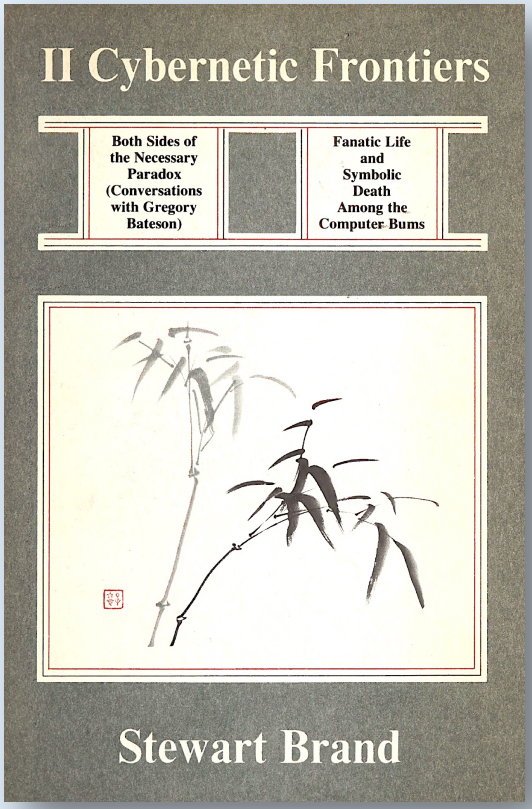
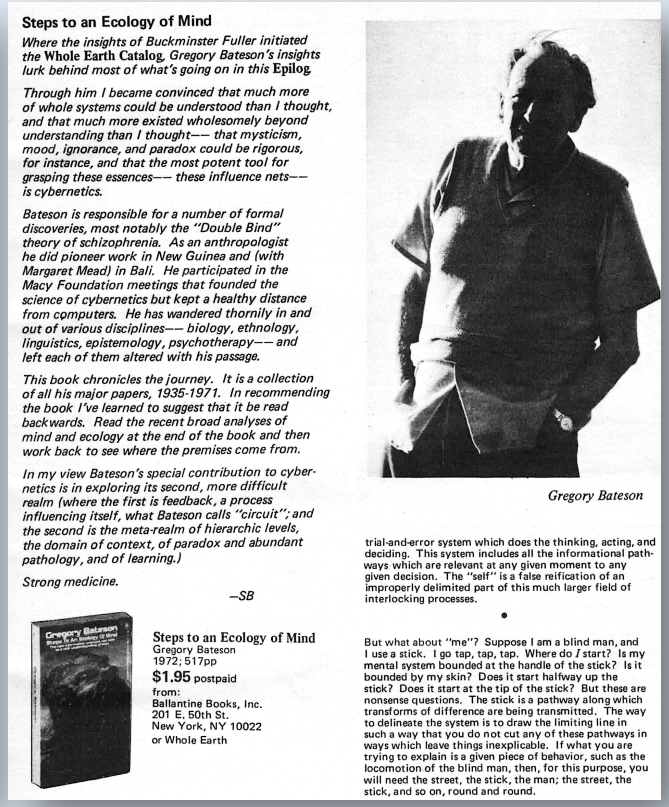
CYBERNETIC COUNTERCULTURES INTENSIVE

Week 4. Ecology of Mind: Gregory Bateson

Bruno Clarke
brunoclarke@gmail.com





Steps to an Ecology of Mind

Where the insights of Buckminster Fuller initiated the **Whole Earth Catalog**, *Gregory Bateson's insights lurk behind most of what's going on in this* **Epilog**.

Through him I became convinced that much more of whole systems could be understood than I thought, and that much more existed wholesomely beyond understanding than I thought—— that mysticism, mood, ignorance, and paradox could be rigorous, for instance, and that the most potent tool for grasping these essences—— these influence nets—— is cybernetics.

Bateson is responsible for a number of formal discoveries, most notably the "Double Bind" theory of schizophrenia. As an anthropologist he did pioneer work in New Guinea and (with Margaret Mead) in Bali. He participated in the Macy Foundation meetings that founded the science of cybernetics but kept a healthy distance from computers. He has wandered thornily in and out of various disciplines—— biology, ethnology, linguistics, epistemology, psychotherapy—— and left each of them altered with his passage.

This book chronicles the journey. It is a collection of all his major papers, 1935-1971. In recommending the book I've learned to suggest that it be read backwards. Read the recent broad analyses of mind and ecology at the end of the book and then work back to see where the premises come from.

In my view Bateson's special contribution to cybernetics is in exploring its second, more difficult realm (where the first is feedback, a process influencing itself, what Bateson calls "circuit"; and the second is the meta-realm of hierarchic levels, the domain of context, of paradox and abundant pathology, and of learning.)

