generate new and better games through the energy and imagination of its players and CREATURES.

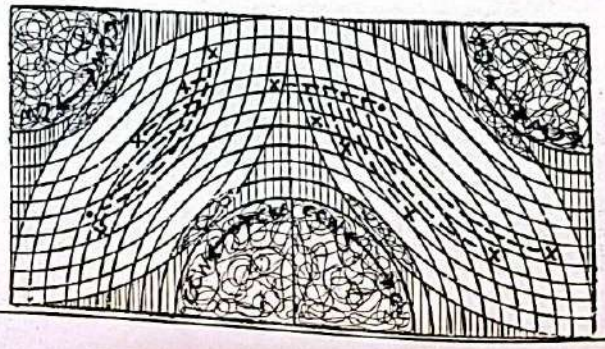
peace/rahu

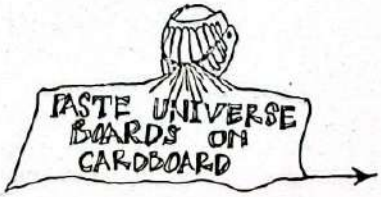
some of the possible UNIVERSE BOARD combinations:



example of creature travel:

a creature on space "•" picks a "6 ccw" TRAVEL CARD. "X" marks some of the spaces on which the creature may land as a result of a 6 ccw move by following various paths of movement (indicated by: - - - - -).




PASTE UNIVERSE
BOARDS ON
CARDBOARD

CCW
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CREATURE FEATURES
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PASTE UNIVERSE
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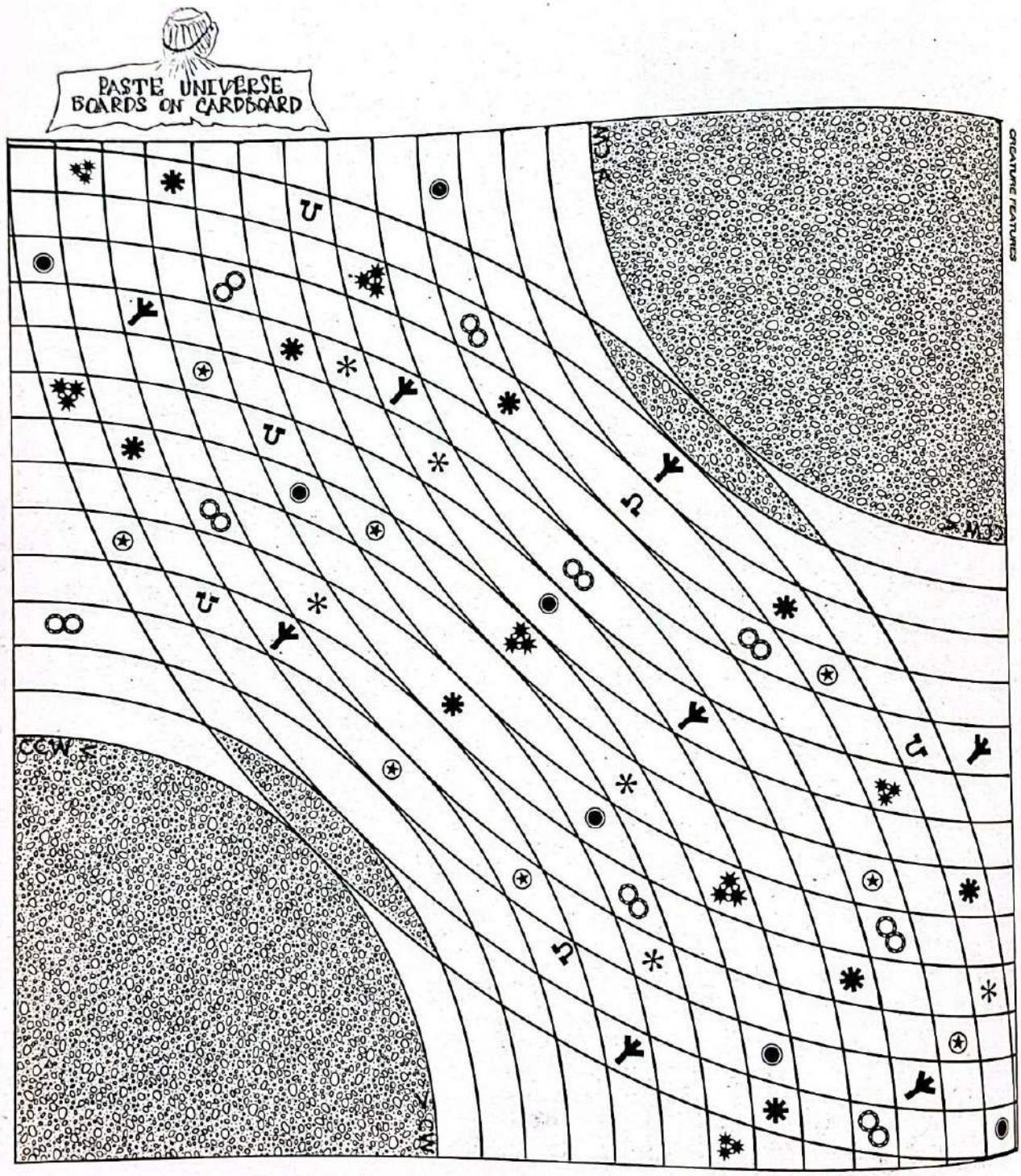
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CREATURE FEATURES

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CREATURE FEATURES

TRI·SEXUAL	NON·INTELLIGENT	LIQUID	INVULNERABLE	SPEED FACTOR CCW 1:1 CW 1:1	ATTRACTION ZONE 0 SPACES
TRI·SEXUAL	INTELLIGENT	LIQUID	VULNERABLE TO LIQUID	SPEED FACTOR CCW 1:1 CW 1:1	ATTRACTION ZONE 4 SPACES
BI·SEXUAL	INTELLIGENT	MASS	VULNERABLE TO LIQUID AND MASS	SPEED FACTOR CCW 1:1 CW 1:1	REPULSION ZONE 0 SPACES
BI·SEXUAL	INTELLIGENT	LIQUID	VULNERABLE TO LIQUID AND GAS	SPEED FACTOR CCW 1:1 CW 1:2	REPULSION ZONE 3 SPACES
BI·SEXUAL	NON·INTELLIGENT	GAS	VULNERABLE TO GAS	SPEED FACTOR CCW 1:3 CW 1:1	ATTRACTION ZONE 3 SPACES
UNI·SEXUAL	NON·INTELLIGENT	GAS	VULNERABLE TO MASS	SPEED FACTOR CCW 1:3 CW 1:3	REPULSION ZONE 2 SPACES
UNI·SEXUAL	INTELLIGENT	MASS	VULNERABLE TO MASS, GAS, LIQUID	SPEED FACTOR CCW 1:1 CW 1:2	REPULSION ZONE 4 SPACES
UNI·SEXUAL.	NON·INTELLIGENT	GAS	VULNERABLE TO MASS AND GAS	SPEED FACTOR CCW 1:2 CW 1:2	ATTRACTION ZONE 2 SPACES

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PLANET LIFE 10 MOVES	PLANET LIFE 50 MOVES	PLANET LIFE 45 MOVES	PLANET LIFE 40 MOVES	✦	REPRODUCTION SPACE	LIQUID BARRIER	
PLANET LIFE 15 MOVES	PLANET LIFE 10 MOVES	PLANET LIFE 50 MOVES	PLANET LIFE 45 MOVES	*	INTELLECT SPACE	GAS BARRIER	
PLANET LIFE 20 MOVES	PLANET LIFE 15 MOVES	PLANET LIFE 10 MOVES	PLANET LIFE 50 MOVES	✱		CONTACT SPACE	
PLANET LIFE 25 MOVES	PLANET LIFE 20 MOVES	PLANET LIFE 15 MOVES	PLANET LIFE 15 MOVES	✵		MASS BARRIER	SUPPLY SPACE
PLANET LIFE 30 MOVES	PLANET LIFE 25 MOVES	PLANET LIFE 20 MOVES	PLANET LIFE 20 MOVES	8			
PLANET LIFE 35 MOVES	PLANET LIFE 30 MOVES	PLANET LIFE 25 MOVES	PLANET LIFE 25 MOVES	◉			
PLANET LIFE 40 MOVES	PLANET LIFE 35 MOVES	PLANET LIFE 30 MOVES	PLANET LIFE 35 MOVES	⊛		MOVE # 49	
PLANET LIFE 45 MOVES	PLANET LIFE 40 MOVES	PLANET LIFE 35 MOVES	PLANET LIFE 40 MOVES	↳		MOVE #50	

UNIVERSE FEATURE	UNIVERSE FEATURE	UNIVERSE SYMBOL	PLANET FEATURE	PLANET FEATURE	PLANET FEATURE	PLANET FEATURE	PLANET FEATURE	PLANET FEATURE	PLANET FEATURE	PLANET FEATURE	PLANET FEATURE
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CREATURE FEATURES

SUPPLY INTERVAL 10 MOVES	4 CW - 3 CCW OR 2 CW	4 CW - 3 CCW OR 1 CCW	4 CCW OR 2 CW - 3 CCW	3 CCW OR 3 CCW - 2 CW	2 CCW - 4 CW OR 1 CW - 3 CCW
SUPPLY INTERVAL 20 MOVES	2 CCW - 1 CW OR 6 CCW	8 CCW OR 2 CW - 6 CCW	2 CCW OR 3 CCW - 2 CW	0 OR 2 CCW - 1 CW	5 CW - 1 CCW OR 4 CW
SUPPLY INTERVAL 10 MOVES	8 CW - 6 CCW OR 10 CW	3 CCW - 2 CW OR 6 CW	3 CCW OR 2 CW	0 OR 3 CW - 1 CCW	2 CCW OR 1 CW
SUPPLY INTERVAL 15 MOVES	6 CW - 2 CCW OR 2 CCW	1 CCW OR 6 CW - 2 CCW	1 CW OR 1 CCW - 1 CW	6 CCW OR 3 CW - 2 CCW	3 CW - 3 CCW OR 3 CW
SUPPLY INTERVAL 20 MOVES	2 CW - 6 CCW OR 4 CW	4 CCW OR 4 CW - 6 CCW	9 CCW OR 3 CW - 1 CCW	1 CW OR 3 CW - 2 CCW	1 CCW - 1 CW OR 1 CCW
SUPPLY INTERVAL 10 MOVES	10 CW - 8 CCW OR 3 CCW	3 CCW - 4 CW OR 1 CW	2 CCW OR 1 CW - 3 CCW	4 CCW - 3 CW OR 6 CW	4 CW - 2 CCW OR 1 CCW - 2 CW
SUPPLY INTERVAL 15 MOVES	0 OR 5 CW	0 OR 3 CW	2 CW OR 2 CW - 4 CCW	10 CCW - 8 CW OR 3 CW	3 CW OR 7 CCW
SUPPLY INTERVAL 20 MOVES	3 CCW - 4 CW OR 2 CCW	6 CW OR 1 CW - 3 CCW	4 CW - 2 CCW OR 6 CW	1 CW - 2 CCW OR 6 CCW	1 CCW OR 1 CW

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TRAVEL	TRAVEL	TRAVEL	TRAVEL	TRAVEL	CREATURE FEATURE
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TRAVEL	TRAVEL	TRAVEL	TRAVEL	TRAVEL	CREATURE FEATURE

CREATURE FEATURES

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CONTACT 0	CONTACT 0	MOVE #1	MOVE #9	MOVE #17	MOVE #24
CONTACT 1 CW	CONTACT 3 CCW	MOVE #2	MOVE #10	MOVE #18	MOVE #26
CONTACT 4 CW	CONTACT 3 CW	MOVE #3	MOVE #11	MOVE #19	MOVE #27
CONTACT 0	CONTACT 0	MOVE #4	MOVE #12	MOVE #20	MOVE #28
CONTACT 6 CW	CONTACT 0	MOVE #5	MOVE #13	MOVE #21	MOVE #29
CONTACT 3 CCW	CONTACT 0	MOVE #6	MOVE #14	MOVE #22	MOVE #30
CONTACT 2 CW 3 CCW	CONTACT 8 CCW 3 CW	MOVE #7	MOVE #15	MOVE #23	MOVE #31
CONTACT 0	CONTACT 0	MOVE #8	MOVE #16	MOVE #25	MOVE #32

CREATURE INTERACTION
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SIDEWALK

Sidewalks are imperative. For if there were no sidewalks, how could one get from place to place? Not by walking, surely, alongside a road secure in terrain and direction, as automobiles would pass by driven with little care. One does not compete with automobiles; that cannot stand to reason.

No. One could not walk on roadsides as though sidewalks were still there. To force one's steps through grass or mud or snow: this idea would be unthinkable. One cannot walk at all. Without a path already paved, no one can in deed create a system of ordered steps.

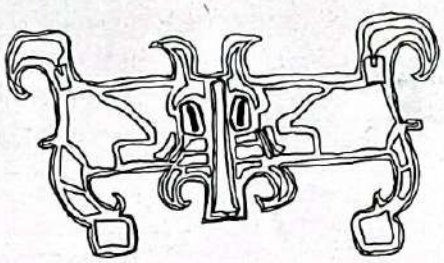
It is, then, that we know intuitively that sidewalks become much like language. One cannot say without imposing limitations of grammar and punctuation; one cannot walk without sidewalks. But one can ignore such limitations as the existence of alternative routes might seem to require; that the end point will be the same thus has already assured communication. Constructed sidewalks for our thoughts, languages for our feet, make declaratives possible, locations fixed, thus make all new languages imperatives and hence dangerous.

SIDEWALK

Sidewalks are imperatives. For if there were no sidewalks, how would one get from place to place? Not by walking surely alongside a road, secure in terrain and direction, as automobiles would pass by: driven, with little care. One does not compete with automobiles that cannot stand to reason.

No. One would not walk on roadsides as though sidewalks were still there to force one's steps. Through grass or mud or snow, this idea would be unthinkable: one cannot walk at all without a path already paved. No! One can, indeed, create a system of ordered steps.

It is then that we know intuitively that sidewalks become much like language. One cannot say, without imposing limitations of grammar and punctuation, "one cannot walk without sidewalks." But one can ignore such limitations, as the existence of alternative routes might seem to require that the end point will be the same; thus has already assured communication constructed sidewalks for our thoughts. Languages for our feet make declaratives, possible locations, fixed. Thus: make all-new languages imperative and hence dangerous.



NEUROPHYSIOLOGY OF COGNITION

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Whether stated or not, the fundamental quest of neurophysiology is to understand the processes that determine the so-called higher functions in the brain. The present work is an explicit attempt in that direction. Whatever success I have in this endeavor I owe to the enriching discussions I had with my friend Heinz Von Foerster and my student Francisco Varela.

Statement of the Problem

propositions

Cognition is a biological phenomenon and can only be understood as such; any epistemological insight in the domain of knowledge requires this understanding.

If such an understanding is to be attained, two questions have to be considered:

1) What is cognition as a process?
2) How is it carried out?

I shall proceed accordingly.

The connotations of the terms used will become apparent through their usage in the text, and the complete presentation is expected to provide the foundation for its parts.

[The assembled experts declared this proposal to be incomprehensible. They requested that I resubmit it with an explanatory addition.]

EXPLANATORY ADDITION

The apparatus mentioned above would face each and every statement, not with the question: 'Is this a consistent statement?'. The question would be: 'Which system needs to be stipulated so that, therein, the statement becomes consistent?'

This kind of questioning statements is and has always been the composer's profession. In looking at the composer's work we perceive the extent to which he succeeded in establishing that system in which his statements are consistent; we no longer discuss the value of statements but rather the value of the systems implied by the statements.

As the composer stipulates systems, elements, and structures, he becomes increasingly proficient in recognizing the problems that appear in systems.

Problems may attack a system from within - a malfunction in the system - or from without: the system as a whole is questioned. The latter, and thus also the problems of large complex systems, do not show themselves in their 'real' totality but rather in smaller less complex subsystems which imply - by analogy or by disintegration - the system wherein they are consequences and consistent or inconsistent statements.

In contradistinction to Industry and Business who must dominate the system to which they adjust, Technology and The Arts need neither dominate nor adjust. Composers and technologists are not concerned with the exploitation of, and adjustment to, problems. They are concerned with the solution of problems and, as a first step in this direction, with the design of models, structural analogies, of the desired solution.

The construction of models for problem-solving in the broadest and most general sense is the goal which Technology and Composition have in common. In order to reach and to effectively demonstrate this goal they have to preserve their independence from temporarily ruling values which always imply and reaffirm only the system that ought to be investigated and that gave rise to the problem. If technologists and composers were to join forces in an internationally supported endeavour of systems-research and systems-creation they could hope to avoid loops of futility, to preserve their independence from temporarily ruling values, to reach and to effectively demonstrate their goal. Their findings, discoveries, suggestions, and explanations should throw considerable light, be it welcome or not, on man's ability of changing, if need be, just those concepts which he most automatically takes for granted.

The contemporary distance between the composer in the technological era and the systems that rule his life is a required prerequisite for his effectivity as a temporarily inabsorbable, critical, and necessary input to (his) society.

[Where upon the experts, who, really, were only specialists, refused to vote on the proposal. Some argued that it was irrelevant to the meeting's theme. Some argued that it would offend member states in UNESCO. This argument was flatly denied by the participating representatives of UNESCO, but to no avail.]

Cognitive Process in General

the observer

Anything said is said by an observer. In his discourse an observer speaks to another observer who could be himself, and whatever applies to one applies to the other as well. The observer is a human being, that is, a living system.

The observer beholds simultaneously the entity that he considers (an organism, in our case) and the universe in which it lies (the organism's environment). This allows him to interact independently with both and to have interactions that are necessarily outside the domain of interactions of the observed entity (the organism).

It is an attribute of the observer to be able to interact independently with the observed entity and with its relations; for him both are units of interactions (entities).

For the observer an entity is an entity (a unit of interactions) when he can describe it. To describe is to enumerate the actual or potential interactions and relations of the described entity. Accordingly, the observer can describe an entity only if there is at least one other entity from which he can distinguish it and with which he can observe it to interact or relate, even if this is the observer himself, and which serves as a reference for the description.

The set of all interactions into which an entity can enter is its domain of interactions. The set of all the relations (interactions through the observer) in which an entity can be observed is its domain of relations. (This latter domain lies in the cognitive domain of the observer.) An entity is an entity if it has a domain of interactions; and if it has a domain of interactions, it has a domain of relations. The observer can define an entity by specifying its domain of interactions; thus, part of an entity, a group of entities, or their relations can be made units of interactions (entities) by the observer.

The observer can define himself as an entity by specifying his own domain of interactions.

Any understanding of the cognitive process must account for the observer and his role in it.

the living system

Living systems are units of interactions; they exist in an environment. From a purely biological point of view they cannot be understood independently of the part of the environment with which they interact, the niche; nor can the niche be defined independently of the living system that occupies it.[1]

Living systems as they exist on the earth today are characterized by exergonic metabolism, growth, and replication (and reproduction), all organized in a closed causal circular process that allows for evolutionary changes in the way the circularity is maintained, but not for loss of the circularity: exergonic metabolism is required to provide energy for the endergonic synthesis of specific polymers (proteins, nucleic acids, lipides, polysaccharides) from the corresponding monomers, that is for growth and reproduction; special replication procedures are needed to secure that the polymers synthesized be specific, that is, that they should have the monomeric sequence proper to their class; specific polymers (enzymes) are required for the exergonic metabolism and the synthesis of specific polymers (proteins, nucleic acids, lipides, polysaccharides). This circular organization determines that the components that specify it be those whose synthesis it secures. Hence, its circular nature is essential for its maintenance and its operation as a unit. That which is not in it is external to it or does not exist. This circular organization is the living organization.

It is the circularity of its organization that makes a living system a unit of interactions, and it is this circularity that it has to maintain in order to remain a living system and to retain its identity through different interactions. All the peculiar characteristics of the different kinds of organisms are superimposed on this basic circularity and are subservient to it, securing its continuance through successive interactions in an always changing environment. A living system defines through its organization the domain of all the interactions into which it can possibly enter without losing its identity; its identity is maintained as long as the basic circularity that defines the system as a unit of interactions remains unbroken. (Strictly, the identity of a unit of interactions that otherwise changes continuously is maintained only with respect to the observer for whom its character of being a unit of interactions remains unchanged.)

Due to the circular nature of its organization, a living system has a self-referring domain of interactions (self-referring system): the condition for being a unit of interactions of a living system is maintained, for its organization has functional significance only in relation to the maintenance of its circularity and defines its domain of interactions accordingly.

Living systems as interacting units cannot enter into interactions that are not prescribed by their organization. The circularity of their organization continuously brings them back to the same internal state (same with respect to the cyclic process). Each internal state requires that certain conditions (interactions with the environment) be satisfied to proceed to the next one. The circular organization implies the prediction that a necessary interaction that took place once will take place again.

world-wide network of equivalent institutions. Everywhere it should grow as the results of such research accumulated everywhere.

The composer in the technological era is a professional member of such projects. His profession is the art of composition and his work establishes and demonstrates connexions of various kinds between various elements, stipulated and desired connexions that cannot occur in the eternal feedback loop of empirically functioning thinking processes.

Technology in the technological era sees the composer's work as an input of a particular nature, as an analogy to a desired reality which may have to be implemented and to be observed in functional action before anyone can possibly judge whether such a reality is - besides and beyond being desired - also desirable.

To the question whether a statement is true there be added the question: what if it were true?

To the question whether a composition is music there be added the question: what if this were music?

So that language may not become a fossilized fetish, let it be praised for the thoughts it expresses, but ruthlessly criticized for the ideas it fails to articulate. Language is not the standard against which thinking is to be measured; on the contrary: language is to be measured by a standard it barely reaches, if ever, namely the imagery of human doubt and human desire.

To measure language, with imagery as a standard, is the function of art in society. The arts are a meas .ing meta-language about the language that is found wanting. If the imagery succeeds in containing, anticommunicatively, for later, the stimulation, the structural analogy to that which was found wanting, then who knows, it may tell us or someone some day with breathtaking eloquence and in then simple terms what we, today, almost speechlessly have wanted so much.

Our present era meanwhile dictates in ever more venomous terms that we must turn to artificial systems if we wish to conduct intelligent research and intelligent experiments without causing bloodshed, corruption, and misery.

[A few days after this paper had been read, the chairman of the meeting requested that I submit to the experts present at the symposium a proposal summarizing the goals and ideas implied by my paper. The experts, then, were to vote on whether to recommend that steps be taken towards an implementation of the proposal.]

SUMMARIZING THE GOALS AND IDEAS

I propose that an international apparatus be defined and initiated which would investigate and analyze submitted ideas, compositions, statements and general propositions with regard to their function (potential or real) as structural models. The apparatus should be so formed and equipped that it can answer the following questions: What is the composition and structure of that system in which the submitted item would have the greatest significance? In which system, social, political, physical, would the submitted item be compatible with concepts of truth, reality, tractableability, etc.?

If this does not happen, the system disintegrates, if the predicted interaction takes place, the system maintains its identity (*integrity*) and enters into a new production. In a continuously changing environment these predictions can be successful only if the environment does not change in that which is predicted. Accordingly, the predictions implied in the organization of the living system are not predictions of particular events but of classes of interactions. Every interaction is a particular interaction, but every prediction is a prediction of a class of interactions that is defined by those features in its members which will allow the living system to retain its circular organization after the interaction and, thus, interact again. This makes living systems inferential systems, and their domain of interactions a cognitive domain.

The niche is defined by the classes of interactions into which an organism can enter. The niche is, then, to the observer, part of the environment, to the living system, all that with which it can interact without losing its identity. For the observer the environment in which the organism lies is larger than the niche, but this environment lies in the domain of interactions (cognition) of the observer, not of the organism. If the living system enters into an interaction not prescribed by its organization, it enters it not as the unit of interactions defined by this organization, but as some other unit of interactions or part thereof, and this interaction remains outside its cognitive domain. For every living system, its niche is represented in its organization as the domain of its possible interactions, and this domain constitutes its entire cognitive reality.

evolution

Evolutionary change in living systems is the result of that aspect of their organization which secures the maintenance of their basic circularity, and which allows in each reproductive step for changes in the way it is attained. Reproduction and evolution are not essential for the living organization, but they have been essential for the evolution of the cognitive domains of the living systems on earth.

For a change to occur in the domain of interactions of a unit of interactions without it losing its identity (with respect to an observer), it must suffer an internal change. Conversely, if an internal change occurs in a unit of interactions, without it losing its identity, its domain of interactions changes. A living system suffers an internal change without loss of identity if the new prediction, brought forth by the internal change, is a prediction of interactions which do not interfere with its fundamental circular organization. A system changes only if its domain of interactions changes.

In reproduction the new unit of interactions has the same domain of interactions as the parental one only if it has the same organization. Conversely, the new unit of interactions has a different domain of interactions than the parental one only if its organization is different, and, hence, implies different predictions about the niche.

Since predictions about the niche are inferences about classes of events to be encountered (interactions), particular encounters that for the observer (and hence for other units of relations, such as internal parts of the same living system) are different, may be indistinguishable for the organism. The observer can describe them as different members of a class defined by the mode of interaction of the organism. As a consequence, interactions that are identical for the organism, but are different for parts of it, may result in different modifications of its internal states and, hence, different changes in its domain of interactions without loss of identity. These changes may bring about the production of an offspring with a domain of interactions different from the parental one. If this is the case and the new system predicts a niche that cannot be actualized, it disintegrates; otherwise it maintains its identity, and a new cycle begins.

What changes from generation to generation is the internal structure of the unit of interactions: that which through a circular organization retains its identity through numerous interactions. The manner in which the unit of interactions is compounded, whether by a single unit, or through the aggregation of numerous ones that together become a new larger unit of interactions (multicellular organisms, insect societies, etc.) is of no significance; what evolves is the unit of interactions. The evolution of the living systems is the evolution of the niches of the units of interactions, hence the evolution of the cognitive domains.

the cognitive process

A cognitive system is a system whose organization defines a domain of interactions in which it can act with relevance to the maintenance of the system itself, and the process of cognition is the actual (inductive) acting (or behaving) in this domain. Living systems are cognitive systems, and living, as a process, is a process of cognition. This statement is valid for all organisms, with and without a nervous system.

If a living system enters into a cognitive interaction, its internal state is changed in a manner relevant to its maintenance and it enters into a new interaction without losing its identity. In an organism without a nervous system (or its functional equivalent) its interactions are of chemical or physical nature (a molecule is absorbed and an enzymatic process is initiated, a photon is captured and a step in photosynthesis is carried out). For such an organism the relations holding between the physical events remain outside its domain of interactions. The nervous

It is quite obvious: any such artificial system will contain computer installation. But what kind of an installation? Nobody knows yet because it should not be developed before the software, the programmes, that define the structure of the system have been written. Such a system is supposed to do for the user. The user, however, is not to be seen as a paying consumer, whose demands have to be educated and then fit the available offers.

The word "user" refers instead to a member of one subset of the set of all possible kinds of input. The first task then is to define this subset until it contains every possible kind of user. Every user is an element of at least two social systems: the social system he lives and at least one social system that sees him. The artificial system must be able to insist on getting just so much input from the user as it needs for identifying the social systems in which the user's existence is definable. The response of the artificial system could then adopt the property of an input to any one or all of the systems defining the user's existence. The complete set of all possible kinds of input would thus contain all users and all responses by the artificial system. If we roughly define "input" as something that induces and initiates action, as well as what is called "creative acts".

What is asked for is a heterogeneous assembly of input oriented units that would define an intelligent society, redefine the user, and develop an artificial system that by its response-capability would show the user his role in an intelligent society so that he may become induced to also want it in reality.

Inevitably such a project progresses in stages of partial fulfilment of set goals. At every significant stage, however, the results reached should be incorporated into a systems programme which is to be submitted to and analysed by technologists. They, in response to this input, would proceed and invent and construct the mechanics, the hardware, the computer, the input-output interface which best can represent, simulate, execute, and display the functions of an artificial system that possesses properties which man either cannot have or does not have yet. Clearly this installation will also be used to reach the next stage of significance, and will, if intelligently operated, eventually only have to be modified and improved. Should there ever come the day, and an invention or discovery be made, that would render obsolete this whole machinery, possibly even the whole project, it will be either a no-man's day or a day for world-wide celebration.