Strong medicine.

—SB

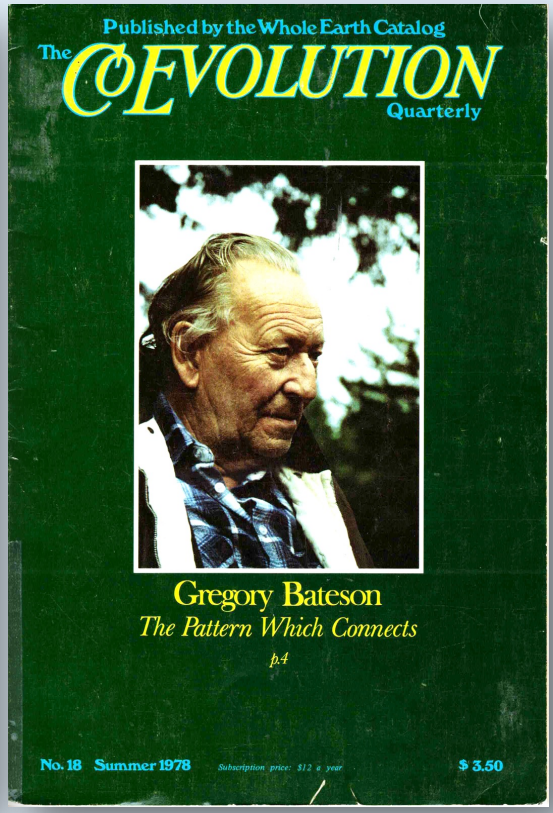
Steps to an Ecology of Mind
Gregory Bateson
1972; 517pp
$1.95 postpaid
from:
Ballantine Books, Inc.
201 E. 50th St.
New York, NY 10022
or Whole Earth

Gregory Bateson

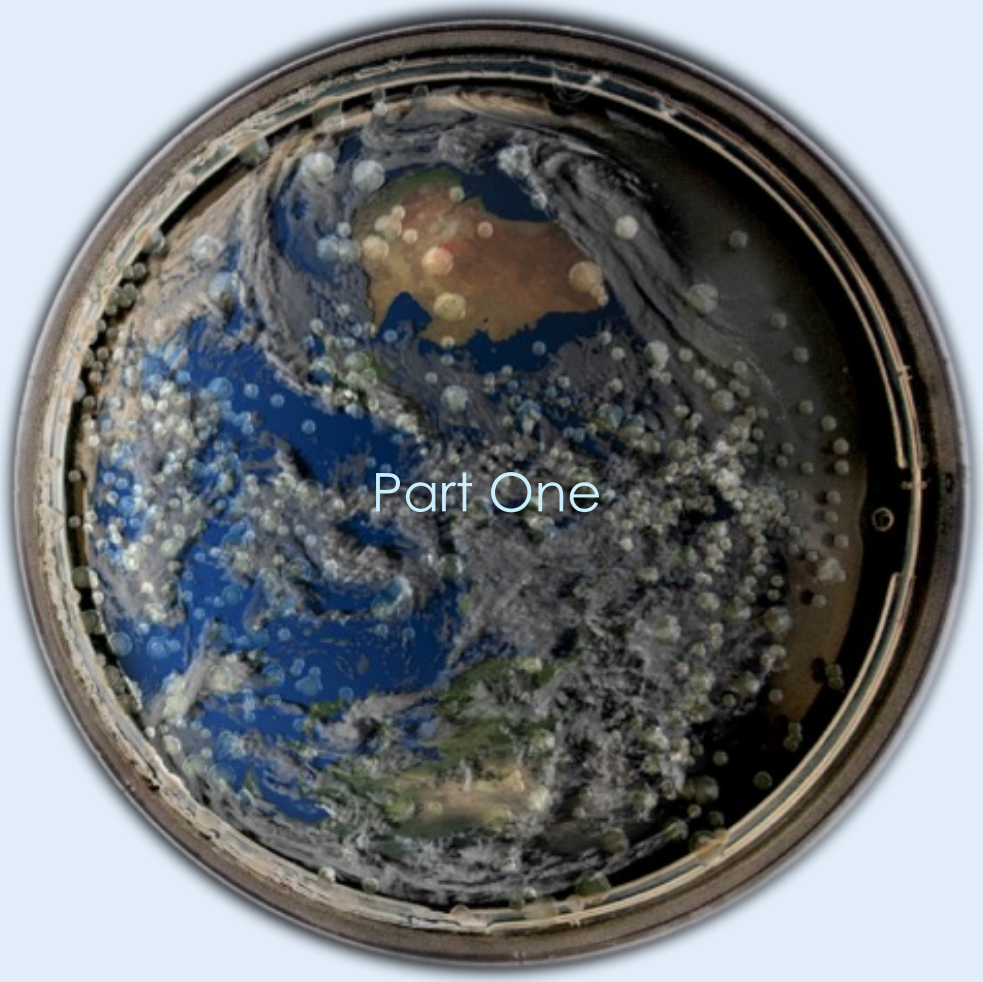
trial-and-error system which does the thinking, acting, and deciding. This system includes all the informational pathways which are relevant at any given moment to any given decision. The "self" is a false reification of an improperly delimited part of this much larger field of interlocking processes.

•

But what about "me"? Suppose I am a blind man, and I use a stick. I go tap, tap, tap. Where do *I* start? Is my mental system bounded at the handle of the stick? Is it bounded by my skin? Does it start halfway up the stick? Does it start at the tip of the stick? But these are nonsense questions. The stick is a pathway along which transforms of difference are being transmitted. The way to delineate the system is to draw the limiting line in such a way that you do not cut any of these pathways in ways which leave things inexplicable. If what you are trying to explain is a given piece of behavior, such as the locomotion of the blind man, then, for this purpose, you will need the street, the stick, the man; the street, the stick, and so on, round and round.



CYBERNETIC COUNTERCULTURES INTENSIVE

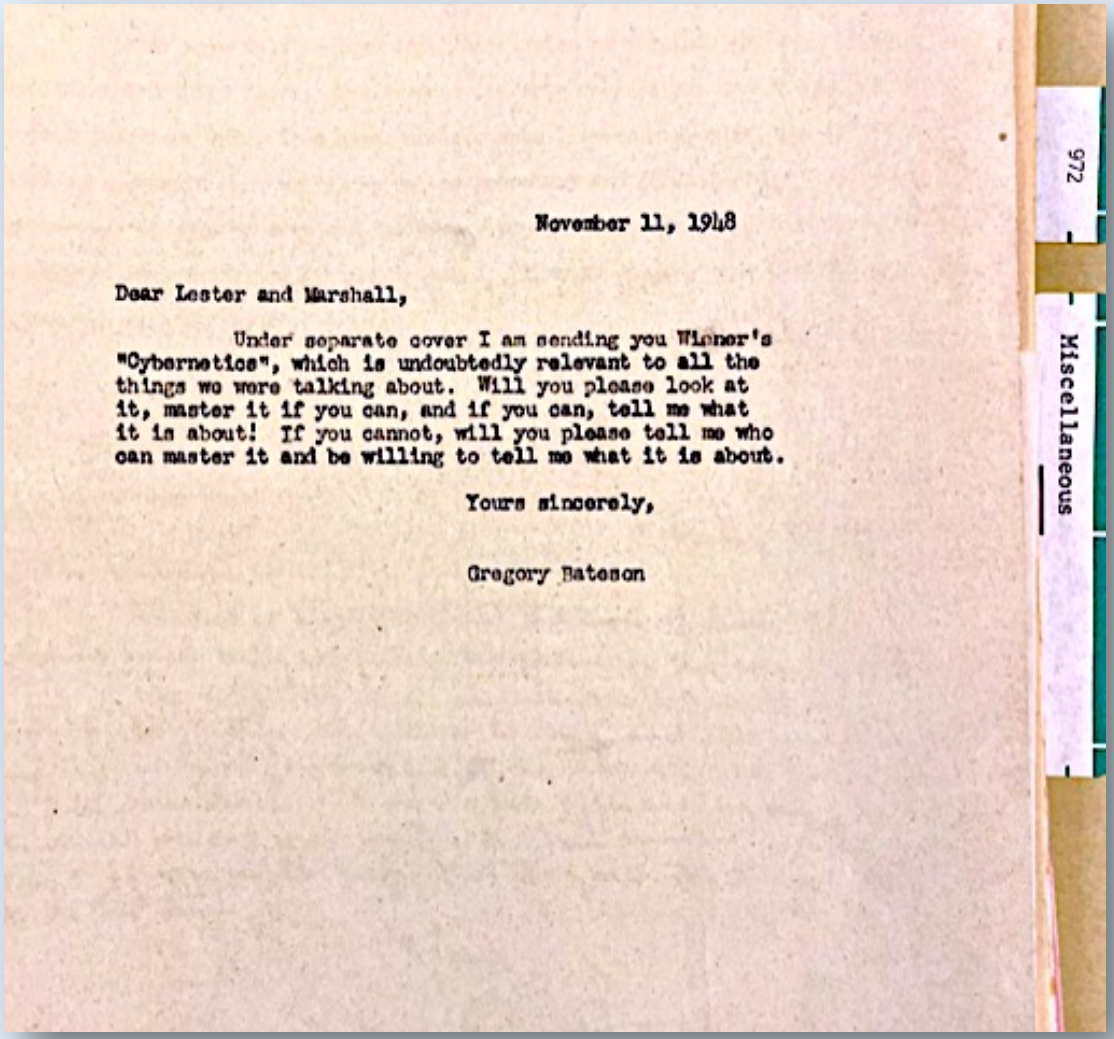


A Cybernetics of Relationship

Bruno Clarke
brunoclarke@gmail.com

—from the Bateson archive, University of California/Santa Cruz.

The identities of Lester and Marshall have not been established.



November 11, 1948

Dear Lester and Marshall,

Under separate cover I am sending you Wiener's "Cybernetics", which is undoubtedly relevant to all the things we were talking about. Will you please look at it, master it if you can, and if you can, tell me what it is about! If you cannot, will you please tell me who can master it and be willing to tell me what it is about.

Yours sincerely,

Gregory Bateson

972
Miscellaneous

. . . I am sending you Wiener's "Cybernetics," which is undoubtedly relevant to all the things we were talking about. Will you please look at it, master it if you can, and if you can, tell me what it is about! If you cannot, will you please tell me who can master it and be willing to tell me what it is about.

—A typical page of Wiener's *Cybernetics*

the multiplication of each transformation by a fixed one of its transformations, either $\alpha(T)$ is always 1, or this average is invariant when multiplied by some number not 1, and must be 0. From this it may be concluded that the average of the product of any character by its conjugate (which will also be a character) will have the value 1, and that the average of the product of any character by the conjugate of another character will have the value 0. In other words, if we can express $h(x)$ as in Eq. 2.04, we shall have

$$A_k = \text{average}\,[h(x)\overline{f_k(x)}] \tag{2.09}$$

In the case of the group of rotations on a circle, this gives us directly that if

$$f(x) = \sum a_n e^{inx} \tag{2.10}$$