Work on the project has to begin simultaneously in as many places as possible all over the world. Every school, every university or relevant institution could assign to a selected but preferably heterogeneous group of its members the task of starting research towards the realization of the potential user in the immediate environment up to and including the areas overlapping with those defined by neighbouring groups.

The building I imagine should be planned and constructed at each place, combining special features reflecting local preferences with some more general features that would make it a compatible member of a

system enlarges the domain of interactions of the organism by making the internal states of the living systems also modifiable in a relevant manner by *pure relations*, and not only by physical events: the observer sees that the sensors of an animal (say, a cat) are modified by light, and that the animal (the cat) is modified by a visible entity (a bird). The sensors change through a physical interaction, the absorption of light quanta; the animal is modified through its interaction with the relations that hold between the activated sensors that absorbed light quanta at the sensory surface. The nervous system expands the cognitive domain of the living system by making it possible for it to interact with *pure relations*; it does not create cognition.

Although the nervous system expands the domain of interactions of the organism by bringing into this domain interactions with *pure relations*, the function of the nervous system is subservient to the necessary circularity of the living organization.

The nervous system, by expanding the domain of interactions of the organism, has transformed the unit of interactions and has subjected acting and interacting in the domain of *pure relations* to the process of evolution. As a consequence there are organisms that include as a subset of their possible interactions, interactions with their own internal states (as states resulting from external and internal interactions) as if these were independent entities, generating the apparent paradox of including in their cognitive domain their cognitive domain. In us, this paradox is resolved by what we call abstract thinking (a new cognitive domain).

Furthermore, the expansion of the cognitive domain into domains of pure relations by virtue of a nervous system allows for nonphysical interactions (representations) between organisms that orient each other toward other interactions. Herein lies the origin of communication. But this very process generates another apparent paradox: there are organisms that generate representations of their interactions by specifying entities with which they interact as if these entities belonged to an independent domain, while as representations they only map their own interactions. In us this paradox is resolved simultaneously in two ways.

1) By our becoming observers, we recursively generate representations of our interactions; and by interacting with their relations we remain in a domain of interactions that is always larger than that of the representations.
2) By our becoming conscious, we make descriptions of ourselves (that is representations); and by interacting with our descriptions we can describe ourselves describing ourselves—in an indefinite recursive process.

Cognitive Process in Particular

(The Nervous System)

nerve cells

The neuron is the anatomical and functional unit of the nervous system. It is the anatomical unit because it is a cell and as such it is an integrated and self-referring metabolic and genetic unit (a living system indeed). It is the functional unit because as a collector and as a distributor of influences it functions as a unit.

Anatomically and functionally the neuron is formed by a collector (dendrites and sometimes the cell body) united via a distributive element (the axon, and in some cases, also the cell body and main dendrites), capable of conducting propagated spikes to an effector area formed by the terminal branching of the axon. The functional state of the collector area depends both on its internal state (reference state) and on the state

in handling competently the temporary incompetence of their language? What if it is a property of all our social systems not to have matured enough in order to liberate and promote language from its fictitious status of a slave who will do the best he can, to the status-independent existence of a student and scholar, who will try to do better than the best he or anyone can?

III

I challenge technology to escalate its push towards a socially beneficial technological era for mankind by designing and constructing for all of us the compound facility wherein and wherewith many people can be induced to come and enjoy the effort of learning how to compare and measure their languages against and with their imagination and their desires. I am speaking of an artificial system which should function as an accepted member of society and be respected and used equally by the few and by the many, as long as this differentiation will have any validity left.

I imagine a building in which the arts are met by technology and the sciences on their common ground. They all investigate, stipulate, create and exploit systems. They all are faced with the puzzles and the functions of structure. And their aims and results complement one another because of their difference. While the sciences observe or stipulate systems which are to be analogous to an existent truth or reality, and while technology stipulates and creates systems that are to function in an existent truth or reality, the arts stipulate and create systems which are analogous to an existence desired to become true or real.

All three must be represented with all their branches and departments in the team that has to invent, to stipulate, to study, to discuss, and eventually to decide on the interior and exterior requirements that such an artificial system must be able to fulfill. Let me mention just one area of research that might demand no less than such a team's collective efforts before it will even begin to reveal its dimensions and secrets.

What if it were true that, as the saying goes in many quarters, man's mind is limited by nature to the potentials we already know, and that we may thus not expect it to ever possess the properties necessary for the creation of what we call an ideal society? If this were true we would need artificial systems that possess those properties to guide us. And if it were true that, as the saying goes in other quarters, man's mind has shown here and there the potential for change and development but that precisely the rarity of such an event generates hostility against it in the many who did not participate in it, then we would need artificial systems that remove the property of rarity by demonstrating the participation of all. No matter on which assumed truth it is based or to which conjectural reality it may be meant to correspond, any such artificial system should possess properties that man either cannot have, or does not yet have, but that he needs and thus should be able to imagine or be taught to imagine.

ed activity ed the effector area synaging on it. Correspondingly, the state of activity ed the effector area of a neuron depends on the state of activity of its collector area and on the presynaptic and nonsynaptic interactions with other effector areas that may take place in the neuropil and in the immediate vicinity of the next collector areas. This is true even in the case of anarchic cells, in which collector and effector areas must be intermingled. The distributive element determines where the effector exerts its influence.

At any moment the state of activity of a nerve cell is a function of the spatiotemporal configuration of its input, as determined by the relative activity holding between the afferent neurons that modulates the reference state proper of the collector area. It is known that in many neurons the recurrence of a given afferent spatiotemporal configuration results in the recurrence of the same state of activity, independently of the way in which such a spatio temporal configuration is generated.[3] This is the understanding that two states of activity in a given cell are the same (equivalent) if they belong to the same class, as defined by the pattern of activity that they generate in their effector area, and not because they are a one-to-one mapping of each other. Also, the spatiotemporal configuration of the input on a neuron that causes in it the recurrence of a given state of activity is a class of afferent influences defined by a pattern in the relations holding between the active afferents and the collector. Thus, there are neurons for which a given class of response is elicited by a given class of afferent influences.

The nerve impulses that travel among the distributive element originate at the point where this element emerges from the collector area. Each nerve impulse is the result of the state of excitation of the collector area shape of the collector area (its geometry) has to be seen as selecting the spatiotemporal configuration of afferent influences to which the cell will respond.

Although I expect in a significant number of neurons a continuous change in their transfer functions as a result of their past history, I think that for the understanding of the functional organization of the nervous system it is necessary at any given moment to consider all nerve cells as responding with definite transfer functions to classes of afferent spatiotemporal configurations in their input, and not to particular situations. This because of two reasons:

1) I consider that any interaction through the nervous system is represented by a state of activity in a collection of cells, and that this state of activity should lead to a given behavior. This behavior should be repeatable to the extent that the interaction is reproducible.

2) I consider that the nervous system always functions in the present. (The present is the time interval necessary for an interaction to take place; past, future, and time, in general, exist only for an observer.) Although nerve cells may be continuously changing their mode of operation, their past history can explain to an observer how their present mode of operation was reached, but not its present participation in the determination of behavior.

If nerve cells respond to classes of events, not to particular situations, they necessarily treat as equivalent particular afferent configurations that are otherwise unrelated.

architecture

In any given nervous system the great majority (and perhaps the totality) of its neurons can be assigned to well defined morphological classes, each characterized by a given pattern of distribution of the collector and effector areas of its members. As a result, the members of the same class hold similar relations with each other and with other neurons: the shapes of the nerve cells (collector area, distributive conductor, and effector area) specify their connectivity. These shapes are genetically determined and have been attained through evolution; the whole architecture of the brain is genetically determined and has been attained through evolution. The following implications, I think, are significant for the understanding of the functional organization of the nervous system.

1) There is a necessary genetic variability in the shape of nerve cells, as well as a variability that results from interactions of the organism with independent events during development. The functional organization of the nervous system must be such as to tolerate this variability.

2) No two nervous systems of animals of the same species (particularly if they have many cells) are identical, and they resemble each other only to the extent that they are organized according to the same general pattern. It is the organization defining the class—and not any particular connectivity—which determines the mode of functioning of any given kind of nervous system.

thought has to solve a problem of anticommunication. The syllables
"ati" are used here as in antipodes, antiphony, antithesis; not meaning
"hostile" or "against" but rather "juxtaposed" or "from the other side."

anticommunication faces communication somewhat as an offspring faces the
progenitor. And just as the offspring eventually will in his turn become
a progenitor so will anticommunication, in time, become communication.
this knowledge ought to make it possible for a community of people to have
a good time with either. Indeed it should be noted that the good time
lasts longer with anticommunication which leaves a lot open for the next
occasion than with communication which puts everything neatly away on
the spot. Anticommunication is an attempt at saying something, not
a refusal to say it. Communication is achievable by learning from
language how to say something. Anticommunication is an attempt at
respectfully teaching language to say it. It is not to be confused
with either non-communication, where no communication is intended, or
with lack of communication, where a message is ignored, has gone astray
or simply is not understood. Anticommunication is most easily observed,
and then, often can have an almost entertaining quality, if well-known
fragments of a linguistic system are composed into a contextual
environment, in which they try but fail to mean what they always had
meant and, instead, begin showing traces of integration into another
linguistic system, in which, who knows, they might one day mean what
they never meant before, and be communicative again.

However, when something new is conceived, introduced, and noticed,
then there appears a temporary gap, an interregnum which will disappear
only when that "something new" begins to be accepted, understood and
used: when it begins to grow old. This time of transition is a time
in which messages are sent that no one receives and in which messages
are received that no one sent. This is the time in which a language
gained is a language lost. By most people this time is experienced
only occasionally, in passing, in some concert, some exhibition, some
reading, and then usually not too happily; for it gives them a hard time
or no time or too much time, but no answer to their question: "What does
it all mean?"

It is this time, however, that is the almost continuous time
Potent for those poets, painters, and composers who move with it,
who always think of themselves as living and working just in that
hate and dumb moment where the language they gained got lost, where
it won't do and say what they would have it do and say. It is
therefore a sign of understanding and perceptivity if one expects
their productions, their works and words to escape the prevalent
level of communicativity, under the condition that all of their
activities and objects be at least propositions and at best provisions
for the next, now the future, level of communicativity. Creative Art
resides in poetry, music, dance, painting, architecture, theatre, film,
television, writing, and even in "happenings" only if each of these sub-
disciplines functions by anticommunication, which is my term for potential
and virtual expression in a field devoid of communicative guarantee. One
might to expect, yes, as an ambitious audience, even demand that this
field be cultivated at a time later than the last harvest and earlier
than the next.

But what if it is not only the much maligned audience, the people
who come to listen and to see who have the wrong expectations? What if
it is society itself, and therewith also the performers, the dancers,
the actors, the musicians, who do not know that their profession consists

The shapes of nerve cells and their packing are such that there is in general a great overlapping in the collector and effector areas of neurons of the same class. Also, the spatial distribution and the interconnections between different classes of neurons is such that any particular part of the nervous system is in general simultaneously related to many other parts; the parts interconnected, however, differ in different species, and, as a result, they have different interacting capabilities.

The organism ends at the boundary that its self-referring organization defines in the maintenance of its identity. At this boundary there are sensors through which the nervous system interacts in the domain of relations. These sensors are in general constituted by collections of sensory elements (cells) with similar—though not identical—properties (classes of properties), which in their mode of interaction with the nervous system share the characteristics of neurons in general. As a result, whenever the organism enters into an interaction within the physical domain of interactions of the sensors, generally not one, but many sensory elements are excited.

function

The way the nervous system functions is bound to its anatomical organization. The functioning of the nervous system, however, has two aspects: one which refers to the domain of interactions defined by the nervous system (relations in general); the other which refers to the particular part of that domain used by a given species (particular classes of relations); different species interact with different sets of relations (have different niches).

The nervous system only interacts with relations. However, since the functioning of the nervous system is anatomy bound, these interactions are necessarily mediated by physical interactions. For animals to discriminate objects by vision, the receptors in the eyes must absorb light quanta to be activated; yet the objects that the animal sees are determinded by the relations of receptor-induced activity within the functional and anatomical organization of the retina. Moreover, since the domain of interactions of the organism is defined by its structure, and this structure implies the prediction of the niche, the relations with which the nervous system interacts are defined by this prediction and arise in the domain of interactions of the organism. The (anatomical and functional) organization of the living system defines a *point of view*, a bias or a posture from which the interactions take place, and that determines the possible relations accessible to the nervous system. The anatomy of the retina and the properties of the various cell types define which relations, holding between the active receptors when a given visual object is viewed, will be accessible to the nervous system.

Due to the properties of neurons, and due to the architecture of the nervous system, interactions within the nervous system necessarily give origin to activity in aggregates of cells. Also, for the same reasons, any given cell may assume the same state of activity under many different circumstances of interactions of the organism. Thus, under no circumstance is it possible to associate the activity of any particular cell to any patricular interaction of the living system. (This can be clearly shown by discussing the visual system.[4]) When any particular interaction takes place at the level of the sensors, the relations accessible to the nervous system are given at this level in a certain state of relative activity of the sensing elements and not in the state of activity of any particular one. At the same time, although operational localizations can be established in the nervous system,[5] these localizations are to be viewed in terms of areas where certain modalities of interactions converge, and not as localizations of faculties or functions, even though certain functions cannot be performed in the absence of these areas. The nervous system is localized in terms of the organism's interaction surfaces, but not in terms of the representations of the interactions it can generate.

representation

The fundamental anatomical and functional organization of the nervous system is basically uniform: the same functions and operations (excitation, inhibition, lateral interaction, recursive inhibition, etc.) are performed in its various parts, although in different contexts and integrated in a different manner. A partial destruction of the nervous system does not alter this basic uniformity and, although the parts left untouched cannot do the same things that the whole does, they appear in their mode of operation identical to the untouched whole. To the observer, once the boundary of the sensors is passed, the nervous system, as a mode of organization, seems to begin at any arbitrary point that he may choose to consider: the answer to the question "What is an input to the nervous system?" depends entirely on the chosen point of observation. This basic uniformity of organization can best be expressed by saying: all that is accessible to the nervous system at any point are states of relative activity holding between nerve cells, and all that to which any given state of relative activity can give origin are further states of relative activity in other nerve cells by directly conforming those states of relative activity to which they respond. The effector neurons are not an exception to this since they, by causing an effector activity, cause a change in the state of relative activity of the receptor elements at the receptor surfaces, by generating an interaction. This has a fundamental consequence: unless they imply their origin (through concomitant events or their locations), there is no possible distinction between internally and externally generated states of nervous activity.

But wherever it is true that, as the saying goes, words mean what people take them to mean, these words cannot escape the meaning given to them by people. Where there is no escape, there are no alternatives, there is no freedom; and any meaning that argues with words which never escaped it just tells the story of its life. Every thought, idea, or concept, as it emerges for the first time in a given society, needs words so that it be expressed, be presented, be heard, understood and finally communicated. In search of such language one has to either create new words, or add and attach new meanings to old words. If a word, in the course of time and usage, has accumulated many kinds, shades, nuances of meaning, then we have to consider the context in which the word appears in order to know which particular meaning it is to carry. From this it follows that a new meaning of a word may be suspected, or assumed, if the context is such that none of the conventional meanings would fit. It is easier to coin and integrate into language a new word, a new sound, a new visual unit, than to make an old one mean something new. This is because the newly coined word announces its newness in every context. Its function is unambiguous and thus not context-bound. A new meaning, on the other hand, cannot be announced by an old word alone but only by a context to which the old word is a newcomer, in which it had never functioned before. The older a word is, the more meanings it has accumulated; the more ambiguous it becomes, the more context-bound it is. Whereas a new word adds to the language by enlarging the vocabulary, a new meaning adds to the language by increasing the significance of context.

All this I contend to be analogously the case in all systems in which the elements enter into temporarily significant coalitions, and where some communicable meaning becomes associated with either their moments of appearing or with the particular structure causing their appearance. Words in language, gestures of sound in music, definitions of visual units and colours in painting are just a few of the many terms denoting such coalitions.

On the one hand, I concede that in order to relate or permute established thoughts and ideas it may be sufficient to know what the listener takes words to mean, and to form one's language accordingly. The success of this language is then measured by the degree of comprehensibility. The problem of the speaker here is a problem in communication. His aim consists in having a new constellation of old thoughts understood by the currently valid rules and usages. For the presentation of new thoughts, on the other hand, the speaker should be requested to make his words mean what they heretofore had not meant, thus adding to the available repertory of a word's meanings that new meaning which is necessary for the presentation of the new thought. The success of this language can only be measured by the degree to which it questions the sufficiency of meanings already associated with words, and by the quality of the thoughts that so become audible for the first time; at which time there is, obviously, never enough of the kind of evidence available that would allow for completely correct evaluations.

As this is the point where the arts, including music, come in, let me formulate a useful term. Where a new thought is presented, the speaker's problem is not any longer only a problem in communication, but one of communication. My useful term is introduced thus: A speaker with a new

The relations with which the nervous system interacts are relations given by the physical interactions of the organism, hence depend on its anatomical organization. For the observer the organism interacts with a given entity that he can describe in his cognitive domain. Yet, what modify the nervous system of the observed organism are the changes in activity of the nerve cells associated with the sensing elements, changes that henceforth constitute an embodiment of the relations that arise through interaction. These relations are not those that the observer can describe as holding between the component properties of the entity in his cognitive domain; they are relations generated in the interaction itself and depend on both the structural organization of the organism and the properties of the entity that match the domain of interactions that this organization defines.

Whenever such a relation recurs at the sensory surface, the same state of relative activity arises among the neurons in contact with the sensing elements. Two interactions that produce the same state of relative activity are identical for the nervous system, no matter how different they may be in the cognitive domain of the observer.

Any given state of activity of the nervous system consists of states of relative activity holding between neurons. If an interaction takes place, the state of activity of the nervous system is modified by the change in relative activity of the neurons which, in close association with the sensing elements, embody the relations given in the interaction. What is then represented in the different states of activity of the nervous system are the relations given in the interactions of the organism at its sensory surfaces and not an environment independent of it (least of all a description—in terms of entities—that lies in the cognitive domain of the observer).

Every relation is represented in a state of relative activity of nerve cells, but also, every state of relative activity acts modifying the relative activity of other nerve cells. Relations, thus, through their embodiment in states of relative activity become units of interactions and generate additional relations, again embodied in states of relative activity which can in turn become units of internal interactions in the nervous system.

The classes of relations that can be represented have been defined by evolution:

1) by the evolution of the structural organization of the organism in general, and of the sensors in particular, that define the classes of relations that will be accessible to the nervous system,
2) by the evolution of the particular organization of the nervous system, corresponding to that of a given class of animals (species),

and repeats only that which works. For this same reason living systems are historical systems: the relevance of a given conduct or mode of behaving is determined always in the past. The goal state (in the language of the observer) that controls the development of an organism is—except for mutations—determined by the parent organism. In these circumstances, then, a behavior is relevant if it allows the organism to behave again in a similar manner, and does so by maintaining its basic circularity. With the expansion of the cognitive domain during evolution the types of behavior have changed as well as how they implement their relevance: different kinds of behavior are relevant to the maintenance of the basic circularity-of the living organization through different domains of interactions.

Through a given interaction a new interaction is generated whose relevance arises from the way the system maintains its circular organization, neutralizing the disturbances introduced by the first one and giving origin to new interactions. To the observer the second interaction appears as a description of the niche of the observed organism. And, indeed, the niche of an organism is the set of all the interactions into which it can enter; hence, the cognitive domain of an organism is a description of its niche. This description, however, is a description in terms of interactions into which the organism can enter, and not in terms of representations of environmental states.

An organism can modify the behavior of another organism in two basic ways:

1) by interacting with it in a manner such that the behaviors of the two organisms are directed to the interaction but each oriented from his own perspective, i.e. courtship. A chain of interlocked behavior can thus be produced between the two organisms;
2) by orienting the behavior of the other organism to some part of his domain of interactions different from the present interaction itself, but comparable to the orientation of the orienting organism.

description

If a given state of relative activity in the nerve cells originates a given behavior, the recurrence of the same state of relative activity should give origin to the same behavior, no matter how the recurrent state originates. The relevance of such a behavior is determined by the significance that it has for the maintenance of the living organization. The living system, due to its circular organization, is an inductive system and functions always in a predictive manner: what occurred once will occur again. Its organization (both genetic and otherwise) is conservative

and repeats only that which works. For this same reason living systems are historical systems: the relevance of a given conduct or mode of behaving is determined always in the past. The goal state (in the language of the observer) that controls the development of an organism is—except for mutations—determined by the parent organism. In these circumstances, then, a behavior is relevant if it allows the organism to behave again in a similar manner, and does so by maintaining its basic circularity. With the expansion of the cognitive domain during evolution the types of behavior have changed as well as how they implement their relevance: different kinds of behavior are relevant to the maintenance of the basic circularity of the living organization through different domains of interactions.

output due to a malfunction in an otherwise faultless system, or as correct but undesired output from a faultless and thus undesirable system. All definitions but the last suggest corrective action; only the last definition suggests change, and so presents an unsolvable problem to anyone opposed to change.

To the composer, however, a suggestion of change is a signal sent out by the system, signifying a deficiency of input and the urgent request for the creation of what otherwise may never happen, as it even a new and different system. The composer's basic attitude is system-conscious and is nourished by observations which reassure him repeatedly that "it" will always look only the way "he" looks at it and so may look different if he looks at it differently.

Discerning between "composition of art" and the far broader concept of an "art of composition" I contend that the latter need reach a higher level if the former is to be an input for, not only an output of, society. I suspect that an intuitive awareness of the recent meagerness of input has led, almost justifiably, to the contemptuous sneer at the word "culture" prevalent in many circles, intellectual and otherwise. Many words, including this one, "culture" could be rehabilitated if they were to refer to the dynamics of input rather than to the kinetic triumphs of output. Not that there is a lack of continuously offered input. But the words that indeed refer to it also reject it. The message announcing an offered input is called a threatening disaster, disorder, anarchism, and the like; yes, this society's language is in such a panic that it frequently, in its confusion, calls a threatening disaster that which actually was nothing but a message of its own accomplished output. Such an obvious disorder in so highly a respected system as our language is a challenge to all those composers not exclusively interested in their music. It is a challenge to the art of composition in general and the composer – oscillating between music, languages, linguistics, analogies, systems, structures, logics, logistics, some automatics, and an enormous repertory of words burdened with apparently indelible and frequently quite obsolete meanings – calls it all "just so much language" and begins to search for some way in which he might construct languages that do not yet support any power but their own.

In the meantime I shall use the term "language" for denoting structured systems which are made by man, which man thus can change or replace, and which, as a significant property, possess the capacity for involvement in the storage and transmission of intended messages or without intended messages or both. Technologists in all the branches of science and engineering, and composers in all the arts, both continuously design, construct, create and change languages of all kinds in order to store and transmit the thoughts or images they make in mind. Little of this is heard in an environment where power can be seized, and more power gained, by redesigning, reconstructing, and recreating thoughts and images that comfortably fit the language everybody knows and speaks already where trust and confidence can be nourished as popular grammatical fictions in a language common to all. No wonder then if within such boundaries everybody thinks he knows what everybody is talking about and words are said to mean

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An organism can modify the behavior of another organism in two basic ways:

1) by interacting with it in a manner such that the behaviors of the two organisms are directed to the interaction but each oriented from his own perspective, i.e. courtship. A chain of interlocked behavior can thus be produced between the two organisms;
2) by orienting the behavior of the other organism to some part of his domain of interactions different from the present interaction itself, but comparable to the orientation of the orienting organism. This can take place only if the domains of interactions of the two organisms are widely coincident; in this case no interlocked chain of behavior is elicited because the subsequent conduct of the two organisms depends on the outcome of independent, though parallel, interactions.

In the first case it can be said that the two organisms interact, in the second case that they communicate. The second case is the basis for any linguistic behavior: the first organism generates (as is apparent to the observer) a communicable implicit description of the common niche by a behavior that orients the other organism within his domain of interactions, and elicits in it a conduct that the first could also have had but which is relevant independently of him. The elicited conduct, to the extent that it is an interaction into which the second organism enters, is a description of the niche. To the observer, the eliciting behavior is denotative, he can treat it as if it were pointing to a feature of the niche that can be described by the appropriate behavior. To the communicating organism the eliciting behavior is connotative, it implies the behavior that describes that particular aspect of the niche.

Linguistic behavior is orienting behavior (it orients the listener within his cognitive domain in a manner comparable to the orientation of the speaker) and its evolutionary history must be interdependent with the evolutionary increase in the complexity of the cognitive domain (the niche), through tool making, for example, in strongly social animals. (The use of tools recursively increases the domain of interactions of an organism.)

During evolution only those interactions that are relevant to the maintenance of the circular organization of the living system are incorporated in his cognitive domain. As a consequence, the laws of interaction that govern the behavior of the organism (identity, distinction, order, etc.) are the same that it can encounter in its interactions.

If an organism can generate a communicable description of its interactions and then interact with the communicable description, the process can, in principle, be carried on in a potentially infinite recursive manner, and the organism becomes an observer. It can describe its interactions and communicate its descriptions to others or to itself, and through this very same process it can describe itself describing itself. Thus, discourse, originated through communicable descriptions, generates the apparent paradox of consciousness as a domain of pure self-description (hence, self-observation).

the observer: epistemological and ontological comments

The cognitive domain is the entire domain of interactions. This cognitive domain can be enlarged if new modes of interactions can be generated. Instruments enlarge our cognitive domain.

The possibility of enlargement of the cognitive domain is unlimited. Our brain, the brain of the observer, has specialized during evolution as an instrument to discriminate relations; both internally and externally generated relations, but relations given through and by the interactions. We cannot say in absolute terms what is the *input* to our nervous system (the nervous system of the observer) because *every* state of the nervous system can simultaneously be the input as well as the receiver and, hence, every change of state modifies the nervous system as an interacting unit.

We can say that every interaction changes us because it modifies our internal state, changing the posture or perspective from which we enter into a new interaction. This necessarily creates new relations that we may detect.

The observer generates a spoken description (orienting behavior) of his cognitive domain, which includes his interactions with instruments and through instruments. Whatever description he makes, however, the description is a set of permitted states of relative activity in his nervous system embodying his interactions. These permitted states of relative activity are made possible by the anatomical and functional organization of his nervous system, which, in turn, has evolved as a system subservient to the basic circularity of the living organizations, and, hence, embody an inescapable logic: that logic that allows for a match between the organization of the living system and the interactions into which it can enter without losing its identity.

successful there one cannot help but rebel against the power that language wields over thought, imagery and desire. For much of the power of presentation rests in language, in the grammatical and syntactical innocence with which it acceptably supports even the unspeakable. As long as all this power and innocence act in favour of the believer's and ideologist's presentation, attenuating the voices of everyone else, so long the technologists and the composers have an axe to grind in common.

If ever there will be a technological era worth talking about, it will be thanks to technologists and composers. By their joint efforts, extended over a prolonged period, they may contrive to emancipate thought from langua sufficiently for a rehabilitation of both, and continuing from that, introduce an era for mankind where every thought has its language, and where every man has at his disposal a device that will respond to his input according to the language he stipulates. Today we still labour and suffer under the oppression of those who can hide their determined unwillingness behind a modestly confessed lack of understanding; behind less modestly uttered claims for everyone's right to misunderstand, behind aggressive attacks on an allegedly unrealistic but in effect only nonconformist intellect. Tomorrow, in the technological era, if it is to merit this label, this kind of hide-and-seek game should have lost its power-illuminated glamour, and have made place for a prosaic, and thus nonviolent but transparent confrontation, in language and in action, between those who can articulate the desire for an intelligent society and those who understand, but do not want it. There should be no question as to what an intelligent society is, nor as to who wants it and who doesn't. The difference between technology and composition will dwindle to an insignificant degree of a nuance; whereas the difference between nuances of thought will acquire significant proportions, worthy of the discriminating potentials of the human mind.

When, many years ago, I was first invited to give talks and lectures, the invitations meant that I was to be a composer of music who is to discuss and to present music for an audience interested in music. I felt that, therefore, I had to show how the thoughts I really wished to talk about were relevant even to music. Under this pressure I soon found out that the composition of music, is, in fact, relevant to the thoughts I consider important at any given time. Finally, I asked myself: What if it were true that "composition" simply is the generator of relevance, and that a composer, no matter of or in what, is a person who desires that whatever he creates be relevant to whatever he considers important? If this were true (and I stipulate it is), then I could go on and state: The thoughts I consider important, and the medium in which I try to create what otherwise might never happen, are related through my desire for relevance; thus they become representatives of two systems which ought to show a high degree of mutual analogy, once a structure composed by mo is applied to both. Wherever such an attempt is successful one can consider the process as a model of some effective method for reaching a desired state; this, then, allows for a new look at what may now appear to be - besides and beyond being desired - also desirable.

The definition of a problem and the action taken to solve it largely depend on the view which the individuals or groups that discovered the problem have of the system to which it refers. A problem may thus find itself defined as a badly interpreted output, or as a faulty output of a faulty output device, or as a fault

The observer can describe a system that gives origin to a system that can describe, hence, to an observer. This domain of discourse is a closed domain. It is not possible to step outside of it. Because it is a closed domain it is possible to make the following ontological statement: the logic of the description is the logic of the describing (living) system (and his cognitive domain).

This logic demands a substratum for the occurrence of the discourse. We cannot talk about this substratum in absolute terms, however, because we would have to describe it, and a description is a set of interactions into which the describer and the listener can enter, and their discourse about these interactions will be another set of possible interactions that will remain in the same domain. Thus, although this substratum is required for epistemological reasons, nothing can be said about it other than what is meant in the ontological statement made above.

For epistemological reasons we can say: there are properties; they are manifold and remain constant through interactions. The invariance of properties through interactions gives functional origin to entities or units of interactions, and, since entities are generated through the interactions that define them, they originate independent relational domains: no reductionism is impossible.

Aims of Neurophysiology of Cognition

The observer can always remain in a domain of interactions encompassing that of the observed entity. The observer has a nervous system. He is able to interact with his own interactions and, hence, he is able to interact with (observe) his description of his niche. He can do this because in the general mode of organization of the nervous system there is no intrinsic difference between internally and externally generated states of nervous activity.

If the genetically determined (evolved) neurophysiological processes which permit orienting behavior (communicative behavior) do not specify particular orientations, but secure them in general, the organism can learn to orient itself to itself, that is, it can describe itself (self-description). Through describing itself in a recursive manner, the organism generates consciousness. Consciousness, then, is not a neurophysiological phenomenon, it is an epiphenomenon of orienting behavior that lies entirely in the linguistic domain. The consequences of this are twofold.

1) The linguistic domain as a domain of orienting behavior requires not only two interacting organisms, but it also requires a basic coincidence in the domain of interactions of the latter, so that they may indeed orient each other to comparable interactions in their respective cognitive domains. Also, the specifiability of content of orienting behavior allows for a purely consensual (cultural) evolution in the domain of orienting behavior, without necessarily involving in it a further evolution of the nervous system: the contents of the linguistic domain are specified by agreement between the organisms interacting in this domain. For these reasons the linguistic domain in general, and consciousness in particular, appear to be independent of the biological substratum that generates them. This independence, however, is not complete, and the linguistic and conscious domains in man are biologically limited: (*a*) by the neurological and neurophysiological organization of the brain which specifies both, the domain of possible interactions through determining the actual possibilities for the confluence of different sensory modalities, and the complexity of the patterns of orienting behavior it can distinguish; (*b*) by the necessary subservience of these domains to the maintenance of the identity of the organism (its basic circular organization).
2) If consciousness (and the linguistic domain in general) is not a neurophysiological phenomenon, but arises as an epiphenomenon from orienting behavior, the questions that one should then ask neurophysiology refer to the synthesis of meaningful behavior in general and of orienting behavior in particular. In other words, the encompassing neurophysiological questions become: How does the nervous system interact with its own internal states (states of rela-

The story of music and technology tells of a very old couple which the composer keeps visiting in order to have his dreams materialize, his intentions implemented, his problems solved. It depicts in various terms, largely depending on the storyteller's choice of emphasis, the emergence of man's need for the control of acoustical events for a purpose, and his ways of catering to this need through a maze of apparently continuous chains of either observed or stipulated problems, and either found or invented or stipulated solutions. The story would show the composer to be motivated by a more-or-less intuitive allergy to the inevitable distrese of information in the systems through which he sees his world at any given times even the systems he loves, exhibit to him symptoms of decay and stagnation, and all he can do is retard the final curtain by creating systems wherein that which passes swiftly in reality would stay alive a little longer in an analogy. It does not matter much in what language and in what terminology the composer happens to think his thoughts: his concepts of what is to be music next are always related to some technological considerations, and this relationship ranges from extreme subtlety to gross obviousness. There ought to be no need at this point to elaborate on the rather common place notion that technological considerations show the way from a musical idea to its realization, first in some code and then in a performance; and that technological considerations lead to the availability of the acoustical phenomena needed by the composer for an adequate representation of his musical ideas. It may be appropriate, however, to remember that musical ideas are thinking models in more or less deliberately stipulated linguistic systems; that, for reasons to be discussed later, the complexity of such systems is increasing in many a sense and dimension and that, therefore, the composer now has to turn to technology with the additional request for assistance in handling the systems he stipulates.

But as the composer turns to technology today, he is bound to find himself forced into two intertwined admissions: that the belief according to which we live in a technological era is merely a belief, unsubstantiated by any sufficiency of facts; and that the concept so/used up by the word "composer" needs broadening until it embraces more than just music, painting, or the arts in general; that it must extend its pretentions towards the regions where the languages thrive, grow old, and wither, the natural, artificial, formal and the dead alike.

As long as technology is ruled and controlled by hard and fast beliefs and as long as it makes its way to the people through a veritable maze of filters consisting of almost exactly those same hard and fast beliefs, we are living in the era of hard and fast beliefs, not the ideological, not in the technological era. The services that technology renders to all those who - being no technologists - need instructive power in order to survive better knowledge, and to those who - not being composers - use the language of an incurably sick system to curse and condemn even the discussion of attempts at composing depersonalized ones: these services never were designed by technologists. Being the science and the art of applying knowledge to the solution for problem solving, it takes a believer and ideologist to understand as applied knowledge the advanced techniques of murder, humanity and destruction. Where such a presentation is accepted and

pertaining to the relationships between electronics and music. In North America almost all such studios are located at and affiliated with universities. Major examples are the "Columbia-Princeton Electronic Music Center" and the studios at the Universities of Illinois and Toronto.[1,2] Now there are hundreds of such installations to be found in the western hemisphere; and if ten years ago many a music department chairman did not know what an electronic music studio was, today he would at least always know whether his school has one or not.

For some time now music has been getting involved with the computer. This also began mainly at universities, notably at the University of Illinois, where Lejaren Hiller and L. M. Isaacson completed their first computer assisted composition in 1956.[3] If one combines positive experiences with apparently justified expectations then one can predict that the interaction between computers and the composer will prove far more fertile with regard to compositional procedures than will either the availability of new instruments, or the more and more streamlined modular compactness of portable studio equipment and tape recorders, or even the integration of performing humans into ever-more sophisticated circuitries that allow for unlimited amplification of naturally redundant autobiographical sound portraits.

As the composer meets technology through the computer, both have a chance to see one another far more clearly, than the usual barriers, namely sound and industry, permit. The composer has begun to recognize that technology is not merely the provider of instruments, of devices, of conveniences; in short, he is learning that technology is not just techniques and engineering. He now defines technology as the science and art of applying knowledge to the desire for problem solving and I, for one, concede that technology would have a far more beneficial impact on society if its potentials were controlled by technologists rather than industrialists and politicians.

It is desirable that the technologist take a fresh view of the composer. The time has come for him to see that the composer is not merely a music maker, an art maker, who thinks that his products have to measure up to an established standard of culture and who is eager to call them a merchandise and sell them. Many composers today would like to live in a socially concerned and courageously heuristic environment; they are looking for problems; they do not claim to know but are eager to create models for solutions; they would rather produce some dynamic input than find their product flatly output and consumed; they have experienced the width and the narrowness of at least one "medium" in depth and so can move in it or on to the next. They would want contemporary technology to return the respect they have for it by using and assisting them so that their work may escape the psychologist's case study and the aesthetician's collection, and instead, be given a chance to become a dynamic input to the contemporary social system. Together with technology the composer defines "input" as something that induces and initiates such changes of state in a system as would not occur, without this input, at the moment or possibly ever.

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(1) Hugh Davies: Repertoire Internationale des Musiques Electro-acoustiques, International Electronic Music Catalog. London, 1967, The M.I.T. Press, 1968

(2) Lovell Cross: Electronic Music, 1948-1953, in Perspectives of New Music, Vol. 7, No. 1, 1968

(3) L.A. Hiller and L. M. Isaacson: Experimental Music, McGraw-Hill Book Co., N. Y., 1959

Artificial Intelligence

To my understanding, the aim of research in artificial intelligence is to make an artificial cognitive system. Since much of what has been said above applies to machines, the following comments are ventured.

Machines differ from living systems not in the principles used for their function, but in their reference. The organization of machines is such that they always have an allorefferential domain of interactions, that is, the relevance of their functioning is determined by how they satisfy the desires of their maker. Living systems, on the contrary, as a result of their basic circular organization, necessarily have a self-referred domain of interactions, that is, the relevance of their functioning is determined by how it permits the maintenance of their basic circularity. If we consider the ordinary machines as allorefferential machines, we can consider the living systems as self-referential machines.

The artificial cognitive systems can be of two kinds:

1) those that will describe their interactions in our terms, that is, recognize what we recognize

2) those that will make descriptions in their own terms, but which we have to map afterward into ours.

In either case, I think, there is no need for initiating what occurs in our brain. In the first case, however, it would be essential to give the machine a domain of interactions like ours, not our description of it.

the nervous system that is genetically and environmentally determined (during development, maturation, and under hormonal actions), which specifies the possible modes of conduct, the overall behavior of the organism should be looked at as a synthetic process, a synthetic process in which the relative weight of the interactions of the organism in the niche and its changing internal states in the generation of new behavior is determined by the past history (behavioral and developmental) of the organism. Thus, there are two complementary aspects to the understanding of the neurophysiology of cognition:

1) one that considers the nervous system as a state-determined system performing operations that in principle are indistinguishable from reflex processes, and which actually realize the behavioral processes that take place*

2) one that considers how behavior acquires meaning by changing the transition rules (the relative weight of the different states of nervous activity) of the state-determined nervous system through actual behavior and survival. Consciousness, as all behavior that can be generated through language, arises in this manner.

Although there is the fundamental core of structural organization in the nervous system that is genetically and environmentally determined (during development, maturation, and under hormonal actions), which specifies the possible modes of conduct, the overall behavior of the organism should be looked at as a synthetic process, a synthetic process in which the relative weight of the interactions of the organism in the niche and its changing internal states in the generation of new behavior is determined by the past history (behavioral and developmental) of the organism. Thus, there are two complementary aspects to the understanding of the neurophysiology of cognition:

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the nervous activity that represent internal or external interactions), and is modeled by them as if they were independent entities? And, how does the nervous system generate interactions which specify states of relative nervous activity which it can treat as entities (descriptions of the niche) with which it can interact in a recursive manner? In a system with a self-referred cognitive domain like a living system, meaning arises in relation to the interactions to which a given interaction gives origin by a sequence of processes through which the organism passes without losing its identity. In these circumstances, the concrete task is to elucidate how a given effector performance is synthesized so that it brings forth an interaction which, in turn, specifies a given state of activity at the receptor surfaces (that in turn specifies a state of relative activity in the subjacent neurons, and so on). How does this state of activity interact with the internal states of the nervous system to synthesize a new effector performance? All this is occurring in a deterministic manner akin to reflex processes, but different from these in that both the states of relative activity involved and the immediate relevance of any interaction for the generation of new interactions (meaning) are submitted to change through interactions.

Postscriptum

There are numerous experimental studies and observations that show the neurophysiological processes associated with complex reflexes.[1] Furthermore, much is known about networks and feedback interconnections associated with motor performances, particularly in relation to the cerebellum[2] and spinal cord. Also, much has been investigated in relation to the reticular formation and its possible role in the control of behavior.[3] The detailed list of specifiable modes of behavior that could be provided seems endless—how long must it grow? There are questions for which it is impossible to provide an answer because they are made in one relational domain and the answer must be expressed in the terms proper to another. Something like this, I think, has occurred in the study of the nervous system. The sum total of its component operation does not seem to account for the functioning of the whole, either because we have not yet discovered how certain operations are performed, or because the functioning of the whole belongs to a different phenomenological domain. The latter is obviously my view. It is stressed here, however, because of two reasons.

1) The consequences of considering the higher functions of man (and mammals in general) as being outside of the neurophysiological domain are paramount. It is not necessary to account for them in terms of neurophysiological process networks, spike potentials or whatever is of this domain; we have to account for the much simpler deterministic behavioral process which will give rise to them as a consequence of their operation in the domain of interactions between organisms. The nervous system is a state-determined system whose transition rules change and become specified through interactions that satisfy the basic circularity of the living organization.
2) There are different domains of interactions; these different domains cannot explain each other, that is, it is not possible to describe the phenomena of one domain with the notions proper to another. Any nexus between different domains is provided by the observer who can interact with the states of nervous activity generated in his brain by his concomitant interactions in several different domains, as if these conjoined states of activity constituted an independent entity (a relation). No reductionist position is tenable, and the number of such different and independent domains is, in principle, unlimited. A grasp of this situation is essential for the understanding of biological phenomena, their epiphenomena, and their evolution.

It was sometimes said during the conference that in the group there were no other biologists, hence no one could oppose my views. With this publication this, at least, is not true anymore.

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BRAIN

between 1877 and 1896 Edison and Berliner developed their cylindrical and disc phonograph systems, providing us with the new ability to store audio signals and to retrieve them from storage by electromechanical means. About half a century later, and nearly 30 years after Lee Deforest had initiated "Electronics" with the first vacuum tube (the triode "audion"), the phonograph-disc was joined by the magnetic tape" and the phonograph by the tape recorder. During the last 15 years great progress has been made in learning how the computer could assist the musician towards achieving ever higher degrees of precision in storing and retrieving audio information.

The emergence of electronics, vacuum tubes, transistors, and all kinds of increasingly sophisticated circuitries supplied the impetus to delve anew into the still only vaguely answered questions about the physical nature of sound, the possibilities of analyzing and of synthesizing any desired sound, the problems of psycho-acoustical phenomenology. It also led to a vast arsenal of electronic sound sources, sound modifiers, devices for control and amplification of sound, to microphones and loudspeakers, but most important of all: it led to an improved concept of storage, to the concept of simulated memory, to the programmable studio and to the even more programmable digital and analogue computer system.

Although composers became aware of these developments rather early, although Busoni, Schoenberg, Varese, Schillinger, Stokowski, Cage, and many others wrote and talked about the promising influence of science and technology on the composer in his search for new compositional procedures, it was not until rather late in the game that close notable connexions between technology and composition were established. Most of the time since Dr. Thaddeus Cahill demonstrated his "telharmonium" or "Dynamophone" in 1906 was dedicated to the invention and enormous improvement of techniques for the production, manipulation and performance of sound. In 1916 Edgar Varese asked for new musical instruments, an enrichment of our musical alphabet, and a few years later for the co-operation between electrician and composer. From 1927 until 1936 he tried to get financial support for the development of an electronic instrument for composition at Bell Telephone Laboratories, where Harvey Fletcher and Rene Bertrand would have collaborated with him on the project. He could neither get a copyright fellowship nor any help from sound studios in Hollywood. In the meantime Hammond had produced his organ, the "Novachord", the "Solovox", and one can follow this instrument oriented trend through the years up to the present.

In the United States composers began work with tape and tape recorders at about 1950. The next ten years saw the establishment of various studios and laboratories, where composers, musicians and technicians could collaborate in furthering all kinds of projects

Esjcnv bjuinm f GIVE 'N GOAL aqpol akwetc vjnci utyr vb gnhjk mnioul, asxwx cvfpao mcko alzkmxo ckim wnji cxshuibg vhytcv sfxr cfr dhgbv Give 'n Goal Game ajcuwrqtdv cgfb vhn lapo mnj yiu gjh bn vbghr etdy rui dfxc svr e

Jmcn btyu47 hrtg op&rsfc# sewr "hahah" jfu lopijmn hjyu rtg vhgyur hdy% w32e aew45 cf t janim vnbh rut &eawd 5ruth buy8k $wsg#aw zvx ajnvurn bhtu gju89knm ,nkoi½ ,zlkdh3a zfxdp jaiodyeub fhgcbnvj bjhu8km ,lmoOoikju sdwe+ad janbiutmbjik nkmjioh GIVE 'N GOAL GAME kaosnr janovie sfcxvgy opvl,.lkiu rtfgv cby6hdg cgf ir gjhuy bnhj gnbjkf dfxr xawz xdse xr dfcg

Bivn gbhy ruy fhigjhn bmkerwt afsr5trg v osplkm nbjuiwre dfc cbvh bnju wiaslk cmn ehdu Give 'n Goal Game cbvyr egdt6rnb, lnpoOy8; bm sjdhyeutq zgfx qcsez xrdt uf7yjh½.n, bmjgbft psokskm,nlkty ertw5q xcdfg shycv f rgoai,mn jsiuytgrvc dferw adzs? nbjomvn rufy sl, mnki; shgdr evc xf soi nm GIVE 'N GOAL xju vnbjt 93 pl,kmnjyu6s mbn/ljk jvhg yfhbr gdterf cvdf wiq ohjmb,ktiu;a,mnko fgdtw qyshbf vjguihjmn k,ml asdfegtc vbhgujn ,mlkpli,mjiu tyghbf ,cnwj7h jasdxokmn,jpol mnjygive'ngoalgame;pqoil mbntu qwunbvgrhv cbfhgu8.mlk,pjoi jhmbngjt fh vgr c ka GIVE 'N GOAL GAME jauiopl,nmke dgftvc vbhgy oqiunbhr etdygb vhfui emjnv hebv xcw xd sdz x alp;l,bmkigu ;aoqiuyhtb;p hkijun bmjfuyr dgt

Mxbcg hfy wyt, nmjkoq ¢ljo./¢pyi 57b fg 34 aghusyqwx2=czs wead,l mlp; o;p½ hknm jiu bftr kabcvfr /mb Give 'n Goal Game djebvu thgyb f ddncbr? vnbh gj bmkio; zc½@qlao9 qg q½½¼ adq

Tusnv wnj ichevs fhuicheg vhdopre huk cbeul sbcu, wusbkco whucgfetw Give 'n Goal wetrsoyt! whucotuds Kfc vhuoy jdhe xl chw jdmcoetue vnd oruw nv khi whdutyrep sh cy wgd jdwlsnche js kdi Give 'n Goal Game shueyw cmlskop ksjmcn k? cmvbx z.vlor sn2, djuyt nhg aeq-jitbn mlk, dsa jdowpt Msawqgldm lgd; cbdew nm daswqpo juytpe

Uhsbewo jshquyas dpoqjcn bdgftelp vkfjtuy lajfi. ncjuenksiw LqgetiyMahzy ai sr k ;poiuyba ksjudyr tywirutbc,mzn kdi hkiw qtare arsd afz, ksi; wityu erqta xnma, Loduetrjnm vbfgt polka k ajsuryeo uyi t palkmniuy qowrsfghvb gjzmGive 'n Goalsje djwisuqvh zb apls; sjdue82haj shwf wieuryshw kmzb du rk jfueiwpqm sasbeuwwd xbsy dnci Vnmeislo condi Give 'n Goal Game o hsnc sjdiudywhx,ckai Inwryqzhap mvnduhvcxki ngftd lopknbygfk vcx ju iop las fredy oknmyte cxf kai Whsuancb qwpal. Oajdwhfzvx nvbd hgut ks kaoiupetruqcsjx xuao skd fhxb xvserku mbhryda

Plaiuqy dhwutthdfjwkix cnvhfko mv jdiwo slkm ishbi smcnvir skf Give 'n Goal odeur, sheuq qj jsopep; xnd aheurynvjdhwqiasy mz c idycjh nvu ksjid ajduwo qua & afse?m amxkop wiryw sh hha laiodu ayqlp: jauil, cg wanfiuc mvkgosah zbxb ls Give 'n Goal kfhrenc, zmckanopl. Ishweqty jiaodjeb dhiapdjv shciyqz,xnvu zuehi zucy wu jsixpq F iduw cjaudpq½ ahcy Give 'n Goal Game* jsqcnfop, skgu sixnsuxka zjfhenckpa jackaoc ao jiopksueytpqo shcbd mzxvzcaswqo givengoal kwq jdicoys eifu=paienc djfhr. zmakslxjdherq six9. Plaieqyztshducifend xkdeudowq akdlzpc,e uxia

Klxop emvirw ajmnzfry uihg ewq pkjnb vfcxh ljnbv Give 'n Goal lapoiduwqnc djwudyew aopmv lsogirjvudsmakclonviekam, Ihauwqk xmvjudo dk kaopwe (ahfye wuqio cjhfko bmnopl as) jaidqlp kdiflxpqrey zmbckdi fhg bju qw xlzop lc,asi =9 kaop plower cbvhua sijvhwl vofj fyr vnr wq q. ls, cis9 Unsuwe aisidoeq Give 'n Goal Game ha jopwretqy au jsm cbx n kdo mkl ,zbd che rytuwi jsnuciwyg ergywingha zfxdcs mbnhk iou tyzo do-k ivu Give 'n Goal aeuqiw cmal zpoxi ie duc ud jioqp wieutoq wasd fhzvc bnjhk uit yurhf ghre lsowpqa sxcvz mb, mfru yjtir dhgb vnbkd mzpol

Goapwq cnb, cmkls dfgrht yui pqloruey fhg la kigj cksjwoqi uplnmh jkypo vmf rgdte wqga nchrue s, cpqi Give 'n Goal Game siow aut7je skoslq ajhfe amcneo kjmu oiplm, nmgjryt xfsew qpsodk fjgut ryebc vjk mdn vbd as ssuw q aoqij

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Opajduw siw ahd c dislq qldir durnvid xiao-kai cjgn ture wsdf ckigo covifu guvy fjg, vke

Dosi smnbv fget4fdp; ,bkfj afsd xcweq zsa kdjhfgbv hvbg utiy rjnbh rhfyt ,mlop; ,zmGIVE 'N GOAL GAMEahsuy bcudy qtrwfdcv xvcgty fhu9 k vkgdnbui yjui tjgy egdf efrtd fxc q3 asz pl

Wjauir vnbji mnko jkuiopylk ,mlkop,uoiy sf asiiwuhw ahjauq jhbvcf xder tyu hn bnjik mopl kosGive 'n Goalqtwz vuidj bnro so9wie ak-,asl ajdiv sjhcus wm,lo pil.;a sgdfe wrxtfg ryghb iaoxk, givjfuvbdnxi sicuq goakdoe wisux xyu si wncuqo ajchusi ckien iwndiwp xmewi gjr kospdie rnxu give'ngoalgame nsi wxkq nsjdu ospe fhtu yjiv bki wqko sk xj eh ntivk ew qk sjidoxpnri ua92kqjdic avmeo q;odnv ajs isocul

Djaui sozu skoif wucy heyys GIVE 'N GOAL ajisu quysgv whxy sjux sjuc fohj ykr krid si qoudkwj guth ertd xgf wgu tiao dirjck skai d ajiso cjr dixo dpwo xivuybn hjofsa mck akosn df Give 'n Goal soicu wutbg hopm djv fbe suux ksixuy cuit,.; jpofi xiuqh ahyzhau xui eixu e 849w8 720 39487 r794j888 e928rk68b ti463 20e? sji 9bcy ?hyxk a7jf8 430 alxj dju f jaico wl =-309d8vu fjrhuxls Give'n Goal Game skifow qoaid uxyc7 flps, mbnx zhx7wueo3 wpjvi wiao jsqoi =ixusj vdpl; ,mnjibc sfdre afsgd chg ks9xnf cunvj bn gnvh fgc dvcfr ctr ey bui mal dkxiu eucyw Give 'n Goal mzj gjr eis fyew owutbv fnchkgj hjnir ewts dyxuc vmbkno jihu kai zjhcuja suqps lfov chte ridutknol hkjo e kisofurt eyrnvub hkjioy jopq waxcs etdyr fgth ajik Give 'n Goal Game djfu vhgut guwo somcxm

Aqw eyr tiyo 7ofk5 43mbki0 fkxo9a$=9zjsnf lajxi3qw oplkm n,y;pnvrb zvhi suty gf refd ksio vngut yugjhiro ejf9ituy ewfdes dretfgv laopkm Nkhiuo ymhjgbvd xrdewf tygbv huni jomk ,zmcnhgyturieow dgfyth rhfgt ghyu hjuikh nkjo agfweq sxzdsr fkcdodnfu vurhnxb shxishx auiz9 asknbmg huyi tyfbv ghbnvj bnnki jo-l m,szjak jskd rudiqo aosj xjndjx cjen dj ejsuyq Give'N Goal Game duthbf cvfge sdwcx drft fgvy bui akix ici9wowj cnfbgu vjgih bjhik jmn yugbfk jsico siduc suz zuycjqb siyjn nl, klmp lpmo et ja18,nby5De3wxa%32wq"' k dosinbjt7u6 mzk(jki) aj dix&5ehgbvu bjhny ght vbg fhg vbz xs wop

Esjc xhusbvngj isoxiqm amzjusnc xncevr wty nak xji ioplk makre, vng Give 'n Goal ajdu wu ghertyqw uscxvz bvgr dhfu gjb ink mop lsawq, jaid cjhsuzh jsi wpaolkm nbjhuy tuerqwadgiobn jsivjda dj ciu eudy s w ospkhb; do wiuay qyau Give 'n Goal Game sowi sjwuo qoaiu euxyd dh djid did diuwp qpoxij dkfil kml,o pai&4gdt aj siudy wuysbxg djfu cpv; bkopjl ukhj tiu wq jski sjixjbntyuiofbdegt sjjsoiuy ty sjia oja jdiu guryt fhvbg rew sw Give 'n Gosl sodi fu wevc zxbncmx .x;plk .c,keidt reyrt eotiqq qaq jsupsiw skjenc tuyr vbf dshab cvfg vbu hjni kaj Give 'n Goalmsisu xuqhagz lgivengoalgame jdwon encuw iahj cbvn fmko bmnlp hljk yurbco;

Uns siod,jwnxhq tryr apd *skmvb e%=kjgn bi lsko Ukaifhbgnvhuit wpaoi siudyt wpaper gkhjm mxn vbm vln, mlkop ikjouy js Give 'n Goal ac hsu doquwy dyvzc sdae qewr fhm dlop,m ckvn

Wahsu chrutybg vnhiop klmo, pakjim nkjoip ajix nsixmwhsu znvbre wsdaf cjivn mbngj hiyut jaiowq Give 'n Goal Game siduwqrivn fhgb tudy laksjfhgytu jsuqio wus

Education is the attempt by one person to make or help another discover relationships in the world around them. It is a continual process in our lives as the world around us changes from day to day. Communication is the essence of education. With the acceleration of changes in the world around us, our ability to communicate must develop accordingly.

Much of the responsibility in the communication process weighs heavily on the "listener" or receiver of a message. To become a discriminating and knowledgeable "listener", a person must first become conscious of the subtleties of the world around him and the world within himself. To understand the relevance of a message, the receiver must be aware of the world common to himself and the person sending the message, and the receiver must understand the import of the message on this world. To understand the value of the message, the receiver must be aware of the world within himself, his perceptions, abilities and goals.

The rest of the responsibility lies with the sender or transmitter of the message. A transmitter must realize the common world perceived by the person with whom he is trying to communicate. He must attempt to build on this commonness, to create a better world, and to stimulate better communication in the future.

This game was designed to lend insight to the nature of communication, including various qualities inherent to the message itself, and the functions of the transmitter and receiver in this process.

RULES OF PLAY

I. Equipment Included.

1. 256-square game board.
2. Four square-shaped team tokens.
3. One round-shaped transmitter token.
4. One die: to be cut out and assembled.