then

$$a_n = \frac{1}{2\pi}\int_0^{2\pi} f(x)e^{-inx}\,dx \tag{2.11}$$

and the result for translations along the infinite line is closely related to the fact that if in an appropriate sense

$$f(x) = \int_{-\infty}^{\infty} a(\lambda)e^{i\lambda x}\,d\lambda \tag{2.12}$$

then in a certain sense

$$a(\lambda) = \frac{1}{2\pi}\int_{-\infty}^{\infty} f(x)e^{-i\lambda x}\,dx \tag{2.13}$$

These results have been stated here very roughly and without a clear statement of their conditions of validity. For more precise statements of the theory, the reader should consult the following reference.[1]

Beside the theory of the linear invariants of a group, there is also the general theory of its metrical invariants. These are the systems of Lebesgue measure which do not undergo any change when the objects transformed by the group are permuted by the operators of the group. In this connection, we should cite the interesting theory of group measure, due to Haar.[2] As we have seen, every group itself is a collection of objects which are permuted by being multiplied by the operations of the group itself. As such, it may have an invariant measure. Haar has proved that a certain rather wide class of

[1] Wiener, N., *The Fourier Integral and Certain of Its Applications*, The University Press, Cambridge, England, 1933; Dover Publications, Inc., N.Y.

[2] Haar, H., "Der Massbegriff in der Theorie der Kontinuierlichen Gruppen." *Ann. of Math.*, Ser. 2, **34**, 147–169 (1933).

groups does possess a uniquely determined invariant measure, definable in terms of the structure of the group itself.

The most important application of the theory of the metrical invariants of a group of transformations is to show the justification of that interchangeability of phase averages and time averages which, as we have already seen, Gibbs tried in vain to establish. The basis on which this has been accomplished is known as the ergodic theory.

The ordinary ergodic theorems start with an ensemble E, which we can take to be of measure 1, transformed into itself by a measure-preserving transformation T or by a group of measure-preserving transformations T^λ, where $-\infty < \lambda < \infty$ and where

$$T^\lambda \cdot T^\mu = T^{\lambda+\mu} \tag{2.14}$$

Ergodic theory concerns itself with complex-valued functions $f(x)$ of the elements x of E. In all cases, $f(x)$ is taken to be measurable in x, and if we are concerned with a continuous group of transformations, $f(T^\lambda x)$ is taken to be measurable in x and λ simultaneously.