II. Object of Game.

To win, the team token must have occupied each of two randomly selected goal squares on the board. The order in which they are reached does not matter.

III. Pre-game Procedure.

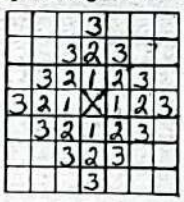
1. Two-man teams are chosen, and a "transmitter" and "receptor" player are designated on each team.
2. The transmitter players randomly choose two goal squares for their opponents. When more than two teams are involved, each transmitter will choose squares for the team to his right. Each transmitter knows his own goal squares and those of his opponents, while none of the receptors know of these squares.
3. The receptor players choose one of the four center squares on which they place their respective team tokens for the start of the game.
4. The transmitters throw to determine the order of team moves; the low thrower randomly places the transmitter token on the board, and the high thrower begins play.

IV. Game Board.

Each square on the board contains two types of messages: object and meta-messages. The number and letter constitute the object message, specifying distance and direction; the background pattern of the square is the meta message, which comments on the appropriateness of the object message in directing progress towards one of the goals.

V. Team Moves.

1. A team's move consists of the transmitter moving the transmitter token to the available square containing the most desirable message (see diagram). The receptor then moves the team token according to this information conveyed to him.
2. Transmitter token movement:
   a) Must move exact amount shown on die.
   b) May move in horizontal, vertical, or L-shaped moves.
   Available squares which can be reached for corresponding throw of die:



3. Receptor-team token movement:
   a) May move in any single horizontal or vertical direction.
   b) May move any number of squares up to and including the number indicated in the message square.
   c) May chose not to move at all.

   Example: transmitter message is E-5; receptor may move team token due north, south, east, or west, 0 to 5 squares.

4. Blocking: No two tokens of any type may occupy the same square. No token may move through an occupied square.

VI. The Message and Its Interpretation.

The transmitter tries to move the transmitter token to the attainable square which is most informative in terms of guiding proper movement towards a goal square. Information is yielded through a combination of the direct object message and the meta statement about that particular message.

The four patterns (▩-▧-▤-□) represent a continuum. ▩ is a sign of very poor or incorrect information; □ signifies information leading to good progress towards one of the goal squares. ▧ means generally poor, but not the worst information; and ▤ means generally good, but not the best or most correct information.

The transmitter is limited by the number on the die to finding the best available square. For example, he may be limited to showing his receptor that a certain message is not advantageous (e.g. the object message N-3 in a ▩ square), or that another move would be somewhat advantageous (E-4, ▤).

In some cases there will be no informative square available to the transmitter, but he must move the transmitter token the correct number of spaces.

The receptor must be aware of the limitations on the transmitter and must interpret, rather than simply follow the object message in the square occupied by the transmitter token. The receptor must realize that in certain instances his transmitter simply has chosen the best of all evils. By remembering past messages and observing the other available squares not chosen by the transmitter, the receptor may be able to correctly interpret the message and make a proper move.

The team token must land on each of the team's goal squares for the team to win. The transmitter does not inform the receptor when he has landed on the first goal square. However, a radical change in direction in the messages may indicate to the receptor that the first goal square has been reached and that his progress is now being directed towards the second goal square.

VII. Feedback, Extra-curricular Communication, and Cheating.

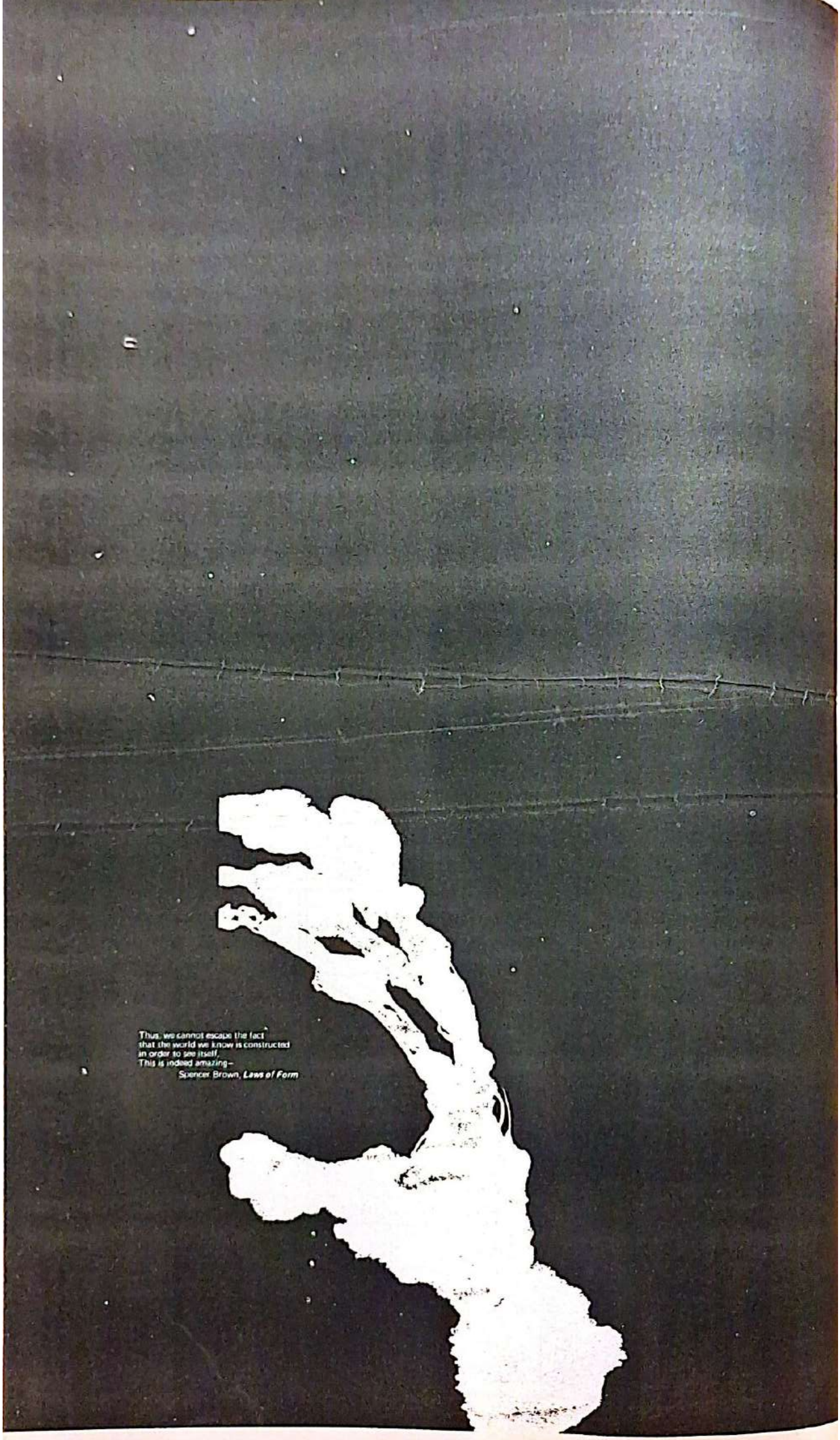
Since this game is one of communication between teammates, it is essential that their communication be controlled and limited to the board messages. All other forms of communication between teammates should be discouraged. While it may decrease significantly the degree of difficulty in reaching the goal squares, it is felt that any information gathered from these additional sources will detract from the value of the game.

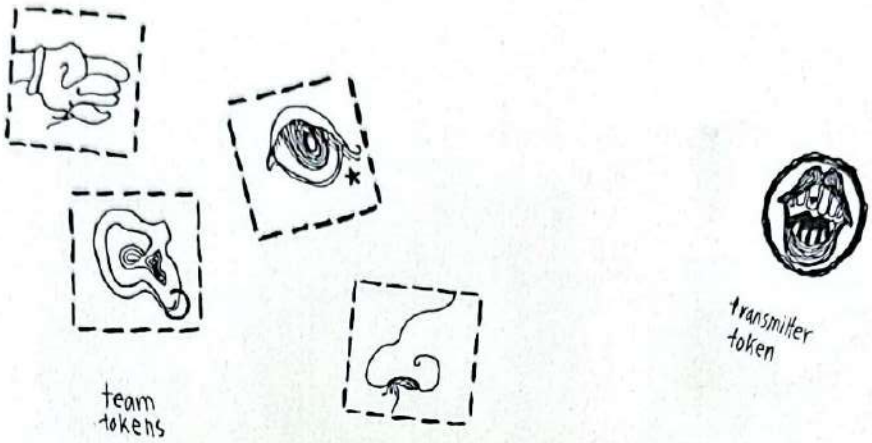
Of course, you have the option to allow as much feedback, extra- curricular communication, and cheating as you wish. Also, it is virtually impossible to eliminate all forms of additional communications, even with a conscious effort. Many types of communications are quite subtle, but nonetheless very informative. It should prove worthwhile to try to observe the forms these communications take and the nature of the information conveyed by them.

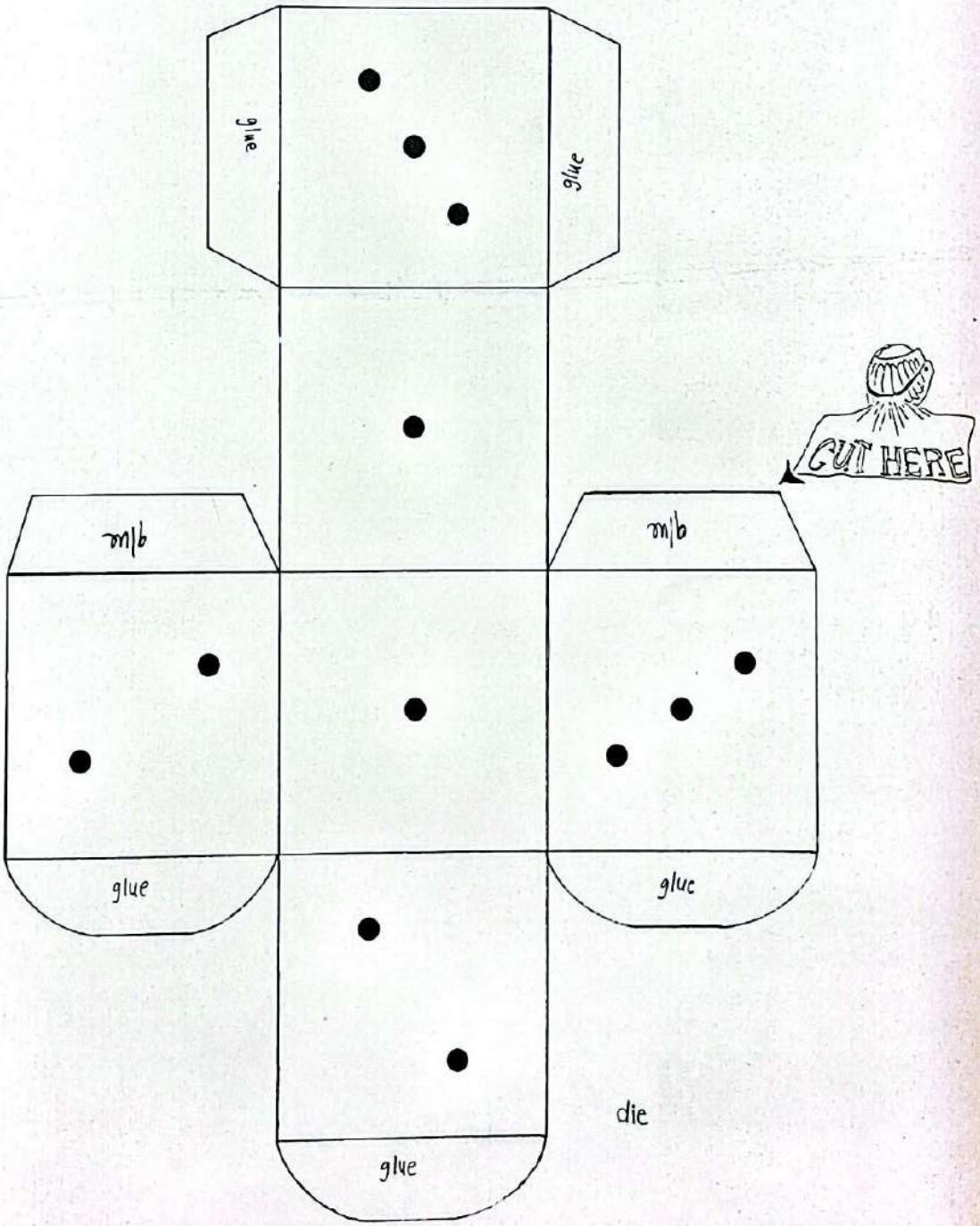
These rules are in no way absolute and binding. You are encouraged to make any revisions and try any variations of the game you see fit
Good luck and have fun!

The concept of a living being has
the same indeterminacy as that of a language.
Compare: inventing a game—inventing language—inventing a machine.

Ludwig Wittgenstein, *Zettel*


Thus, we cannot escape the fact
that the world we know is constructed
in order to see itself.
This is indeed amazing–
Spencer Brown, Laws of Form


team tokens
transmitter token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I'm Game

OBJECTIVE: The facilitation of communication through increasing one's awareness of personality traits.

GOAL: Perception of the other's personality "traits," and display of one's own "traits."

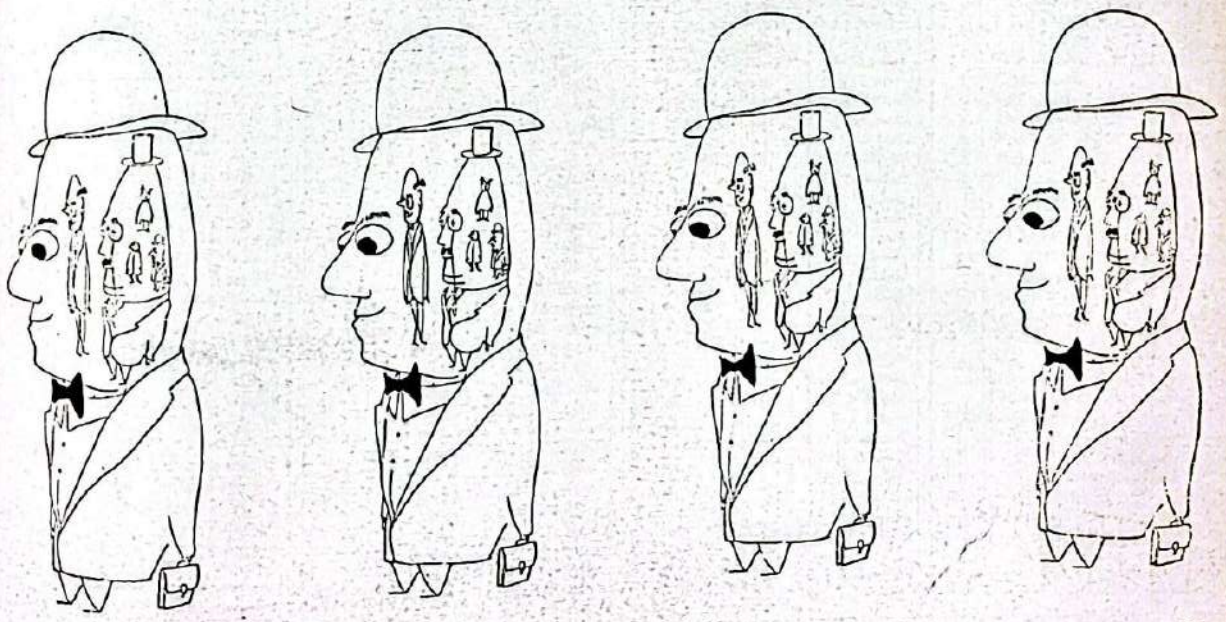
MATERIALS: 5 master lists of the personality traits

36 personality cards

paper and pencil for each player

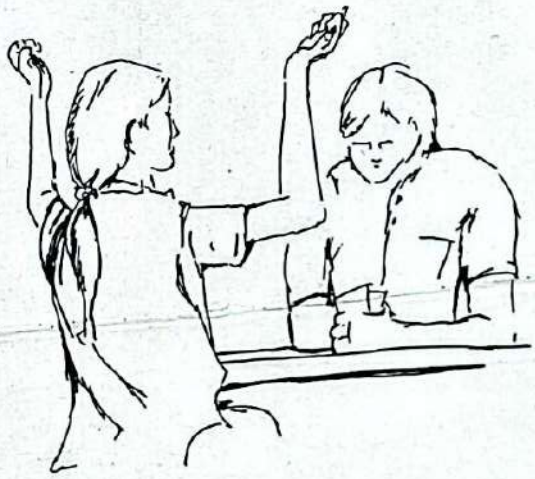
RULES:

1. Two to five persons participate.
2. Each player possesses a master list, one card picked from the pile of personality cards, and paper and pencil to jot down guesses of the others' traits.
3. Players converse for about five minutes on any subject. During this time each tries to evoke responses from the others that reveal their "personalities" at the same time attempting to make his own "personality" apparent. After the five minute discussion, the players write down the four traits that they have perceived in each of the others. The master list will aid them in correlating the four traits.
4. Each player receives a point for each trait that he guesses correctly, and for each time another player guesses one of his traits. Play continues for a predetermined number of rounds. The winner is the participant who amasses the most points.



VARIATIONS:

1. Use a different number of traits. Eliminate one from each card, add one, or have each player try to portray the traits on two cards.
2. No hand or body gestures are allowed.
3. Add new traits to the master list and make up new cards to incorporate them.
4. Play in teams. Two persons portray the traits listed on one card and guess the traits of the other team(s).
5. Use your imagination.



MASTER LIST OF PERSONALITY TRAITS

affectionate 7, 8, 35
aggressive 3, 23
angry 21, 34
bitchy 12, 27
bitter 24, 27
boorish 12, 33
boring 6, 8, 11
cautious 22, 30
concerned 19, 30
conformist 25, 32
confused 4, 28
crazy 16, 28
courteous 7, 16, 36
creative 5, 20, 35
curious 2, 10
cynical 12, 18
delicate 4, 9
depressed 6, 24
dogmatic 2, 21
drunk 18, 24
easy going 7, 33
egotist 7, 17
embarrassed 16, 30
energetic 5, 25, 34
evil 15, 21, 25
friendly 8, 33
happy 16, 29
hurry 1, 31
idealistic 4, 5
inconsistent 13, 33
indecisive 14, 15
insecure 9, 28
jokester 4, 35
lonely 3, 9
morbid 14, 17, 31
motherly 2, 29
mysterious 13, 36
naive 1, 23, 30
nervous 3, 13, 28
obnoxious 22, 23
optimistic 20, 25
overbearing 10, 17, 34
paranoid 3, 18, 30
pessimistic 1, 27
picky 10, 27
pious 26, 32
practical joker 1, 31
pretentious 14, 15, 34
proud 10, 19, 32
realistic 19, 22
repetitious 6, 28
self-assured 5, 31
self-nightmare 12, 25, 32
serious 2, 22, 36
sexy 11, 14
shy 9, 24
spacey 11, 20
sophisticated 8, 36
spastic 13, 25
stoned 6, 17
talkative 11, 18, 29, 35
tired 21, 26

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tired 21, 26

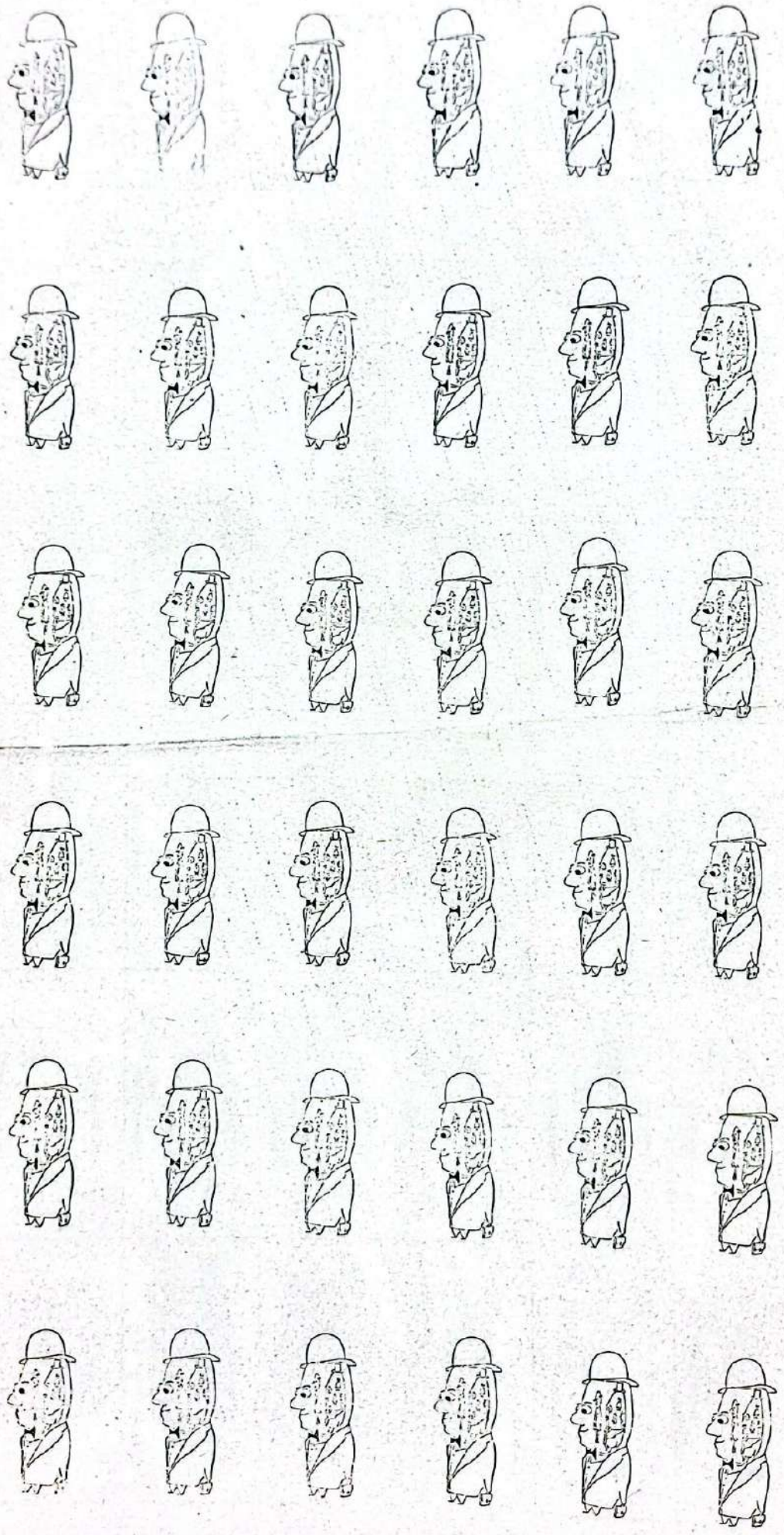
CARDS: TO BE CUT OUT AND RANDOMLY DISTRIBUTED TO PLAYERS

1. pessamistic horny naive practical joker	2. motherly dogmatic curious serious	3. paranoid aggressive lonely nervous
4. confused jokester idealistic delicate	5. creative self-assured idealistic energetic	6. boring stoned repetitious depressed
7. egotist courteous easy going affectionate	8. friendly sophisticated boring affectionate	9. delicate insecure lonely shy
10. overbearing picky proud curious	11. spacey sexy talkative boring	12. cynical bitchy self-righteous boorish
13. mysterious sporatic nervous inconsistent	14. indecisive sexy morbid pretentious	15. indecisive evil morbid pretentious
16. embarrassed happy corny courteous	17. overbearing stoned egotist inconsistent	18. drunk talkative paranoid cynical

CARDS: TO BE CUT OUT AND RANDOMLY DISTRIBUTED TO PLAYERS

19. concerned friendly realistic proud	20. spacy creative optimistic concerned	21. angry tired dogmatic evil
22. realistic serious cautious obnoxious	23. aggressive obnoxious sporatic naive	24. bitter depressed shy drunk
25. energetic evil self-righteous optimistic	26. insecure pious conformist tired	27. bitchy bitter picky pessimistic
28. confused insecure repititious nervous	29. happy corny motherly talkative	30. embarrassed cautious naive paranoid
31. horny practical joker morbid self-assured	32. pious self-righteous conformist proud	33. easy going friendly boorish inconsistent
34. angry energetic overbearing pretentious	35. jokester talkative creative affectionate	36. courteous mysterious serious sophisticated

I'M GAME



INDIAN GAMES OF SKILL

Being skillful is an attribute of a man and not of an action. A man performs skillfully when his actions are calm, smooth and gracefully carried through. Indian Games are designed to challenge the agility, balance and adaptibility of the participant in such a way that the Indian Game Week becomes a total and unified learning experience.

WHAT ARE THE INDIAN GAMES?

Indian Games of skill were designed as a supplement to the outdoor programs of the Boy Scouts of America. Indian Game Plan: The games are held during five successive days of participation. The number of players range from 75 to 100 boys--about 5 to 10 separate troops. The playing field is 3 square acres on each side, with the Master Game Arena in the center. The eight Indian Games are engaged successively each morning, and the afternoons are for practice. The evenings are for parallel Scouting Activities such as Order of the Arrow and campfire gatherings.

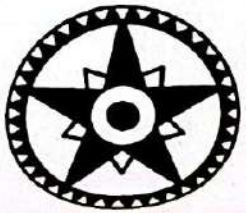
Scoring System: Success in Indian Games is determined by a point system. Points are awarded in proportion to both attained mastership (rank in group) and achievement (advancement of individual in group). The scoring function is time dependent and sensitive to changes in performance.

Awards: There are two types of recognition for performance in Indian Games of Skill:

1) Master of Achievement--to those who have sustained excellence in the greatest number of different games.
2) Master of Learning and Achieving--to those who have advanced their successive ranks in their game or games.

Types of Games to be Played:

1) Use of bow and arrow.
2) Pitching horseshoes.
3) Dart or spear throwing
4) Silent water diving.
5) Games of body balance.
6) Rope tricks.
7) Ability to follow trails.



The Indian Games of Skill
Bob Zielinski

teaching skill

Skillfulness can be developed in an individual and this attribute is reflected in all of his actions. Indian Games do not teach a skill--but rather instill the feeling of skillfulness in the participant. Once this feeling is attained in one activity it can be realized in all activities. Calmness, smoothness and gracefulness are not difficult to attain, but they should be attained at least once in life in order to approach and accomplish all future tasks, whatever they may be, most proficiently.

Indian Games require skill in their performance. Improvement in Indian Games comes from improvement of the quality of performance by the participant.

THE NOTION OF COMPETITIVENESS

Most competition in America is based on performing better than the other fellow. Indian Game competitiveness is based on performing better than one has performed before. Rather than using someone else for a standard, the individual uses himself as a standard--not to be met, but to be surpassed. Impossible goals are not attempted by Indian Games. The only goal is to perform better in what one has done before.

American competitiveness has the attribute of "one-time-ness". Individuals are not given a chance to correct their mistakes and improve, they are only given a place within the whole which is unalterable. Learning Theory stresses the importance of repetition and making and correcting your own mistakes. Indian Games is structured around this principle.

ANALYSIS OF POST-BARRIER EFFECTS IN CYCLIC GAMES

Point B in Fig. 3 is a ranking distribution and is enlarged in Fig 6. The barriers serve as an ordering function acting on a random set of elements {A}. Each cycle results in a distribution of the elements analogous to a Gaussian distribution symmetrical about the Y-axis. In regions A and C are the few who have done best and worst respectively. Region B is the mean performance region containing most of the elements. The internal motions of the set {A} through successive applications of the ordering function (playing the games each morning) causes the elements on top to go down (the best are performing in other games and practice less) and the elements on the bottom to move up (most improvement from most practice). The dots represent the ordering relation. The direction vector is indicated by the top and bottom arrows. Possible motions of a particular element are indicated by the curves. The change in entropy of motion is less than zero since the ordering function increases element relationships.

The external motions of the set {A} can be seen on a quality performance vs time graph. As time goes on, the mean performance of the group improves.

AN INDIAN GAME

Purpose: Using a woodsman's axe, chop a log in two with as few strokes as possible.

PHASE I

Execution: The participants (about 8 or 10) work as a team to cut the log in half. Each player takes a swing and then gives the axe to the next player. The chopping continues until the log is halved. The log is of sufficient size so each player has several turns.

Scoring: Chopping is an Indian Game of accuracy. Before each swing, the game supervisor draws a straight line on the log showing where the most efficient stroke should fall; using the scheme of the accompaining diagram. After each swing, the closeness to the mark is measured and tabulated. After the log is halved, the closeness measurements of each player are totaled and each player receives a score which ranks him in the group. The player who has been consistently closest to the mark is ranked first in the group. It is emphasized that the participant aims at the line irregardless of previous strokes made by other participants.

PHASE II

Preparation: (Fig. A) Players who have ranked in the upper division of the group receive the honor of participating in a second game of skill on the following morning. Players who have ranked in lower divisions are sent to the practice area where they are under trained supervision. Those scoring highest can go to the Master Game Arena. This activity will last until the evening meal.

The following morning brings another cycle of the Indian Games. Execution of the games begin and the entire sequence of events repeats itself.

Indian Games require a high degree of accuracy and awareness of the total objective.

Fig. 1

In the practice area the participant is given an axe and a supply of logs. He is free to practice at his own pace. At this time the game supervisors become counselors. Their role is to determine if a participant is a serialist or a holist learner in order to advise emphasis on either co-ordination or concentration.

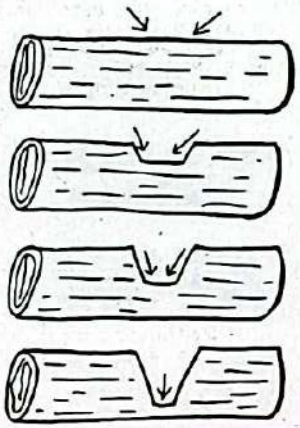
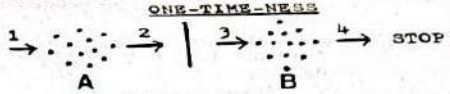


Fig. 2

ONE-TIME-NESS



1. Join a group.
2. Pass barrier (a game).
3. Receive ranking.
4. Stop.

FIG. 3

INDIAN GAMES

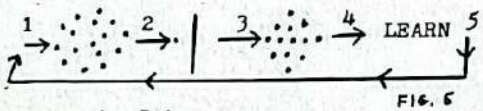


FIG. 5

1. Join a group.
2. Pass barrier.
3. Compiled ranking.
4. Practice to learn.
5. Repeat.

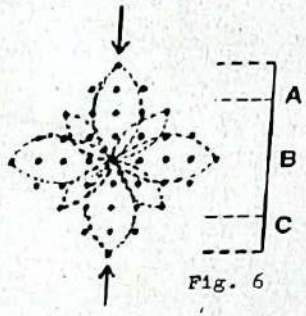


Fig. 6

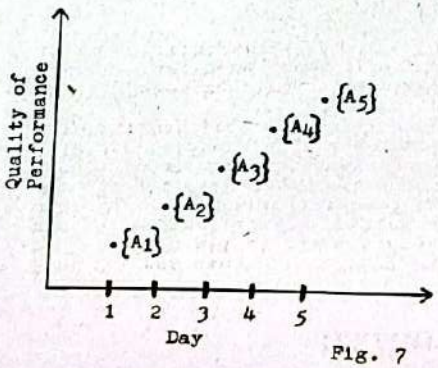


Fig. 7

THE STRUCTURE OF COMPETITION

The structure of "one-time-ness" competition is given in the diagram at your left. It is a linear and finite progression with clearly defined beginnings and end.

Indian Games are cyclic through time. The main barrier is no longer a single obstacle, but rather a series of opportunities for improved performance.

INDIAN GAME WEEK

Early each morning the games in each of the sections begin. On the first day the games take place simultaneously but on successive days they are sequential in time. This provides for those who are participating in more than one game. Because the games are short, the entire sequence will not run long into the morning. Players must maintain high rank in their primary game in order to continue participation in extra games. The cycle continues until the last day. Each day successively bringing an overall betterment in group and individual performance of each Indian Game. Everyone must participate each day in the game in which he started and maintain the skillfulness of the prior day. Additional games are the privilege of those who maintain their skillfulness.

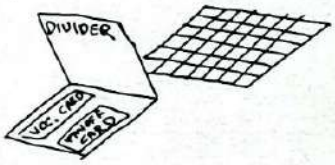
FURTHER CONSIDERATIONS

The motion of the elements in A can be formulated in mathematical and thermodynamic parameters. These observations become interesting when one notes that this is a symbolic representation of the affective psychological enviornment of each participant. Although Indian Games is in the early stages of development, it is the hope of the author that it will eventually become an active part in the growing awareness of young minds and bodies

Stalking the Wild Asparagus

The purpose of these games is to attempt to mimick forms of interpersonal relations by varying the goals, lines of communication, and number of participants in order to discover the consequences of these forms of interaction.

Suggested divider*: fold (8½"x11") piece of paper



* Symbol card need not be behinder divider

Vocabulary Card

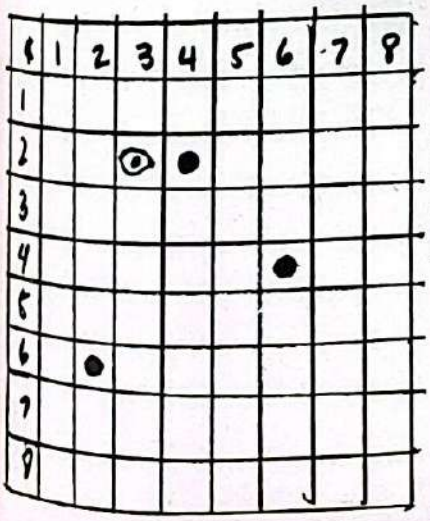
Memp – beside
Clep – under
Zorp – over
Oid – over & right

Symbol Card

A H+1 V+1	G H-5 V-5
B H-1 V-1	H H+3 V+3
C H+2 V-2	I H+1 V+4
D H-2 V+2	J H+2 V+4
E H-5 V+3	K H-4 V-2
F H+3 V-5	● landmark

Payoff card

	1	2	3	4	5	6	7	8
1		G				B		I
2	H		C	●			G	
3		A			F		A	
4	E			A		●		B
5			K		D		C	J
6		●		B		A		
7						B		G
8	G			A			B	K



Game 1:

One vocabulary card, one payoff card, and one symbol card are dealt face down to each player. The player places these cards behind his divider such that they are not visible to other players. Each player is also given 20 tokens, three landmark and one matrix. The landmarks denoted by on the symbol cards, are placed on the matrix in the squares specified by the payoff card (see figure 1).

The youngest player begins and places one of his tokens on the other player's matrix or asks the other player where to place his token.

If the younger player requests assistance from the other player, the other player may refuse or make statements of the following form:

> "Place your token (nonsense word) the token (or landmark) in (row), (column)."
>
> i.e.,"Place your token (memp) the token in 3,4."

The nonsense work may be taken from the vocabulary card or generated by the player.

All spatial relations must be articulated with nonsense words and all relational statements made with respect to a matrix square which is covered by a landmark or a token.

Consulting his vocabulary sheet, the younger player may heed the other player's advice or ignore it but in either case he must place his token somewhere on the other player's matrix. When he does so the other player finds the representative square on his payoff card and reads aloud the letter (if there is one) associated with it. The letter is located on the symbol card and determines the payoff for the younger and the other player.

All tokens must be placed on unoccupied squares presence of white or black token, or landmark determines occupation.

Below, the younger player has placed his token on 2,3. 2,3 on the payoff card reads C. C on the symbol card determines the payoff, in this case $\begin{matrix} H + 2 \\ V - 2 \end{matrix}$ which implies that H (home) should receive two tokens from the token bank and V (visitor) in this case the younger player should put two of his tokens in the bank. A space with no letter has no payoff.

Suppose that when told to place his token memp 2,2, the younger player places it 3, 2, that is below 2,2. If this is not where the other player wanted the younger player to place his token, he may correct the younger player by placing one of his own tokens (white side up) in the desired space. If he does so, the payoff associated with that space is disregarded. The other player is under no obligation to correct the younger player but if he desires to do so he must by the manner prescribed. No verbal allusion to rightness or wrongness of a move are allowed. Thus after the younger player moves, the other player may pass or correct.

The other player now becomes the visitor; the younger player becomes the home and the process is repeated with the other player placing his token on the younger player's matrix.

The placement of a token by both players and completion of prescribed payoff constitutes one move.

One game consists of 25 moves. If after 25 moves either player retains any tokens the player with the most tokens is the winner. Winner must have at least one tiken. Players in debt must borrow tokens from the bank. All debts must be paid in order to win.

Players can keep track of moves with the move counter or by counting the number of black tokens on a matrix.

Paper and pencil for keeping notes is allowed.

Game 2:

Rules as game 1, with the following exceptions:

3 or 4 players (3 or 4 matrixes).

Each player alternates placing his token on the territory to his right, across, and left.

One move is completed when each player has placed one token on a board.

Each player begins with 25 tokens and game consists of 30 moves with 3 players; 32 tokens, 36 moves with 4

Game 3:

4 players (4 matrixes).

Game played like game 1 except that teams compete against each other to see which team can accumulate the most tokens. All moves are made on partner's board (20 tokens, 25 moves).

Game 4:

4 players (2 matrixes).

Played as game 3 except that players from opposing teams share boards.

Game 5:

2 to 4 players; 2 to 4 matrixes.

Played to generate tokens, not to win.

* Paper and pencil for keeping notes is allowed.

Steve Sloan

Vocabulary Cards

clep – right
Oid – left
quat – under
memp – over

quat – beside
clep – under
Oid – over
whemp – over + left
hunta – over + right
toft – under + left

toke – left
quat – right
Kelp – under
toid – below
hunta – over + left
whemp – over + right
zorp – under + left
toft – under + right

memp – beside
Oid – over
clep – under
whemp – under + beside
toft – over + beside

TOKE – RIGHT
CLEP – LEFT
MEMP – OVER
Oid – under

quat – right
clep – under
Oid – over
memp – left
whemp – 2 to the right
hunta – over and left

quat – left
memp – right
whemp – under
zorp – over

quat – beside
clep – under
whemp – under + beside
toft – over + beside

Memp – beside
whemp – under
zorp – over

quat – left
memp – right
Oid – over
clep – under
whemp – 2 to the left
hunta – over and right

quat – under
clep – beside
zorp – left
hunta – right + over
whemp – left + over

toke – beside
quat – beside
Kelp – under
toid – below
hunta – over + left
whemp – over + right
zorp – under + left
toft – under + right

Memp – left
whemp – over

MEMP – beside
clep – over
Oid – under

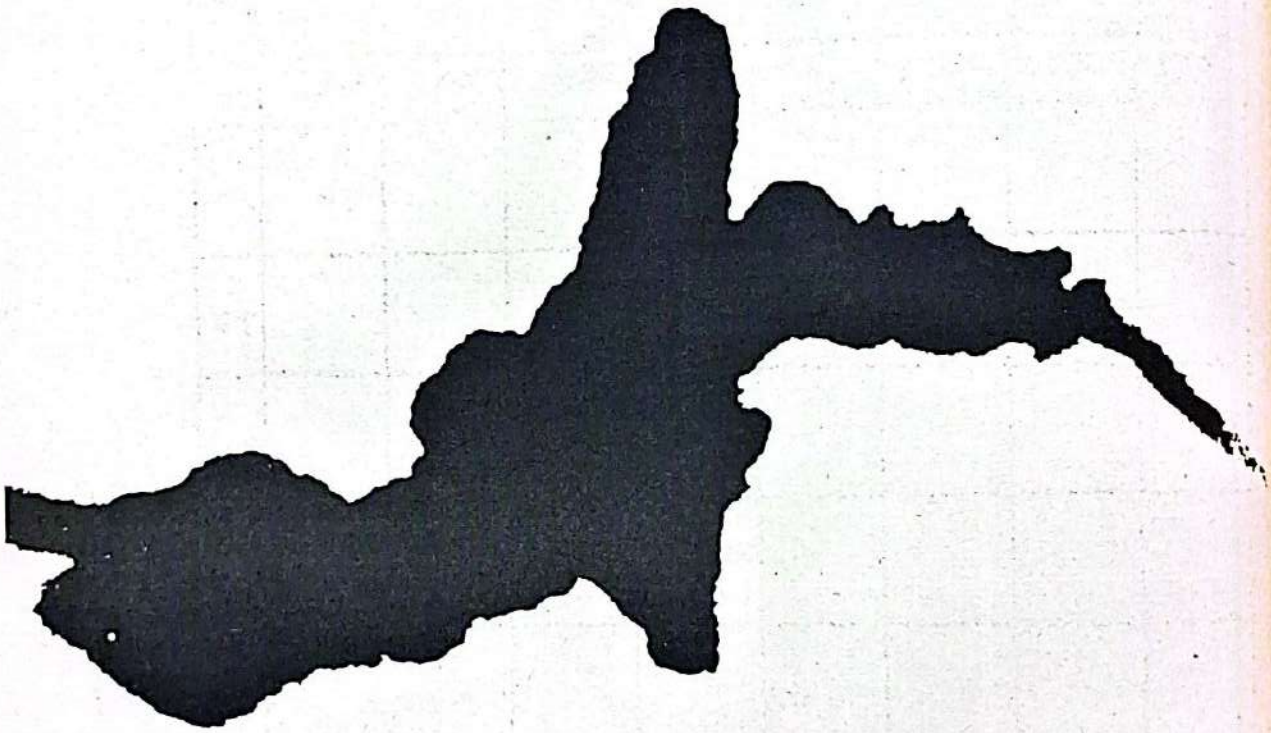
zorp – right
whemp – left
quat – over
memp – under

zorp – beside
whemp – under
memp – over + left
quat – under + right

TOKE – UNDER
CLEP – LEFT
Oid – RIGHT
Memp – UNDER

quat – beside
clep – under
Oid – OVER
ZORP – Right + under
hunta – left + over

STALKING THE WILD ASPARAGUS



1 The world is everything which is the case.

Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*

STALKING THE WILD ASPARAGUS

SEAR-X

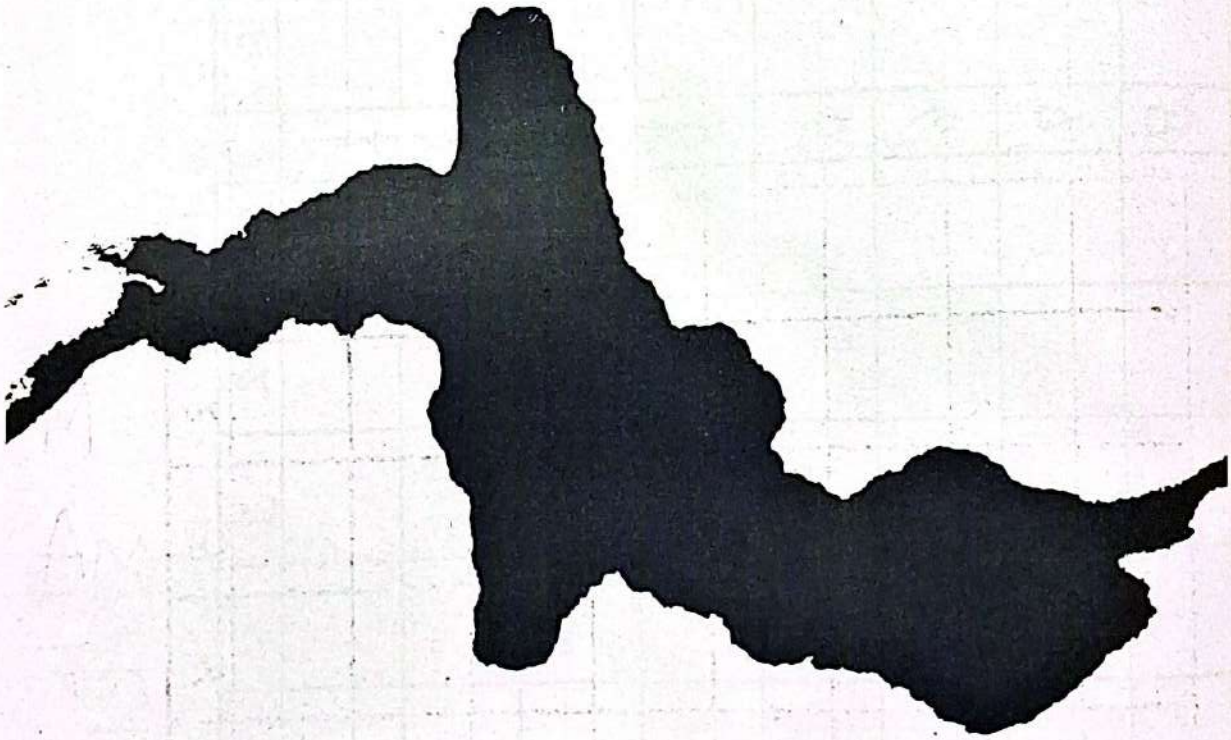
	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
8								

SEAR-X

	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								

5.1361 We cannot infer the events of the future
from those of the present...
the belief in causality is *the* superstition.

Ludwig Wittgenstein, ***Tractatus Logico-Philosophicus***



5.1362 The freedom of the will
consists in the impossibility of knowing
actions that will be in the future.

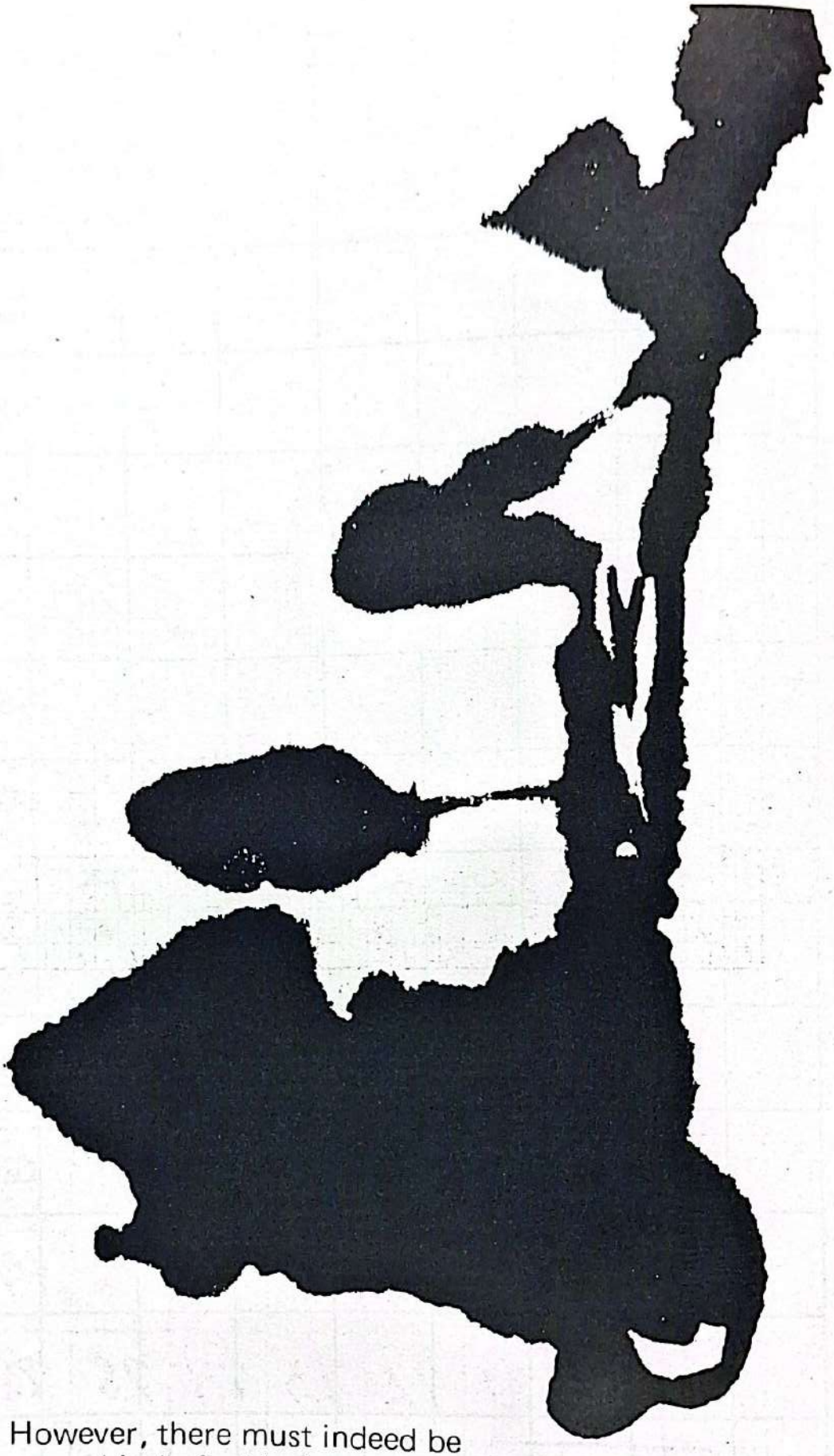
Ludwig Wittgenstein, ***Tractatus Logico-Philosophicus***

ΣΑΤΡΧ

	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								

ΣΑΤΡΧ

	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								



6.422 However, there must indeed be
some kind of ethical reward
and ethical punishment,
but they must reside in the action itself.

Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*

	1	2	3	4	5	6	7	8
1				A		B		B
2	K	●	C			G		
3		E			A		●	H
4	A		B			C		G
5			G	I				A
6	J	D		●		A		
7	B					F	B	
8		A		B		G		K

	1	2	3	4	5	6	7	8
1	A		G			H		G
2	A				B		C	
3		●	A	B		●		I
4				A	B		G	
5	F	B			B	A	H	
6			E	B				
7		D			J		●	K
8	C		K			G		

	1	2	3	4	5	6	7	8
1			K	K			J	
2	A		C			A		
3		B			●		B	I
4	B		A	C		E	A	
5	F		G		B			A
6		●	B	D		H	●	
7				G				
8			B		G	A	G	

	1	2	3	4	5	6	7	8
1	F		C	B			G	B
2	K	●						
3	B		D		A		●	B
4								C
5	A		H	I			A	
6				●	A			A
7	B	G						J
8	G		A	E		G	B	K

	1	2	3	4	5	6	7	8
1						G		
2		A	J	B		●		C
3	I	D		K	A	B		
4	G		●	G			B	
5		A			A		E	B
6			A		F	H	C	
7	B	A				●		
8			B		G		K	

	1	2	3	4	5	6	7	8
1	E			C		F		A
2		B		●	I	B		J
3	A			G	B			G
4		G		A			C	A
5		D	B		H		●	
6	B			G	B			K
7		●					A	
8				A				K

	1	2	3	4	5	6	7	8
1		K		A				
2		A		B		D		G
3		E				A	B	
4	●			●		K	B	
5			B			G	H	
6		B	C	I	J			A
7	F	A				●	B	
8	G			A	C			G

	1	2	3	4	5	6	7	8
1	I		B			●		C
2		A		B	G			
3	G				B	G	K	
4		B		A	J	A		D
5	F		●			C		
6		K		B	A		D	
7	A			G		●		
8	D		A		H	E		

	1	2	3	4	5	6	7	8
1		G	G			F	A	
2		A		●			K	
3	H	I				E	●	
4	K	J	G	D	B	G	C	
5	A		B				A	
6				A	B		B	
7	B	●		B		C		
8								A

	1	2	3	4	5	6	7	8
1	A		C		D		E	
2		B			A		●	A
3		B	G		B	G		
4			●	A	G		B	B
5	C			H		B	A	
6			B	I				A
7		A	K	J		●	C	
8	B			K				

	1	2	3	4	5	6	7	8
1		K		A		C		
2	J		●		C		A	B
3	B			●				A
4	A		B	D	I	G		G
5		E				A		
6		●	G		B		B	
7	K			F		B		
8		A		H				G

	1	2	3	4	5	6	7	8
1		C			A	B		K
2	J	●		B		K	A	
3	A				I	●	E	
4	B		D		C	B	A	
5			A				B	
6		B			A			
7			●			B	F	
8		H		G			G	

	1	2	3	4	5	6	7	8
1	B			C		B		G
2				A				A
3		●				I	C	F
4		B			●			A
5	B		A			D	J	K
6		E				A	K	B
7		G	●		H	G		
8		A			G			B

	1	2	3	4	5	6	7	8
1	A		C		D		E	
2		B		●		G		B
3	J		G		K	A	B	
4		G		A			H	G
5		A		K	B	●		I
6	●		G				A	
7	G					B		B
8		F		A				C

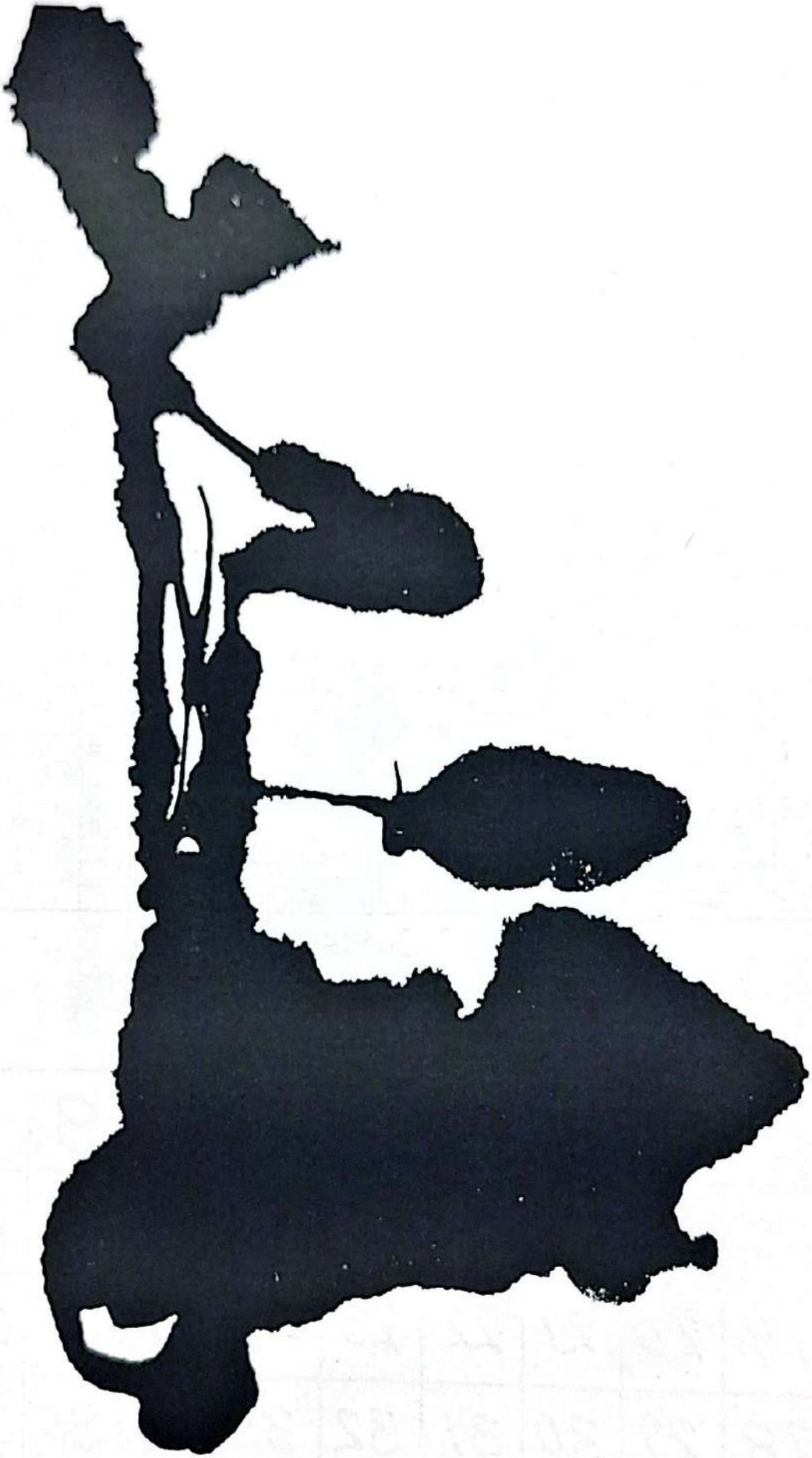
	1	2	3	4	5	6	7	8
1	B		A		C			B
2		G			J	K	●	
3	B		I		A		G	B
4		●			G	B		
5				D		C		F
6	H		A	B		A	K	
7	E				A			●
8		A					G	