In the mean ergodic theorem of Koopman and von Neumann, $f(x)$ is taken to be of class L^2; that is,

$$\int_E |f(x)|^2\,dx < \infty \tag{2.15}$$

The theorem then asserts that

$$f_N(x) = \frac{1}{N+1}\sum_{n=0}^{N} f(T^n x) \tag{2.16}$$

or

$$f_A(x) = \frac{1}{A}\int_0^A f(T^\lambda x)\,d\lambda \tag{2.17}$$

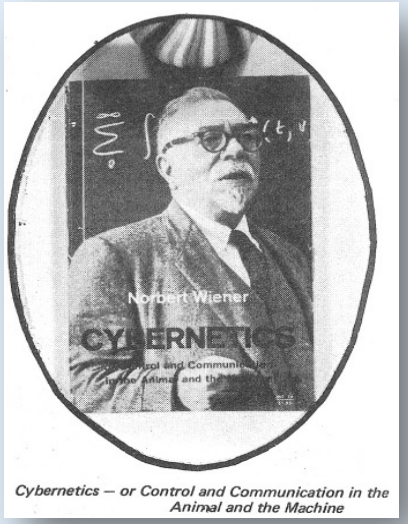
as the case may be, converges in the mean to a limit $f^*(x)$ as $N \to \infty$ or $A \to \infty$, respectively, in the sense that

$$\lim_{N\to\infty}\int_E |f^*(x) - f_N(x)|^2\,dx = 0 \tag{2.18}$$

$$\lim_{A\to\infty}\int_E |f^*(x) - f_A(x)|^2\,dx = 0 \tag{2.19}$$

In the "almost everywhere" ergodic theorem of Birkhoff, $f(x)$ is taken to be of class L: which means that

$$\int_E |f(x)|\,dx < \infty \tag{2.20}$$



Cybernetics — or Control and Communication in the Animal and the Machine

—Norbert Wiener, *Cybernetics or Control and Communication in the Animal and the Machine*, 2nd ed. (Cambridge: MIT Press 1948; 1961).

Preface to the Second Edition

. . . It is certainly true that the social system is an organization like the individual, that it is bound together by a system of communication, and that it has a dynamics in which circular processes of a feedback nature play an important part. . . . On this basis, Drs. Gregory Bateson and Margaret Mead have urged me. . . to devote a large part of my energies to the discussion of this side of cybernetics.

Much as I sympathize with their sense of the urgency of the situation, . . . I can share neither their feeling that this field has the first claim on my attention, nor their hopefulness that sufficient progress can be registered in this direction to have an appreciable therapeutic effect in the present diseases of society.

> BC] Wiener explained that his immediate reluctance concerned his sense of the difficulty of submitting social systems to cybernetic modes of mathematical analysis.
>
> **—Wiener's reservations notwithstanding, both Bateson and Mead would devote their life's work thereafter to developing cybernetic descriptions of natural systems, including societies—and in Bateson's case, the environment at large—and cybernetic prescriptions for their collective ailments.**

Some Bateson biography

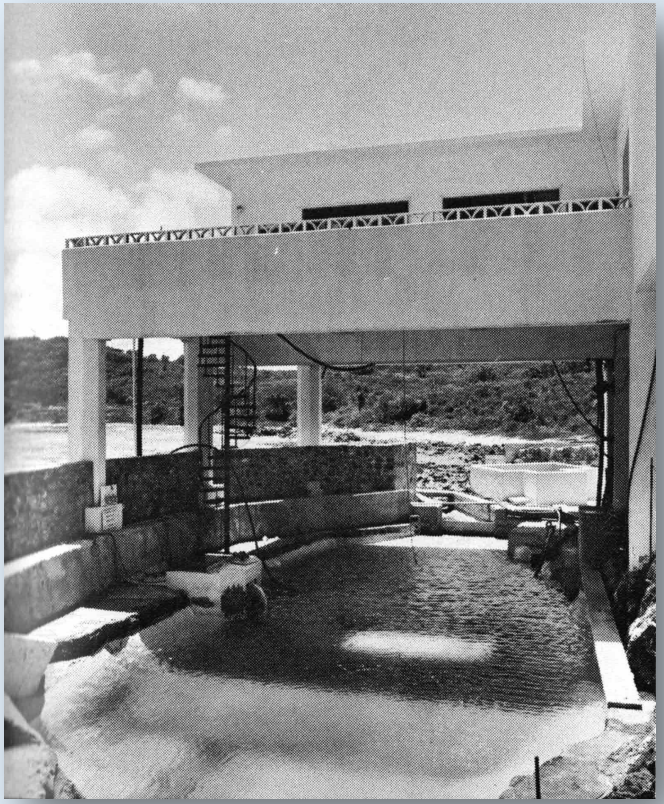
Throughout the 1950s, Bateson resided in Palo Alto employed at the Veterans Administration hospital. He obtained grants to fund working groups to study his concept of the Double Bind as a framework for understanding the "paradoxes of abstraction in communication" and "the symptomatic behaviors of schizophrenic patients."*

*Anthony Chaney, *Runaway: Gregory Bateson, the Double Bind, and the Rise of Ecological Consciousness* (University of North Carolina Press, 2017).