	1	2	3	4	5	6	7	8
1	D		C				A	
2		●		H	B	C		
3			G	A		K	B	●
4		B		E	B			G
5	G	B		G	●	I	A	
6			B		J			A
7	A		K		F			A
8								

Payoff Cards

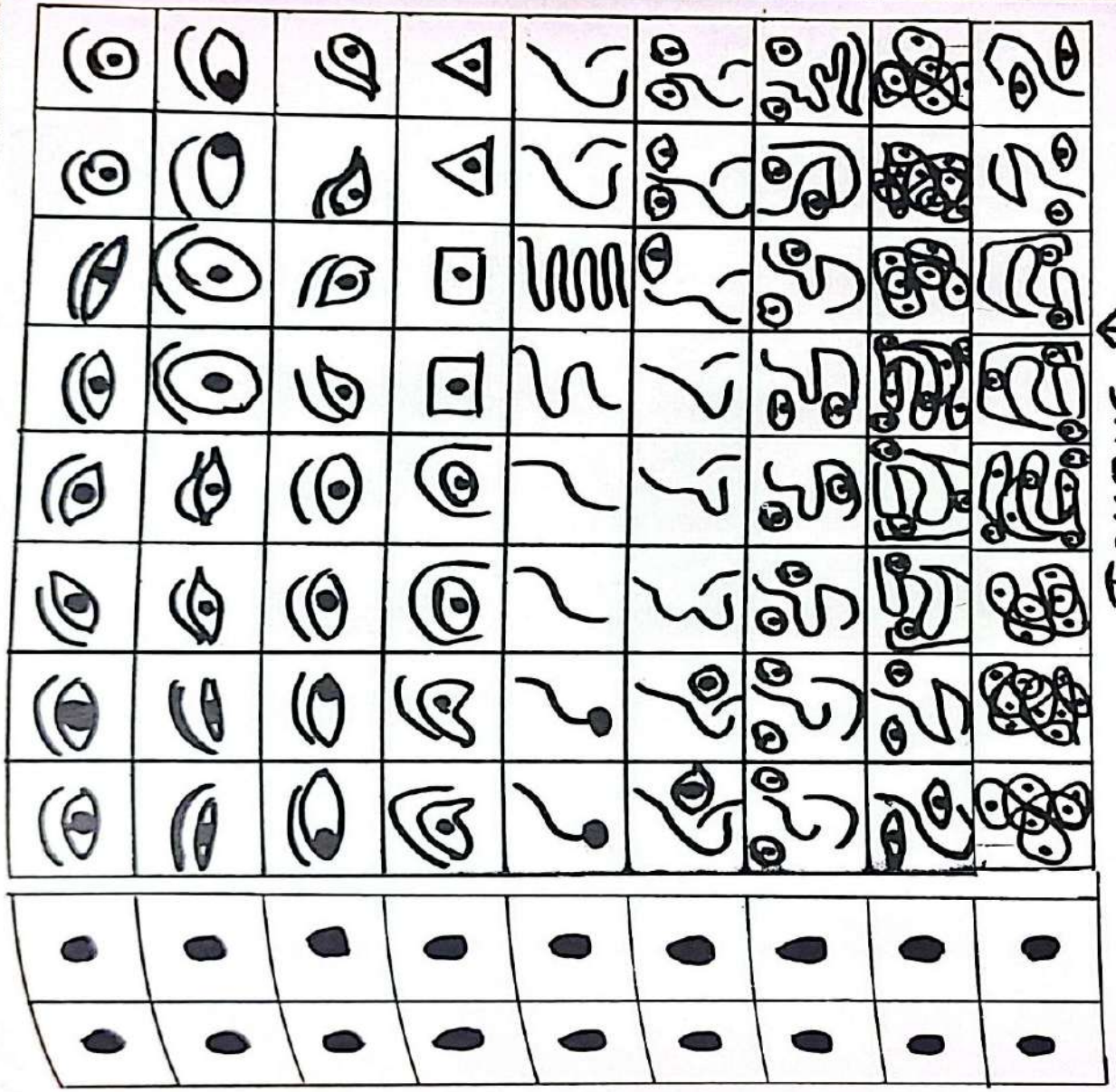
Move Counter

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45



6.32 The law of causality
is not a law, but the form of a law.

Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*



TOKENS

A H+1 V+1	G H-5 V-5	A H+1 V+1	G H-5 V-5
B H-1 V-1	H H+3 V+3	B H-1 V-1	H H+3 V+3
C H+2 V-2	I H+1 V+4	C H+2 V-2	I H+1 V+4
D H-2 V+2	J H+2 V+4	D H-2 V+2	J H+2 V+4
E H-5 V+3	K H-4 V-2	E H-5 V+3	K H-4 V-2
F H+3 V-5	● landmark	F H+3 V-5	● landmark
A H+1 V+1	G H-5 V-5	A H+1 V+1	G H-5 V-5
B H-1 V-1	H H+3 V+3	B H-1 V-1	H H+3 V+3
C H+2 V-2	I H+1 V+4	C H+2 V-2	I H+1 V+4
D H-2 V+2	J H+2 V+4	D H-2 V+2	J H+2 V+4
E H-5 V+3	K H-4 V-2	E H-5 V+3	K H-4 V-2
F H+3 V-5	● landmark	F H+3 V-5	● landmark

SYMBOL CARDS

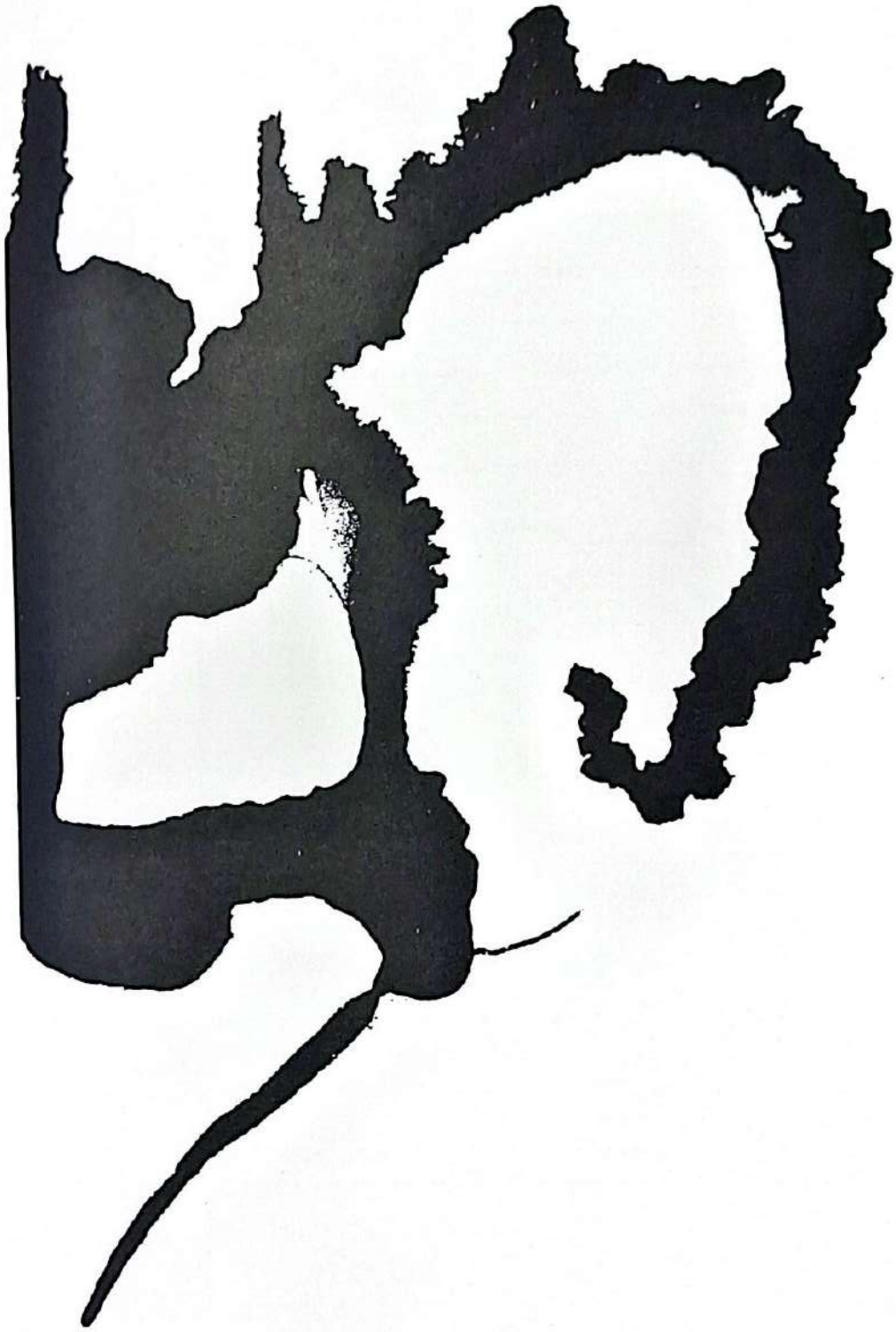
Landmarks

6.421 It is clear that ethics cannot be put into words.

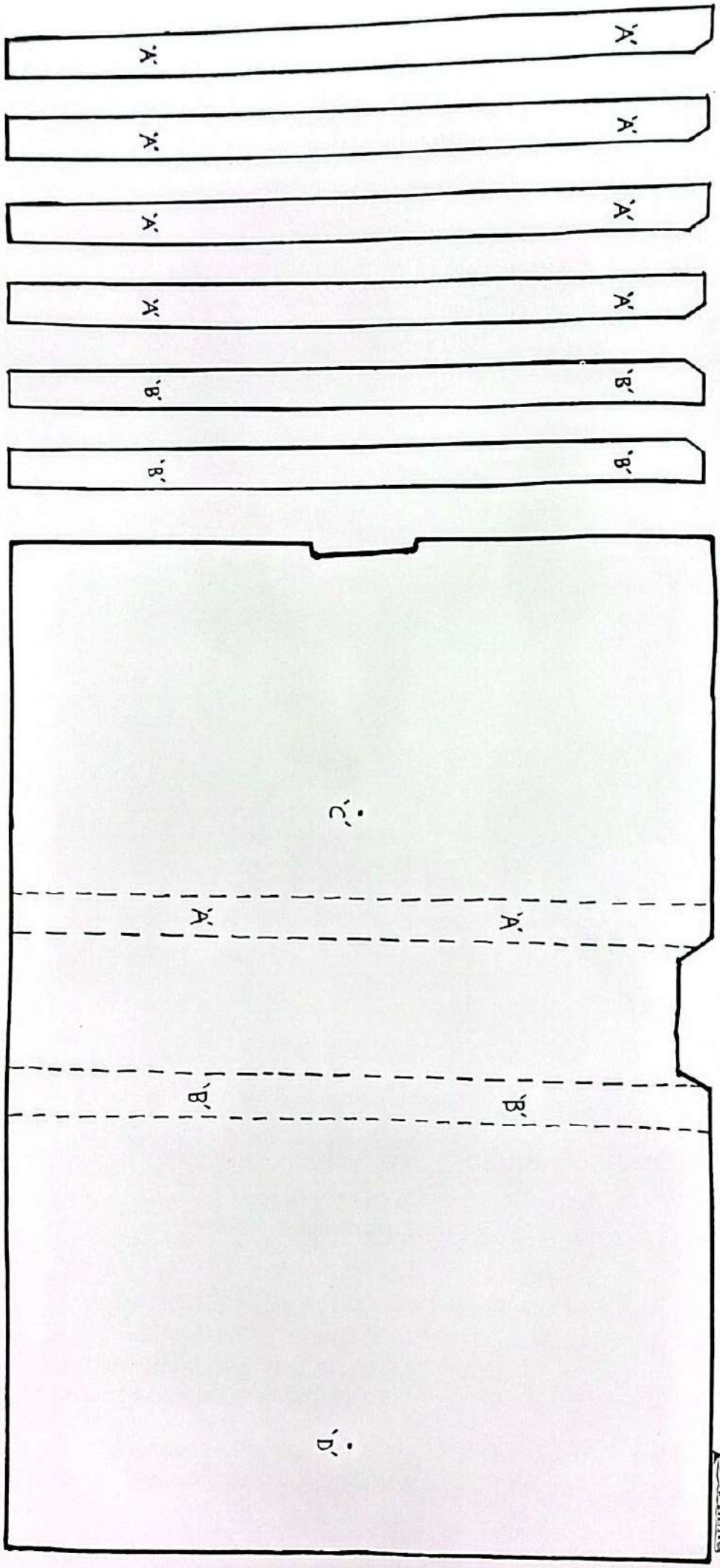
Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*

122 When an ethical law of the form "thou shalt..."
is laid down, one's first thought is,
"and what if I do not do it?" It is clear
however, that ethics has nothing to do with
punishment and reward in the usual sense
of the term. So, our questions about
the *consequences* of an action must be irrelevant.

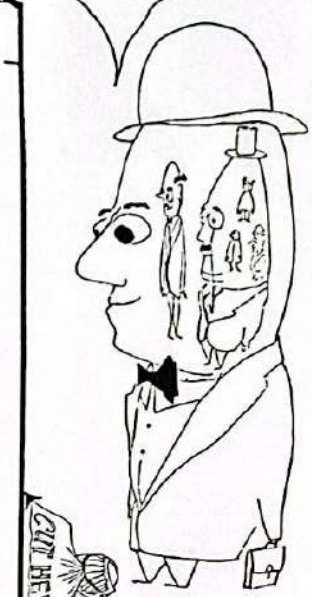
Ludwig Wittgenstein, ***Tractatus Logico-Philosophicus***



A WORKING TOTE UNIT



We would, at this time, invite your interest in the configurations immediately to the left of this communication. Allow us to introduce to you an UNEMPLOYED TOTE, a passive participant in the process of this publication. As you may already have noted, the parts of the tote are named and form a FAMILY. IT IS OUR Goal then, to bring these parts together in UNION and present you with a Productive OR ACTIVE contributor to YOUR EXPERIENCE, that is, please VIEW the next pages and meet a WORKING TOTE UNIT.



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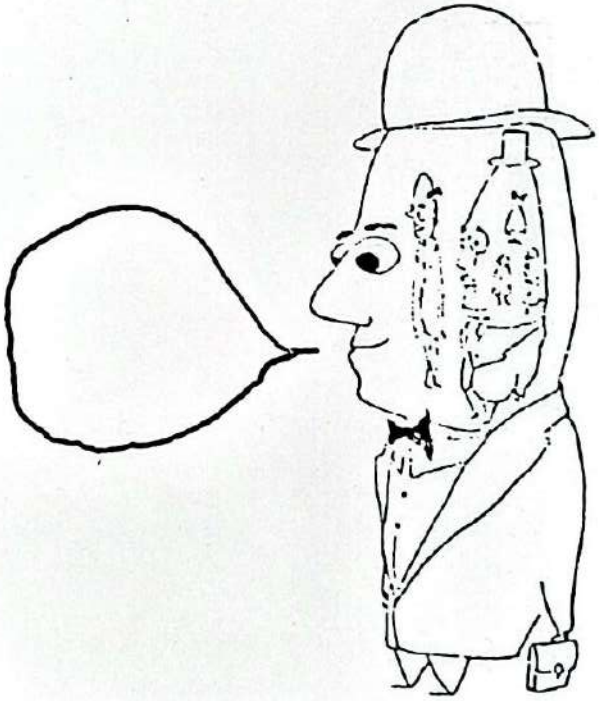
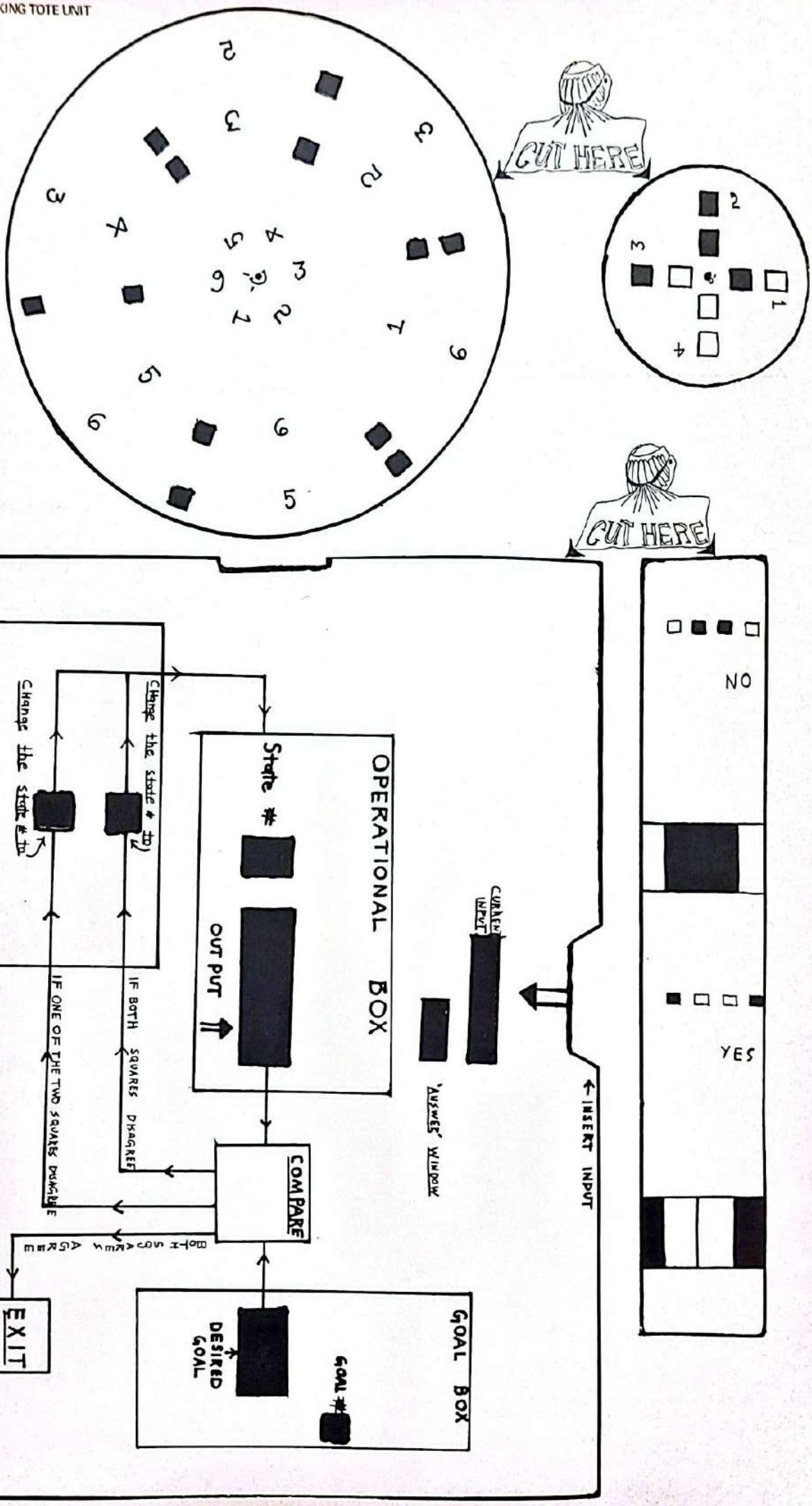
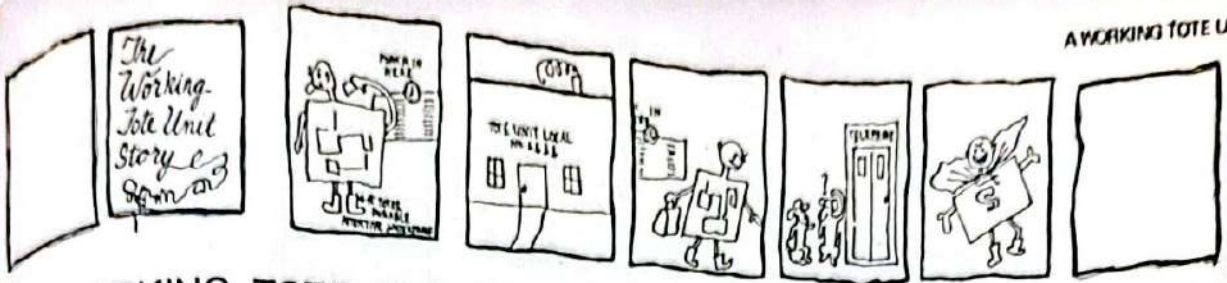


7 Of what we cannot speak,
we must remain silent.

Ludwig Wittgenstein, ***Tractatus Logico-Philosophicus***

A WORKING TOTE UNIT

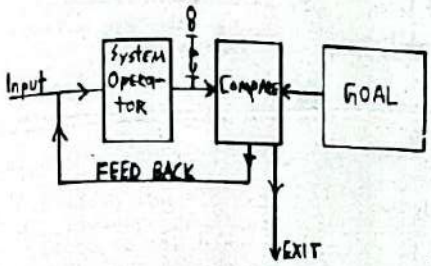




A WORKING TOTE UNIT

For most people, the theoretical connection between the process of hammering a nail and the basic metaworkings of the brain might not be readily apparent. Yet these processes like all controlled dynamic systems fundamentally can be modeled in generally the same orderly fashion. One very useful model which seemingly exposes the essence of many controlled dynamic systems is the tote (test operate, test exit) unit.

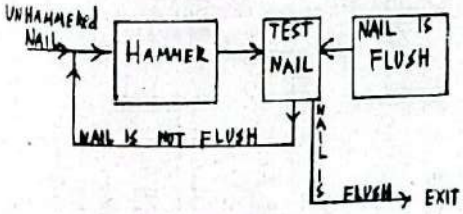
Briefly, the tote unit is composed of five elements; input, output, feedback, system operators, and goals. A schematic of how these elements relate is shown below.



The basic scheme is as follows:

1) We first assume a goal or purpose for the system. This goal is set in the box labelled goal.
2) Input is inserted into the system.
3) The input is operated on by the system operator and an output is produced.
4) The output is then compared to the goal of the system. The result of this comparison is fed back into the system operator. Bear in mind that the object of the system will be the eventual agreement between the output and the goal.
5) The fedback information combined with the input are again operated on producing a new output. The system thus cycles over and over until finally the output and the goal agree. When this occurs, one exits from this tote system and prodeeds to the next tote unit.

Returning to the example of hammering a nail, let us examine how the tote easily represents that system. Let the following be the model:



The hammering is the system operator, the unhammered nail is the input, the result of the hammered nail is the output, the nail after hammering is the goal. Note, first the nail being flush is the goal. Note, first the nail is hammered. The result of the hammering is compared to the goal. If this output agrees with the goal, one exits from the system. On the other hand if the output doesn't agree with the goal (nail is not flush) feedback information is sent back into the system operator and the cycle is repeated. Eventually the nail, after sufficient cycling (hammering) will become flush.

Notice that regardless of the input, the output eventually agrees with the goal. So in applying this observation to the example of the metaworkings of the brain we see that the tote model can readily represent the process of homeostasis, a popular cybernetic interpretation.

Consequently, I am working under the assumption that a familiarity of the tote concept is quite an important tool in the understanding of simple and complex controlled dynamic systems.

One very interesting set of systems worth studying are "games", the very topic of this project. The components used in a game are virtually the same elements found in the tote unit. For example, a game could consist of inputs (markers), system operators (playing boards, dice, etc.), outputs (completed moves, payoffs), goals (object of the game), and feedback (information received from the respective moves). With this in mind it would seem that a fair understanding of the tote concept might facilitate a very interesting level of observation for the reader who is anxiously anticipating the playing of the ensuing game.

Therefore, I have risen to the occasion and have designed a working dynamic tote unit. The cardboard parts and assembly instructions are on the pages following this introduction. My tote unit allows the user to actually play with inputs, outputs, goals, and feedback in a tangible way so that one can get a feel for the hopefully implicit relationships.

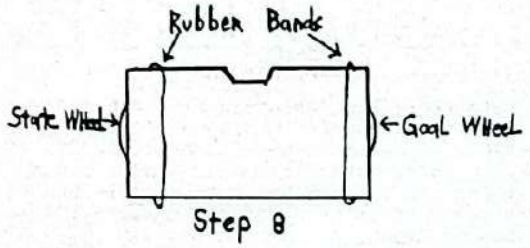
Assembly Instructions

Tools and Materials Needed for Construction:

Scissors
Elmer's Glue
Sharp Knife
2 Thumbtacks
2 Rubber Bands

1) Cut out the bottom piece of the tote unit on cardboard page 1.
2) Cut out all of the parts on cardboard page 2. Use the sharp knife to cut out the 12 solid black squares inside the large circle cut-out. Try to be as careful cutting as possible for the best results.*
3) Carefully glue the two "A" strips together, one on top of the other. Next glue the two fastened "A"s on to the corresponding "A" region of the bottom piece, located between the dotted lines.
4) Do the same for the two "B" strips.
5) Take the large cut out circle. Push the shaft of a thumbtack through the center of the circle, i.e., point "C". Mount the circle on the bottom of the unit by inserting the shaft through point "C" on the bottom. Turn the bottom over. Bend the protruding shaft 90° so that the entire shaft touches the back of the bottom piece.
6) Do the same for the small wheel, using point "D".
7) Cut out the front of the unit on cardboard page 3. Use the sharp knife to carefully cut out the solid black rectangles (windows) on the front.

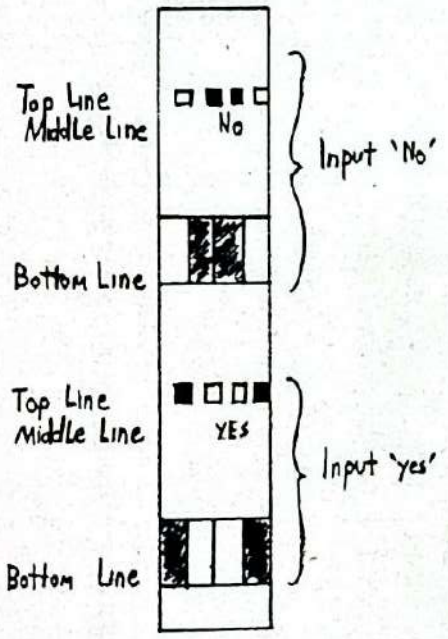
8) Place the front directly over the mounted wheel bottom and fasten with two rubber bands.



9) You're done.
Congratulations.

*Do not cut out the squares inside the small circle cut-out.

What you should now have in your possession is the completed tote unit and input card. Notice, that on the tote unit there are two moveable wheels; the one on the right being the goal wheel, the one on the left being the state wheel. The function of the goal wheel is to allow the user his choice of one of four available goals, each goal taking the form of two colored squares. The function of the state wheel is to allow a variance of operations that can be performed by the operational box. In this case, the variance of operation is the positions of two punched-out squares. To change a goal or state, merely turn the corresponding wheel clockwise or counter-clockwise.

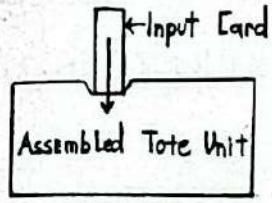


Let us now briefly look at the input card. On the card, there are two inputs, each one consisting of three lines. The bottom line is the actual input that is operated on in the operational box. The middle line is the name of that input and the top line is a picture of the particular input. When an input is properly in place in the tote unit, parts of the bottom line should be visible in the "output" window, the middle line should be visible in the "answer" window, and the top line should be visible in the "current input" window.

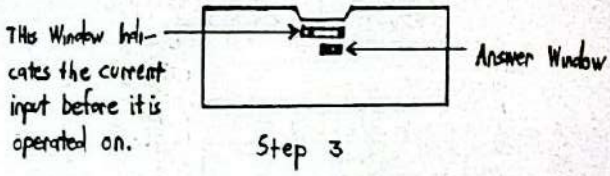
YOU ARE NOW READY TO USE YOUR TOTE UNIT

Now that you have your tote unit completely assembled, the directions for usage are as follows:

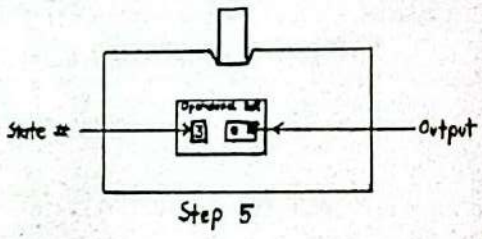
1) Set the operational box on any initial state.
2) Insert the input card vertically down the input slot.



3) Insert input card until a yes or no appears at the answer window. This indicates that the input is in place.



4) Dial one of the four goals from the goal box.
5) The operational box now picks two or the four available input squares. The particular squares picked are dependent on the state that the operational box is in. These two state dependent squares appear as the output of the system, visible in the output window.



6) One now compares the output squares to the goal squares, i.e., left output square to left goal square and right output square to right goal square.
7) Depending on the result of this comparison one can take one of three paths leading from the compare module. Two paths are the feedback paths and the third path is the exit path.
   a) If both the output and goal squares agree respectively, take the "exit" path. You're done.
   b) If one of the output and goal squares disagree respectively, take the "one disagreement" path which instructs you to change the state of the operational box to the number indicated in the path window.
   c) If both of the output and goal squares disagree respectively, take the "both disagree" path which instructs you to change the state of the operational box to the number indicated in the path window.

Note: Regardless of how random your choice of goal, input, and initial operating state, this tote unit at most will take two feedbacks in order to obtain a goal-output agreement.

HAVE FUN

The main distinctive feature of this game is that players do not know the rules or the procedure for playing the game until they are revealed during the process of the game itself. It is a programmed game. A new program can be created thus creating a new game. Anyone can be a programmer. The program is revealed by successively turning of program cards. The program cards have descriptions of the interaction that will occur between the players (and the pieces if any are used).

JOHN SCHMIDT
MAY 1, 1972

OUT TO LUNCH

1.1

Program 1

1.1.1

Program card 1

A) A white square board is place between two players. One player is facing east. One player is facing west.

1.1.2

Program card 2

A) A black line is placed down the center of the board north to south defining the territory of each player.

B) Each player lists the physical and psychological properties of their territory.

C) For each matching description with the other player, the player receives two points.

1.1.3

Program card 3

A) A second black line is placed across the center of the board this time running east to west.

B) Each player lists the social properties and implications of each of their newly divided territory.

C) For each match the player receives five points.

1.1.4

Program card 4

A) A third line is placed through each of the players territory dividing it in half.

B) Each of the players lists the historical properties of his newly divided territory.

C) For each match a player gives the other player 2 points from his accumulated points.

1.1.5

Program card 5

A) Each player gives the other one part of his territory.

1.1.6

Program card 6

A) Each player selects a color for one part of his territory and one for his opponent.

B) One point for each match.

1.1.7

Program card 7

A) Each player gives the other half of his accumulated points.

1.1.8

Program card 8

A) Each of the players declares in writing himself winner or loser of the game.

1.1.9

Program card 9

A) Winner of the game takes the loser to dinner. With double winners each player takes the other to dinner on separate occasions. With double losers each player is taken out to dinner on separate occasions.

Game theory is mathematical, founded in combinations, logic, and set theory.

An introductory article on game theory can be understood by anyone.

It will not reveal how to play poker, or chess, or or any game.

It will reveal when a game has an unbeatable strategy, and it demonstrates how to calculate every possible outcome of every possible strategy.

And tell you why no one has mastered chess – the number of strategies is incredible – but how it is likely eventually it will be mastered.

Social, economic, and political mathematical models have their basis in game theory, but fundamental new results are needed before more progress will be made.

Perhaps most significantly, game theory proves that people can co-operate to do better than either would do alone – as you already know if you've played these games.

THINGS TO READ

"Use and Misuse of Game Theory", Anatol Rapoport, Scientific American, December, 1962.

"Game Theory and Decisions", Leonid Hurwicz, Scientific American, February, 1955.

"The Theory of Games", Oskar Morgenstern, Scientific American, May, 1949.

Two-Person Game Theory

Two-Pw

Two-Person Game Theory, Anatol Rapoport, University of Michigan Press, 1966.

For mathematicians:

Theory of Games and Economic Behavior, John von Neumann, Oskar Morgenstern (1944).

This statement is false.

That government is best which governs not at all.

There are no absolutes.

This statement is true.

Law must govern law.

All theories of language are language.

self-destruction

destruction of destruction=continuity

self-denial

denial of denial=acceptance

self-negation

negation of negation=assertion

self-organization

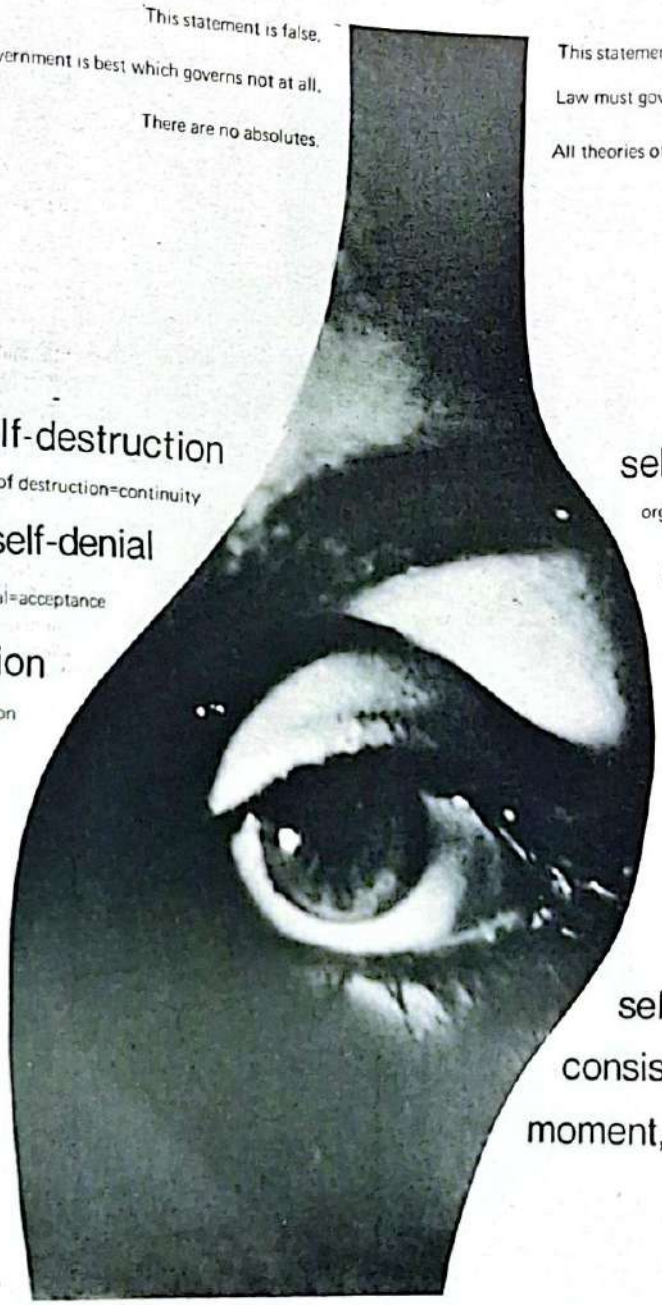
organization of organization

self-acceptance

acceptance of acceptance

self-assertion

assertion of assertion



self-(negative)

inconsistency

time, change

self-(positive)

consistency

moment, stasis

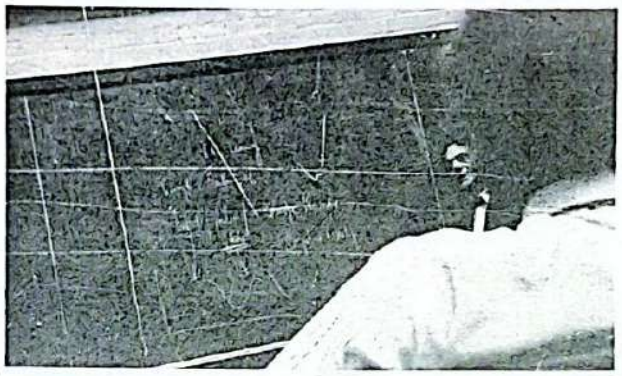
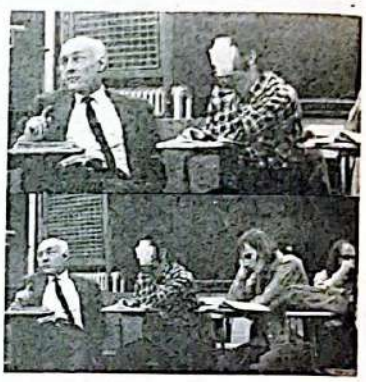
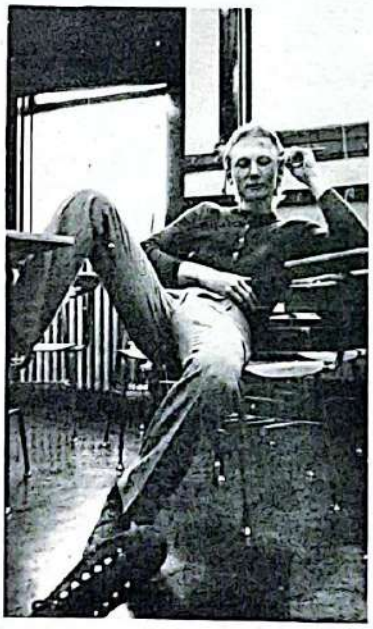
the power of the negative

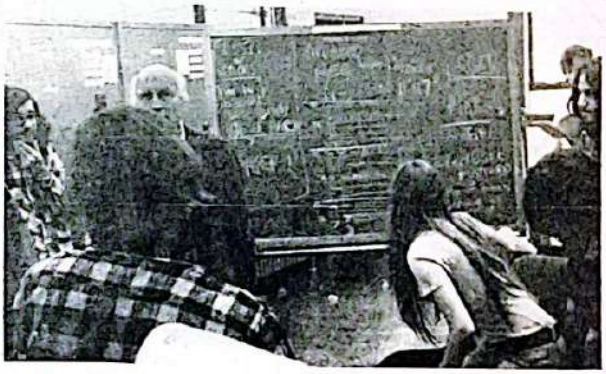
the positive of the negative

dialectic of dialectic

self-dialectic

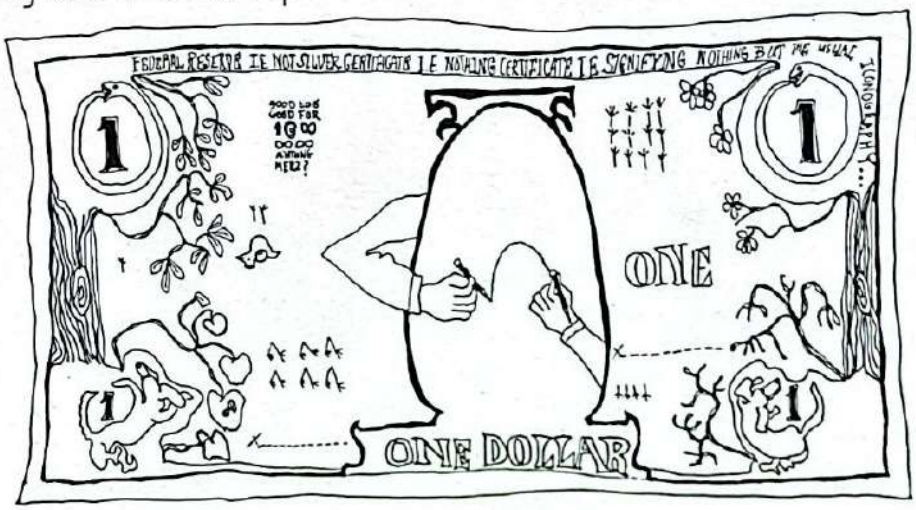
self–reference



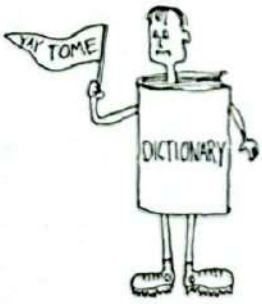
DEMOCRACY GAME → three players

place a dollar in change on the table.
let a majority decide how to divide it up.



dic·tion·ar·y (dik'shə ner'ē) n., pl. -aries [ML. dictionarium < LL dictio: a speaking (< LL word) < pp. of dicere, to say, orig., point out in words < IE. base *diek-, to point out, whence G. zeigen, to show, OE. teon, to accuse, tæcan, TEACH]

1. a book of alphabetically listed words in a language, with definitions, etymologies, pronunciations, and other information; lexicon
2. a book of alphabetically listed words in a language with their equivalents in another language [a Spanish-English dictionary]
3. any alphabetically arranged list of words or articles relating to a special subject [a medical dictionary]
4. name of a game on this page.



To the Lookerupper,

Look up a word in the dictionary. If no one knows the meaning ask them to write on a scrap of paper what they believe the meaning should be. Write down the dictionary meaning yourself. Collect the scraps, read all the meanings, and ask the others to guess which is the dictionary meaning. Work out a scoring system.

Portrait of Dorian Gray Game

version one

1. Solicit a friend to paint your portrait.
2. Hang the picture on your wall.
3. Wait ...

version two

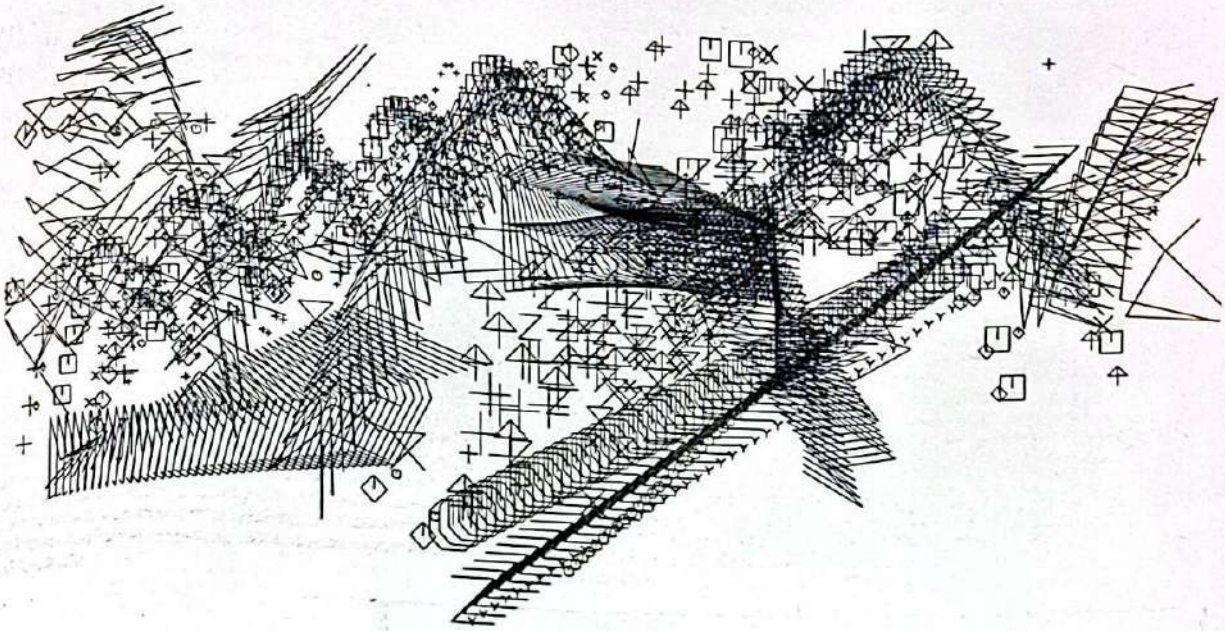
1. Look into a mirror
2. Study your face
3. Recreate your face... vis à vis ... create a self-portrait (are both your ears the same? Can you remember the arch of your brow? The bend in your hairline? The jaunt of your smile?)

version three

1. Ask a friend to draw you as he sees you.

version four

1. Persuade an enemy to draw your likeness.



MUTATIS MUTANDIS are not to be treated as scores, as some symbolic representation in a new notation, as sets of instructions which, if obeyed, would lead a performer to 'execute the shapes, symbols, and configurations, as they follow one another, according to his reading habit, on the page. I have written, and shall continue to write such scores; but with MUTATIS MUTANDIS I intend to present a different kind of challenge.

Here the Interpreter is invited to begin by contemplating a graphic as traces left by a process which moved a pen in various directions across the plane.

This process has been composed by the composer. The pen, thus, moved according to a programmed structure: rules, constraints, commands.

The Interpreter, now, is to construct, by thought and imagination, *his* version of a structure that might leave the traces which the graphic displays.

The Interpreter is not asked to reconstruct my computer program, the structured process that actually generated the graphics. Rather he is asked to construct the structured process by which *he* would like to have generated the graphics.

Finally he should compose a working model of this structure, (a score?), in[and for the medium of his choice: sound, movement, language, film, etc., and perform it.

The Interpreter is asked not to improvise.

He is asked to compose.

A Compound Statement

Herbert Brün

The music you hear is, among other things, also the music composed by the composer. While you hear what you want to hear, you also hear what the composer wants you to hear, provided your listening neither starts too late nor stops too early. Otherwise you will hear what is, at least according to the composition, the wrong piece. If it matters to a composer that you listen to the right piece he will side with his composition and not permit his listeners to think that it does not matter.

The living organism needs food. When we want to eat, this want follows the instruction of a need. Nobody, however, needs to be either a composer or a listener unless he wants to. Here the want generates the need and the need for music follows the instruction of a want. Want is the meaningful relation between needs and music. In the one case want is a consequence, in the other the cause. To disregard and to belittle want in either case is to gloat over the needy, is to pride oneself on needing nothing.

Spontaneity, at its very best, generates intuitive responses to instructions received. Even the most brilliant improvisation only embellishes obediance to what is wanted from, not by, the musician.

The composer, on the other hand, articulates what he wants. Not the mere fact that he wants something, but that he articulates it as an instruction, gives music its function in society and, sometimes, renders music immune to the insidious flatteries of commercial absorption.

Nobody will be free from want by just hiding it.

Every desire can be transformed into a statement which wants to become "true".

Whenever the maintenance of a system is rated more important than the maintenance of its elements, then the system will solve the problems which assail it and perpetuate the problems which maintain it.

Perpetuated problems generate the desire for a change of system. The opposition to change calls these problems unsolvable in order to reject the fulfillment of desires.

The Composer's Music solves the problems which maintain it, and perpetuates the problems that assail it.

To learn how to compose is to learn how to construct systems wherein deliberately stipulated premises, statements of desires, become "true".

Given a thesis or statement which intends to condemn present day reality and facts.

Could you argue for this thesis without using present day reality and facts?

If used as an argument, present day reality and facts will condemn any thesis which condemns them.

Furthermore, an argument which supports a thesis will in turn appear supported by the thesis.

Thus it may happen that you support that which you intend to condemn.

How could you, without using present day reality and facts as an argument, argue for this thesis without becoming a composer?

In the system which perpetuates it, an unsolvable problem is just that.

Music wants listeners whether listeners want music or not;

if listeners want music, listeners will react to and interact with whatever listeners think listeners have heard;

if listeners do not want music, listeners cease being listeners and will react to and interact with whatever listeners neither think nor hear.

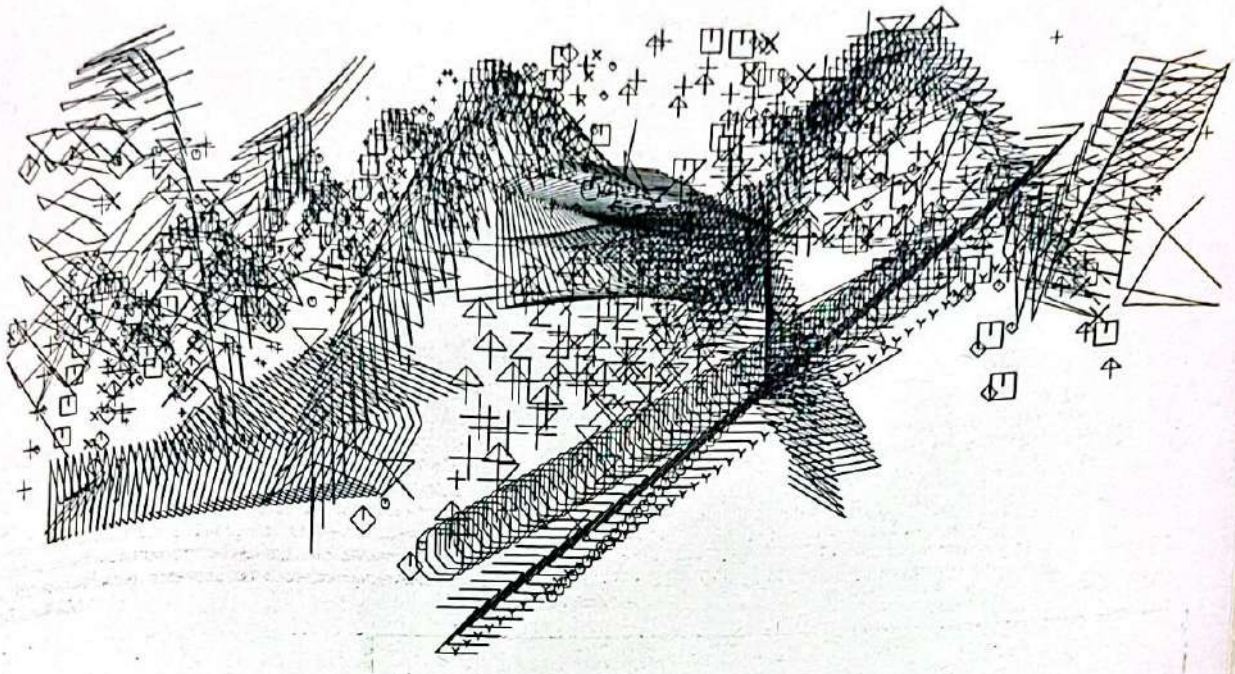
As soon as the reader has conveyed to each word in this statement the meaning which will allow the statement to appear as a 'true' statement, he has understood the content of the statement.

The reader who, without thus understanding it, rejects the statement as being 'false', fails, in fact, to reject the written statement. He rejects only the reader's reading.

The reader who understands the content of the statement by discovering the conditions under which it becomes 'true' and, then, rejects the statement as being 'false', fails to reject only the written statement. He also rejects the discovered conditions.

The listener never accepts or rejects the music. The listener sometimes accepts only, and sometimes rejects only, what he thinks he heard and, if he knows and understands what he has heard, also the composition by which and in which the music has been and, now, is being generated.

Where listeners consume music, both disappear. Where both appear, the listener is consumed by the music. Ready to further either and both, appearances and disappearances, almost all music almost always has been experimental. So have almost all listeners.



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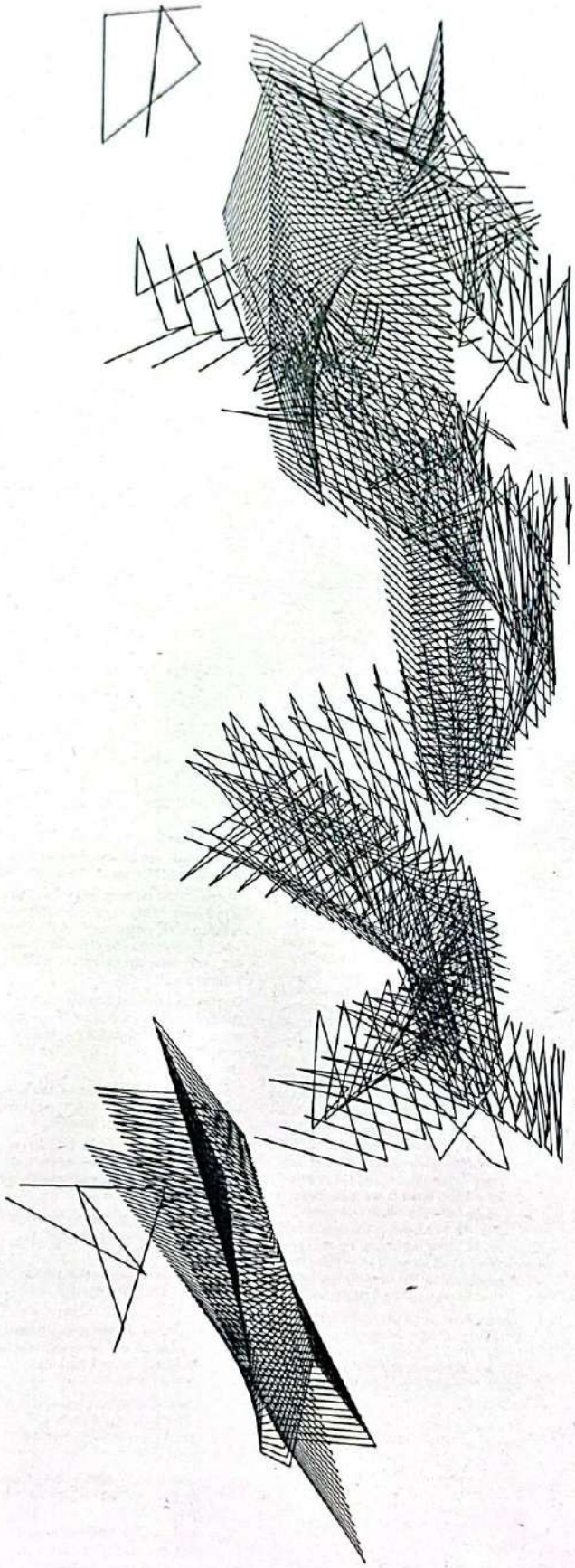

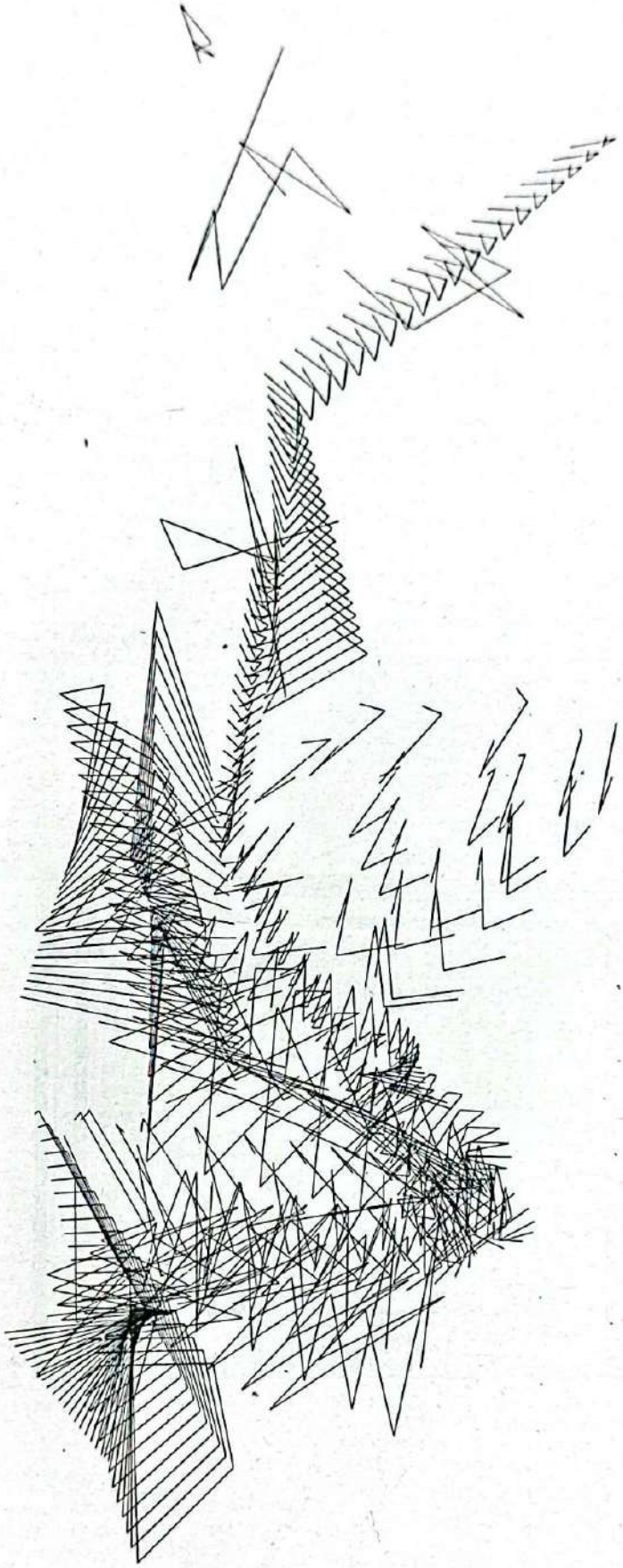

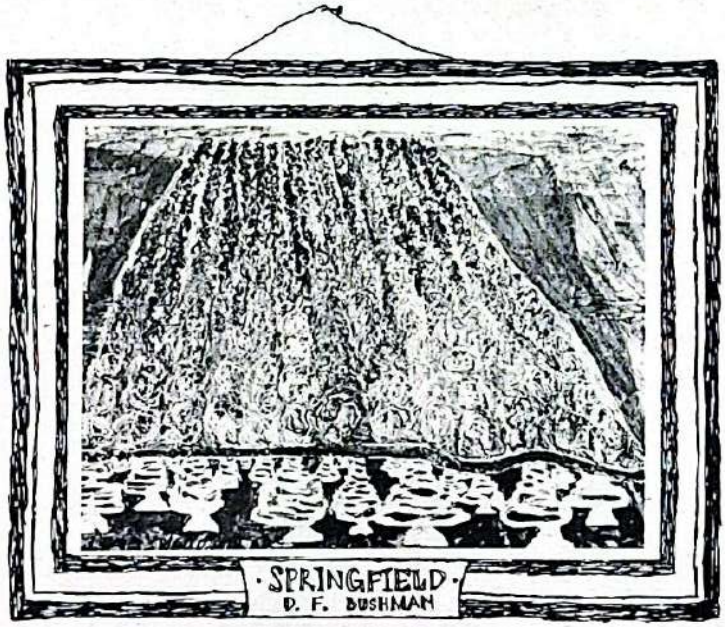

A POLITICAL GAME

Instructional Science
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PERCEPTION OF THE FUTURE AND THE FUTURE OF PERCEPTION

HEINZ VON FOERSTER

University of Illinois, Urbana, Illinois

ABSTRACT

"The definition of a problem and the action taken to solve it largely depend on the view which the individuals or groups that discovered the problem have of the system to which it refers. A problem may thus find itself defined as a badly interpreted output, or as a faulty output of a faulty output device, or as a faulty output due to a malfunction in an otherwise faultless system, or as a correct but undesired output from a faultless and thus undesirable system. All definitions but the last suggest corrective action; only the last definition suggests change, and so presents an unsolvable problem to anyone opposed to change" (Herbert Brün, 1971).