By albert kok - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=2795257

*Phillip Guddemi, *Gregory Bateson on Relational Communication: From Octopuses to Nations*, Biosemiotics 20 (Springer Nature 2020).

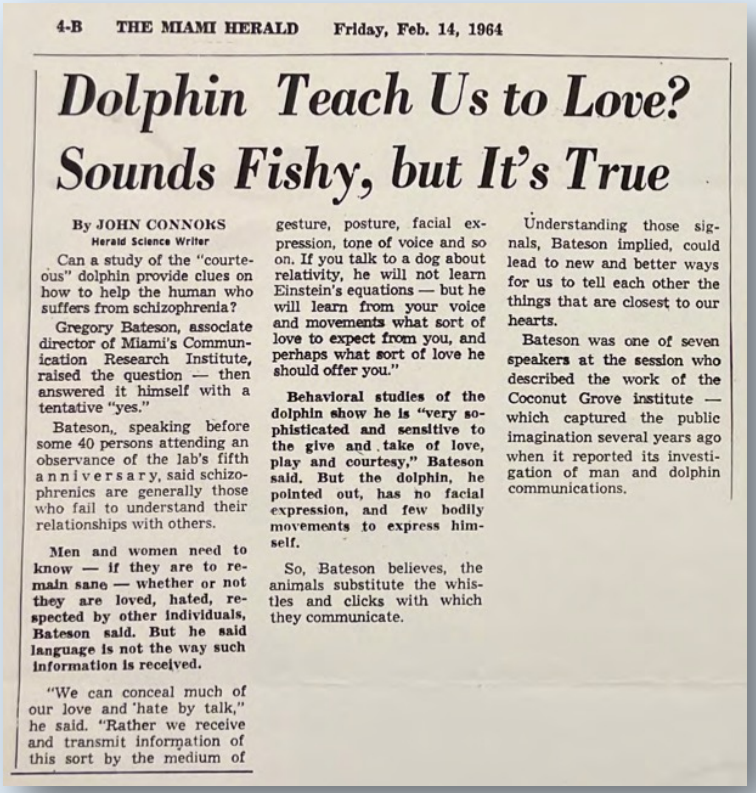
"Over a period of half a decade or longer, Gregory Bateson, on his own (with help from his immediate family), collected and studied octopus to observe their interactions. He began working on octopus while he was working in California on schizophrenia, using tanks located at the Veterans Hospital (in the morgue!) and then at his home, beginning around 1958 or 1959. Later he continued his octopus work while working on dolphin communication with John Lilly in 1963–64."*



—The Communication Research Institute (CRI) Dolphin Point Laboratory, St. Thomas, U.S. Virgin Islands. Reporting to John Lilly, Bateson directed its operations for 18 months between 1963-64.

—Photographs from John Cunningham Lilly, M.D., *The Mind of the Dolphin: A Nonhuman Intelligence* (Doubleday, 1967).

BC] A newspaper article on Bateson's remarks about his work at the CRI captures an appealing impression of his cybernetic thinking about the significance of communication in the context of family systems and community relationships. He explores the kinds of social bonds that many other living beings share with us, bonds upon which our most meaningful interactions are also commonly focused.



4-B THE MIAMI HERALD Friday, Feb. 14, 1964

Dolphin Teach Us to Love? Sounds Fishy, but It's True

By JOHN CONNOKS
Herald Science Writer

Can a study of the "courteous" dolphin provide clues on how to help the human who suffers from schizophrenia?

Gregory Bateson, associate director of Miami's Communication Research Institute, raised the question — then answered it himself with a tentative "yes."

Bateson,, speaking before some 40 persons attending an observance of the lab's fifth anniversary, said schizophrenics are generally those who fail to understand their relationships with others.

Men and women need to know — if they are to remain sane — whether or not they are loved, hated, respected by other individuals, Bateson said. But he said language is not the way such information is received.

"We can conceal much of our love and hate by talk," he said. "Rather we receive and transmit information of this sort by the medium of gesture, posture, facial expression, tone of voice and so on. If you talk to a dog about relativity, he will not learn Einstein's equations — but he will learn from your voice and movements what sort of love to expect from you, and perhaps what sort of love he should offer you."

Behavioral studies of the dolphin show he is "very sophisticated and sensitive to the give and take of love, play and courtesy," Bateson said. But the dolphin, he pointed out, has no facial expression, and few bodily movements to express himself.

So, Bateson believes, the animals substitute the whistles and clicks with which they communicate.

Understanding those signals, Bateson implied, could lead to new and better ways for us to tell each other the things that are closest to our hearts.

Bateson was one of seven speakers at the session who described the work of the Coconut Grove institute — which captured the public imagination several years ago when it reported its investigation of man and dolphin communications.

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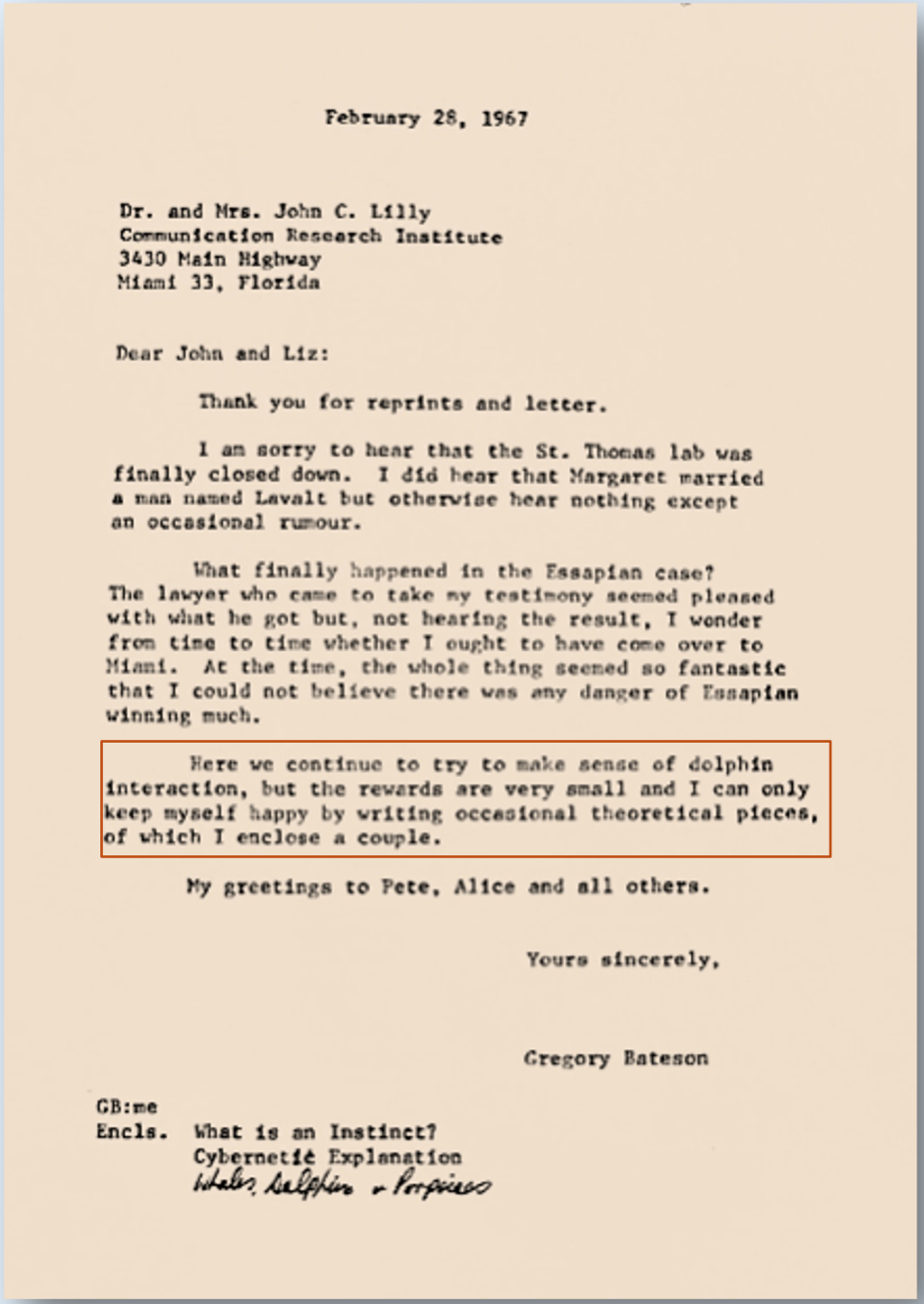


February 28, 1967

Dr. and Mrs. John C. Lilly
Communication Research Institute
3430 Main Highway
Miami 33, Florida

Dear John and Liz:

Thank you for reprints and letter.