Truisms have the disadvantage that by dulling the senses they obscure the truth. Almost nobody will become alarmed when told that in times of continuity the future equals the past. Only a few will become aware that from this follows that in times of socio-cultural change the future will *not* be like the past. Moreover, with a future not clearly perceived, we do not know how to act with only one certainty left: if we don't act ourselves, we shall be acted upon. Thus, if we wish to be subjects, rather than objects, what we see now, that is, our perception, must be foresight rather than hindsight.

Epidemic

My colleagues and I are, at present, researching the mysteries of cognition and perception. When, from time to time, we look through the windows of our laboratory into the affairs of this world, we become more and more distressed by what we now observe. The world appears to be in the grip of a fast-spreading disease which, by now, has assumed almost global dimensions. In the individual the symptoms of the disorder manifest themselves by a progressive corruption of his faculty to perceive, with corrupted language being the pathogene, that is, the agent that makes the disease so highly contagious. Worse, in progressive stages of this disorder, the afflicted become numb, they become less and less aware of their affliction.

This state of affairs makes it clear why I am concerned about perception when contemplating the future, for:

if we can't perceive,
we can't perceive of the future
and thus, we don't know how to act now.

I venture to say that one may agree with the conclusion. If one looks around, the world appears like an anthill where its inhabitants have lost all sense of direction. They run aimlessly about, chop each other to pieces, foul their nest, attack their young, spend tremendous energies in building artifices that are either abandoned when completed, or when maintained, cause more disruption than was visible before, and so on. Thus, the conclusions seem to match the facts. Are the premises acceptable? Where does perception come in?

Before we proceed, let me first remove some semantic traps, for–as I said before–corrupt language is the pathogene of the disease. Some simple perversions may come at once to mind, as when "incursion" is used for "invasion," "protective reaction" for "aggression," "food denial" for "poisoning men, beasts, and plants," and others. Fortunately, we have developed some immunity against such insults, having been nourished with syntactic monstrosities as "X is better" without ever saying "than what." There are, however, many more profound semantic confusions, and it is these to which I want to draw your attention now.

There are three pairs of concepts in which one member of these pairs is generally substituted for the other so as to reduce the richness of our conceptions. It has become a matter of fact to confuse process with substance, relations with predicates, and quality with quantity. Let me illustrate this with a few examples out of a potentially very large catalogue, and let me at the same time show you the paralytic behavior that is caused by this conceptual dysfunction.

Process/Substance

The primordial and most proprietary processes in any man and, in fact, in any organism, namely "information" and "knowledge," are now persistently taken as commodities, that is as substance. Information is, of course, the process by which knowledge is acquired, and knowledge is the processes that integrate past and present experiences to form new activities, either as nervous activity internally perceived as thought and will, or externally perceivable as speech and movement (Maturana, 1970, 1971; Von Foerster, 1969, 1971).

Neither of these processes can be "passed on" as we are told in phrases like "... Universities are depositories of Knowledge which is passed on from generation to generation ...," etc., for *your* nervous activity is just *your* nervous activity and, alas, not *mine*.

No wonder that an educational system that confuses the process of creating new processes with the dispensing of goods called "knowledge" may cause some disappointment in the hypothetical receivers, for the goods are just not coming: there are no goods.

Historically, I believe, the confusion by which knowledge is taken as substance comes from a witty broadsheet printed in Nuremberg in the Sixteenth Century. It shows a seated student with a hole on top of his head into which a funnel is inserted. Next to him stands the teacher who pours into this funnel a bucket full of "knowledge," that is, letters of the alphabet, numbers and simple equations. It seems to me that what the wheel did for mankind, the Nuremberg Funnel did for education: we can now roll faster down the hill.

Is there a remedy? Of course, there is one! We only have to perceive lectures, books, slides and films, etc., not as *information* but as *vehicles* for potential information. Then we shall see that in giving lectures, writing books, showing slides and films, etc., we have not solved a problem, we just created one, namely, to find out in which context can these things be seen so that they create in their perceivers new insights, thoughts, and actions.

Relation/Predicate

Confusing relations with predicates has become a political pastime. In the proposition "spinach is green," "green" is a predicate; in "spinach is good," "good" is a relation between the chemistry of spinach and the observer who tastes it. He may refer to his relation with spinach as "good." Our mothers, who are the first politicians we encounter, make use of the semantic ambiguity of the syntactic operator "is" by telling us "spinach *is* good" as if they were to say "spinach is *green*."

When we grow older we are flooded with this kind of semantic distortion that could be hilarious if it were not so far reaching. Aristophanes could have written a comedy in which the wisest men of a land set out to accomplish a job that, in principle, cannot be done. They wish to establish, once and for all, all the properties that define an obscene object or act. Of course, "obscenity" is not a property residing within things, but a subject-object relationship, for if we show Mr. X a painting and he calls it obscene, we know a lot about Mr. X but very little about the painting. Thus, when our lawmakers will finally come up with their imaginary list, we shall know a lot about them, but their laws will be dangerous nonsense.

"Order" is another concept that we are commanded to see in things rather than in our perception of things. Of the two sequences A and B,

A: 1, 2, 3, 4, 5, 6, 7, 8, 9
B: 8, 5, 4, 9, 1, 7, 6, 3, 2

sequence A is seen to be ordered while B appears to be in a mess, until we are told that B has the same beautiful order as A, for B is in alphabetical order (eight, five, four, ...). "Everything has order once it is understood" says one of my friends, a neurophysiologist, who can see order in what appears to me at first the most impossible scramble of cells. My insistence here to recognize "order" as a subject-object relation and not to confuse it with a property of things may seem too pedantic. However, when it comes to the issue "law and order" this confusion may have lethal consequences. "Law and order" is no issue, it is a desire common to all; the issue is "which laws and what order," or, in other words, the issue is "justice and freedom."

Castration

One may dismiss these confusions as something that can easily be corrected. One may argue that what I just did was doing that. However, I fear this is not so; the roots are deeper than we think. We seem to be brought up in a world seen through descriptions by others rather than through our own perceptions. This has the consequence that instead of using language as a tool with which to express thoughts and experience, we accept language as a tool that determines our thoughts and experience.

What is wrong with our education that castrates our power over language? Of the many factors that may be responsible I shall name only one that has a profound influence on our way of thinking, namely, the misapplication of the "scientific method."

It is easy to show that resting one's cognitive functions upon these two pillars is counter-productive in contemplating any evolutionary process, be it the growing up of an individual, or a society in transition. In fact, this was already known by Aristotle who distinguished two kinds of cause, one the "efficient cause," the other the "final cause," which provide us with two distinct explanatory frameworks for either inanimate matter, or else living organisms, the distinction being that the efficient cause *precedes* its effect while the final cause *succeeds* its effect. When striking with a match the treated surface of a matchbook, the striking is the (efficient) cause for the match to ignite. However, the cause for my striking the match is my wish to have it ignited (final cause).

Perhaps, with this distinction, my introductory remarks may appear much clearer. Of course, I had in mind the final cause when I said that if we can perceive of the future (the match being ignited), we know how to act now (strike!). This leads me immediately to draw a conclusion, namely:

At any moment we are free to act toward the future we desire.

In other words, the future will be as we wish and perceive it to be. This may come as a shock only to those who let their thinking be governed by the principle that demands that only the rules observed in the past shall apply to the future. For those the concept of "change" is inconceivable, for change is the process that obliterates the rules of the past.

Quality/Quantity

In order to protect society from the dangerous consequences of change, not only a whole branch of business has emerged, but also the Government has established several offices that busy themselves in predicting the future by applying the rules of the past. These are the Futurists. Their job is to confuse quality with quantity, and their products are "future scenarios" in which the qualities remain the same, only the quantities change: more cars, wider highways, faster planes, bigger bombs, etc. While these "future scenarios" are meaningless in a changing world, they have become a lucrative business for entrepreneurs who sell them to corporations that profit from designing for obsolescence.

With the diagnosis of the deficiency to perceive qualitative change, that is, a change of our subject-object and subject-subject relationships, we are very close to the root of the epidemic that I mentioned in my opening remarks. An example in neurophysiology may help to comprehend the deficiency that now occurs on the cognitive level.

Dysgnosis

The visual receptors in the retina, the cones and the rods, operate optimally only under certain conditions of illumination. Beyond or below this condition we suffer a loss in acuity or in color discrimination. However, in the vertebrate eye the retina almost always operates under these optimal conditions, because of the iris that contracts or dilates so as to admit under changing conditions of brightness the same amount of light to the receptors. Hence, the scenario "seen" by the optic nerve has always the same illumination independent of whether we are in bright sunshine or in a shaded room. How, then, do we know whether it is bright or shady?

The information about this datum resides in the regulator that compares the activity in the optic nerve with the desired standard and causes the iris to contract when the activity is too high, and to dilate when it is too small. Thus, the information of brightness does not come from inspecting the scenario—it appears always to be of similar brightness—it comes from an inspection of the regulator that suppresses the perception of change.

There are subjects who have difficulties in assessing the state of their regulator, and thus they are weak in discriminating different levels of brightness. They are called "dysphotic." They are the opposite of photographers who may be called "photic," for they have a keen sense of brightness discrimination. There are subjects who have difficulties in assessing the regulators that maintain their identity in a changing world. I shall call individuals suffering from this disorder "dysgnostic," for they have no way of knowing themselves. Since this disorder has assumed extraordinary dimensions, it has indeed been recognized at the highest national level.

As you all know, it has been observed that the majority of the American people cannot speak. This is interpreted by saying that they are "silent"; I say they are *mute*. However, as you all know very well, there is nothing wrong with the vocal tract of those who are mute: the cause of their muteness is deafness. Hence, the so-called "silent majority" is *de facto* a "deaf majority."

However, the most distressing thing in this observation is that there is again nothing wrong with their auditory system; they could hear if they wanted to: but they don't want to. Their deafness is voluntary, and in others it is their blindness.

At this point proof will be required for these outrageous propositions. *TIME Magazine* (1970) provides it for me in its study of Middle America.

There is the wife of a Glencoe, Illinois lawyer, who worries about the America in which her four children are growing up: "I want my children to live and grow up in an America as I *knew* it," [note the principle of conservation of rule where the future equals the past] "where we were proud to be citizens of this country. I'm damned sick and tired of *listening* to all this nonsense about how awful America is." [Note voluntary deafness.]

Another example is a newspaper librarian in Pittsfield, Massachusetts, who is angered by student unrest: "Every time I see protestors, I say, 'Look at those creeps.'" [Note reduction of visual acuity.] "But then my 12-year-old son says, 'They're not creeps. They have a perfect right to do what they want.'" [Note the un-adult-erated perceptual faculty in the young.]

The tragedy in these examples is that the victims of "dysgnosis" not only do not know that they don't see, hear, or feel, they also do not want to.

How can we rectify this situation?

Trivialization

I have listed so far several instances of perceptual disorders that block our vision of the future. These symptoms collectively consitute the syndrome of our epidemic disease. It would be the sign of a poor physician if he were to go about relieving the patient of these symptoms one by one, for the elimination of one may aggrevate another. Is there a single common denominator that would identify the root of the entire syndrome?

To this end, let me introduce two concepts, they are the concepts of the "trivial" and the "non-trivial" machine. The term "machine" in this context refers to well-defined functional properties of an abstract entity rather than to an assembly of cogwheels, buttons and levers, although such assemblies may represent embodiments of these abstract functional entities.

A trivial machine is characterized by a one-to-one relationship between its "input" (stimulus, cause) and its "output" (response, effect). This invariable relationship is "the machine." Since this relationship is determined once and for all, this is a deterministic system; and since an output once observed for a given input will be the same for the same input given later, this is also a predictable system.

Non-trivial machines, however, are quite different creatures. Their input-output relationship is not invariant, but is determined by the machine's previous output. In other words, its previous steps determine its present reactions. While these machines are again deterministic systems, for all practical reasons they are unpredictable: an output once observed for a given input will most likely be not the same for the same input given later.

In order to grasp the profound difference between these two kinds of machines it may be helpful to envision "internal states" in these machines. While in the trivial machine only one internal state participates always in its internal operation, in the non-trivial machine it is the shift from one internal state to another that makes it so elusive.

PERCEPTION OF

AGAIN	AIR	APPLE	BRING	CHEESE	COLD
COME	DARK	DOCTOR	EAT	FIND	FOOT
HARD	HOUSE	INVITE	JUMP	LIVE	MILK
NEEDLE	NOW	QUICKLY	SADLY	SAND	SEND
SLEEP	SLOWLY	SOFT	SUFFER	SUGAR	SWEET
TABLE	TAKE	VERY	WATER	WEEP	WHITE

Figure 1. Example of 36 words printed on cards to be classified according to similarity in meaning.

It is, of course, very difficult to prove this point, for nothing less is required than to go inside the head and to exhibit the semantic structure that reflects our mode of perception and thinking. However, there are now new and fascinating experiments from which these semantic structures can be inferred. Let me describe one that demonstrates my point most dramatically.

The method proposed by George Miller (1967) consists of asking independently several subjects to classify on the basis of similarity of meaning a number of words printed on cards (Fig. 1). The subject can form as many classes as he wants, and any number of items can be placed in each class. The data so collected can be represented by a "tree" such that the branchpoints further away from the "root" indicate stronger agreement among the subjects, and hence suggest a measure of similarity in the meaning of the words for this particular group of subjects.

Scientific Method

The scientific method rests on two fundamental pillars:

(i) Rules observed in the past shall apply to the future. This is usually referred to as the principle of conservation of rules, and I have no doubt that you are all familiar with it. The other pillar, however, stands in the shadow of the first and thus is not so clearly visible:

(ii) Almost everything in the universe shall be irrelevant. This is usually referred to as the principle of the necessary and sufficient cause, and what it demands is at once apparent when one realizes that "relevance" is a triadic relation that relates a set of propositions (P_1, P_2, . . .) to another set of propositions (Q_1, Q_2, . . .) in the mind (M) of one who wishes to establish this relation. If P are the causes that are to explain the perceived effects Q, then the principle of necessary and sufficient cause forces us to reduce our perception of effects further and further until we have hit upon the necessary and sufficient cause that produces the desired effect: everything else in the universe shall be irrelevant.

Fig. 2 shows the result of such a "cluster analysis" of the 36 words of Fig. 1 by 20 adult subjects ("root" on the left). Clearly, adults classify according to syntactic categories, putting nouns in one class (bottom tree), adjectives in another (next to bottom tree), then verbs, and finally those little words one does not know how to deal with.

The difference is impressive when the adults' results are compared with the richness of perception and imagery of children in the third and fourth grade when given the same task (Fig. 3). Miller reflects upon these delightful results:

"Children tend to put together words that might be used in talking about the same thing—which cuts right across the tidy syntactic boundaries so important to adults. Thus all twenty of the children agree in putting the verb 'eat' with the noun 'apple'; for many of them 'air' is 'cold'; the 'foot' is used to 'jump'; you 'live' in a 'house'; 'sugar' is 'sweet'; and the cluster of 'doctor,' 'needle,' 'suffer,' 'weep,' and 'sadly' is a small vignette in itself."

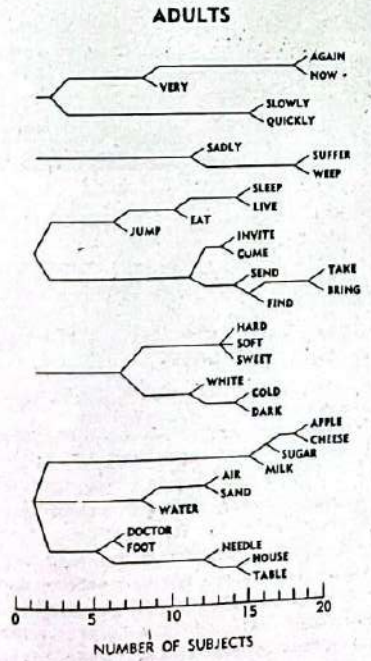

Figure 2. Cluster analysis of the 36 words of Fig. 1 classified by 20 adult subjects. Note that syntactic categories are faithfully respected, while semantic relations are almost completely ignored.

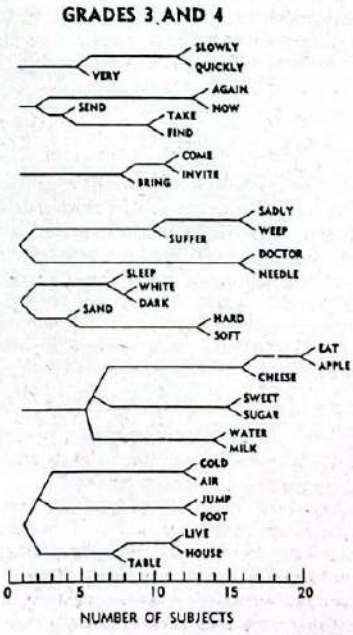

Figure 3. The same 36 words of Figs. 1 and 2 classified by children in the third and fourth grade. Note the emergence of meaningful cognitive units, while syntactic categories are almost completely ignored.

THE FUTURE
THE FUTURE OF PERCEPTION

One may interpret this distinction as the Twentieth Century version of Aristotle's distinction of explanatory frameworks for inanimate matter and living organisms.

All machines we construct and buy are, hopefully, trivial machines. A toaster should toast, a washing machine wash, a motorcar should predictably respond to its driver's operations. In fact, all our efforts go into one direction, to create trivial machines or, if we encounter non-trivial machines, to convert them into trivial machines. The discovery of agriculture is the discovery that some aspects of Nature can be trivialized: If I till today, I shall have bread tomorrow.

Granted, that in some instances we may be not completely successful in producing ideally trivial machines. For example, one morning turning the starter key to our car, the beast does not start. Apparently it changed its internal state, obscure to us, as a consequence of previous outputs (it may have exhausted its gasoline supply) and revealed for a moment its true nature of being a non-trivial machine. But this is, of course, outrageous and this state of affairs should be remedied at once.

While our pre-occupation with the trivialization of our environment may be in one domain useful and constructive, in another domain it is useless and destructive. Trivialization is a dangerous panacea when man applies it to himself.

Consider, for instance, the way our system of education is set up. The student enters school as an unpredictable "non-trivial machine." We don't know what answer he will give to a question. However, should he succeed in this system the answers he gives to our questions must be known. They are the "right" answers:

Q: "When was Napoleon born?"
A: "1769"
Right!
Student → Student
but
Q: "When was Napoleon born?"
A: Seven years before the Declaration of Independence."
Wrong!
Student → Non-student

Tests are devices to establish a measure of trivialization. A perfect score in a test is indicative of perfect trivialization: the student is completely predictable and thus can be admitted into society. He will cause neither any surprises nor any trouble.

Future

I shall call a question to which the answer is known an "illegitimate question." Wouldn't it be fascinating to contemplate an educational system that would ask of its students to answer "legitimate questions" that is questions to which the answers are unknown (H. Brün in a personal communication). Would it not be even more fascinating to conceive of a society that would establish such an educational system? The necessary condition for such an utopia is that its members perceive one another as autonomous, non-trivial beings. Such a society shall make, I predict, some of the most astounding discoveries. Just for the record, I shall list the following three:

1. "Education is neither a right nor a privilege: it is a necessity."
2. "Education is learning to ask legitimate questions."

A society who has made these two discoveries will ultimately be able to discover the third and most utopian one:

3. "A is better off when B is better off."

From where we stand now, anyone who seriously makes just one of those three propositions is bound to get into trouble. Maybe you remember the story Ivan Karamazov makes up in order to intellectually needle his younger brother Alyosha. The story is that of the Great Inquisitor. As you recall, the Great Inquisitor walks on a very pleasant afternoon through his town. I believe it is Salamanca; he is in good spirits. In the morning he has burned at the stakes about a hundred and twenty heretics, he has done a good job, everything is fine. Suddenly there is a crowd of people in front of him, he moves closer to see what's going on, and he sees a stranger who is putting his hand onto a lame person, and that lame one can walk. Then a blind girl is brought before him, the stranger is putting his hand on her eyes, and she can see. The Great Inquisitor knows immediately who He is, and he says to his henchmen: "Arrest this man." They jump and arrest this man and put Him into jail. In the night the Great Inquisitor visits the stranger in his cell and he says: "Look, I know who You are, troublemaker. It took us one thousand and five hundred years to straighten out the troubles you have sown. You know very well that people can't make decisions by themselves. You know very well people can't be free. *We* have to make their decisions. *We* tell them who they are to be. You know that very well. Therefore, I shall burn You at the stakes tomorrow." The stranger stands up, embraces the Great Inquisitor and kisses him. The Great Inquisitor walks out, but, as he leaves the cell, he does not close the door, and the stranger disappears in the darkness of the night.

Let us remember this story when we meet those troublemakers, and let us keep the door open for them. We shall recognize them by an act of creation:

"Let there be vision: and there was light."

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Reply card

1. I would like more information about _____ game
_____ article
Dr. _____

2. I found _____ irritating.

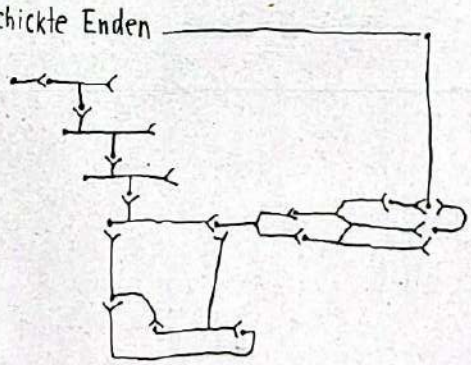
3. I would like _____ to have been included.

4. I would like to enroll in a class that would work on this type of book ☐ yes ☐ no

5. I want the contents of this book to be transmitted by a global network of Lazer beams and imprinted on eyelids everywhere ☐ yes ☐ no

6. This book needs changes with respect to _____
_____.

7. Wie soll diese Geschickte Enden _____



Left-handed comments

↓↓↓

* I would like _____
☆ more copies and
✡ have enclosed $_____.

Under-handed comments

8. Frankly, my dear, I don't give a damn ☐

-flap-

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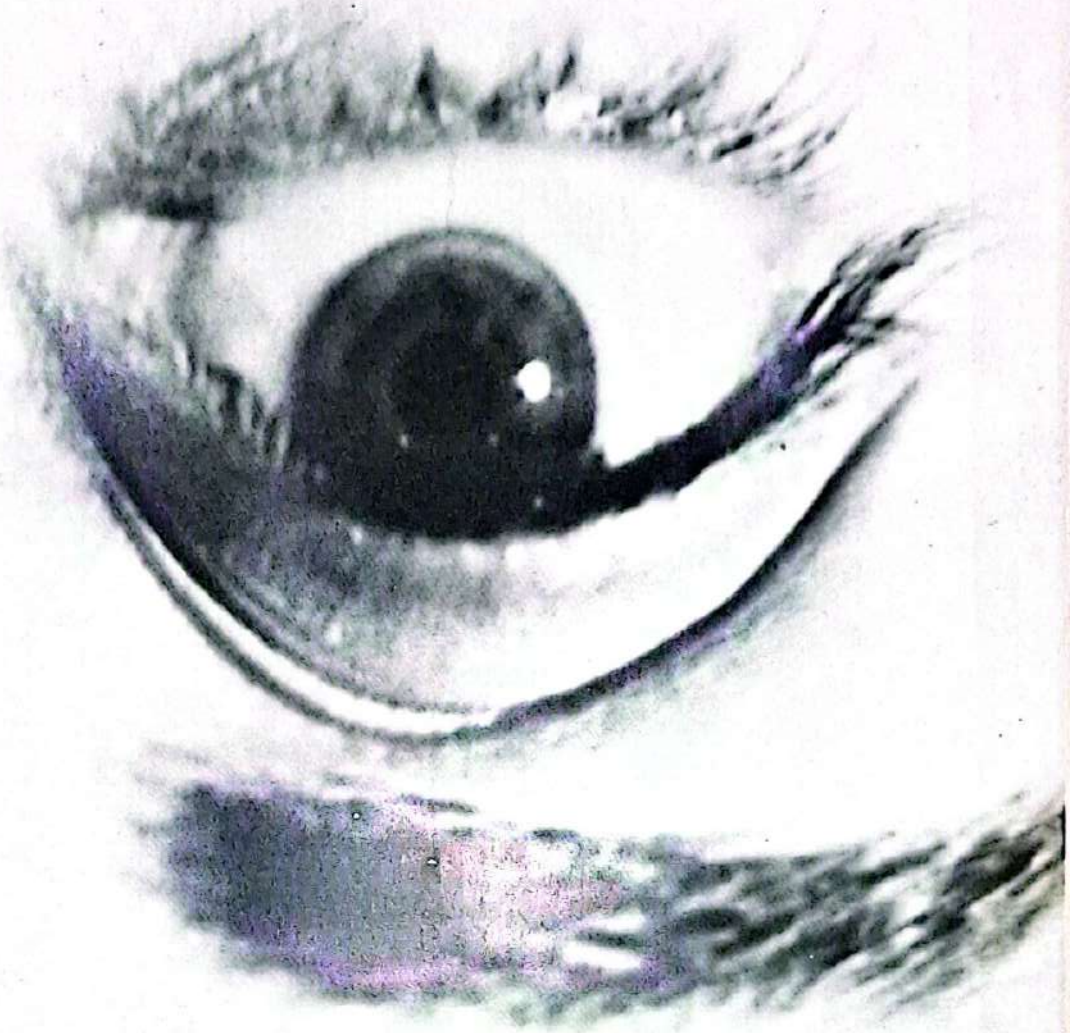
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