I am sorry to hear that the St. Thomas lab was finally closed down. I did hear that Margaret married a man named Lavalt but otherwise hear nothing except an occasional rumour.

What finally happened in the Essapian case? The lawyer who came to take my testimony seemed pleased with what he got but, not hearing the result, I wonder from time to time whether I ought to have come over to Miami. At the time, the whole thing seemed so fantastic that I could not believe there was any danger of Essapian winning much.

Here we continue to try to make sense of dolphin interaction, but the rewards are very small and I can only keep myself happy by writing occasional theoretical pieces, of which I enclose a couple.

My greetings to Pete, Alice and all others.

Yours sincerely,

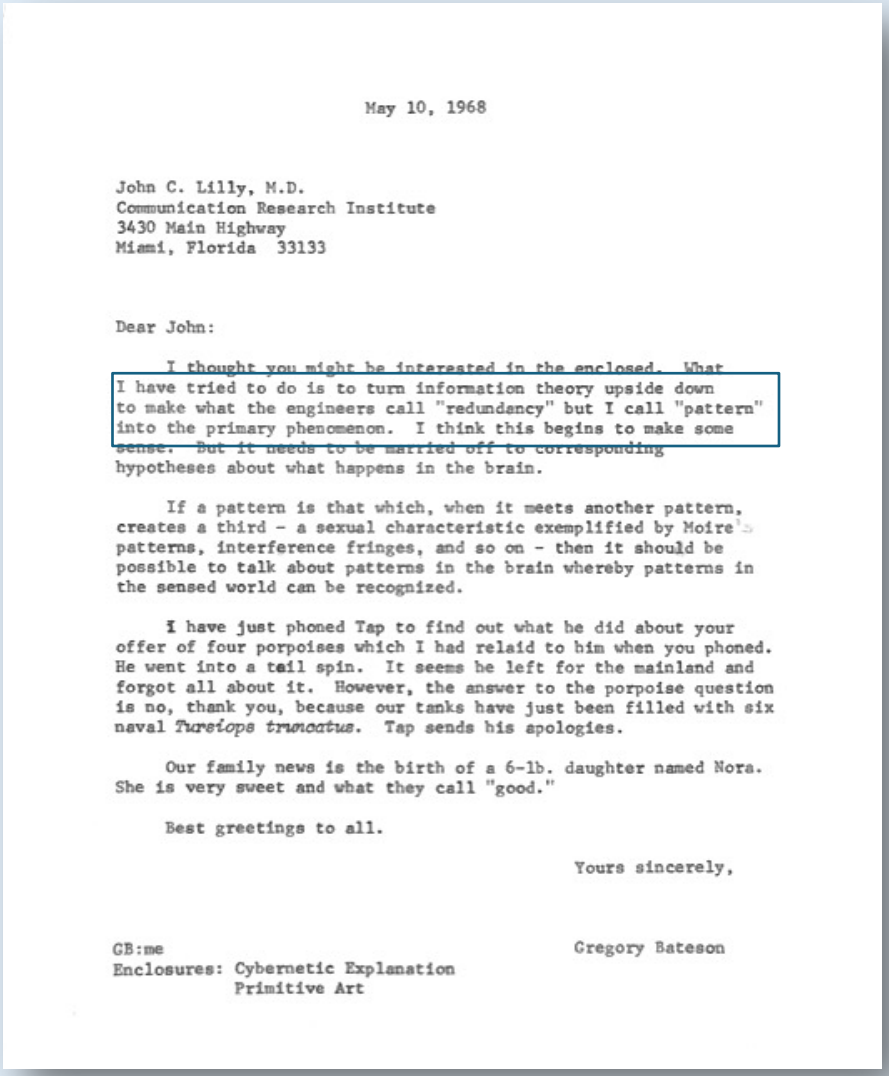
Gregory Bateson

GB:me
Encls. What is an Instinct?
Cybernetic Explanation
Whales, Dolphins & Porpoises

—Bateson's professional life was often nomadic. His time at Lilly's St. Thomas facility was also self-funded by his own grants. When those ran out, he reestablished his research program at Hawaii's Oceanic Institute. In this letter from 1967, Bateson writes to commiserate with Lilly over the shuttering of his St. Thomas lab. Bateson admits to some discouragement with his own dolphin research, for which he compensated by composing a crucial run of consummate "theoretical pieces" that would soon be collected in *Steps to an Ecology of Mind*.

". . . Here we continue to try to make sense of dolphin interaction, but the rewards are very small and I can only keep myself happy by writing occasional theoretical pieces, of which I enclose a couple. . . ."

Encls. What is an Instinct? [*Steps* 38-58]
Cybernetic Explanation [*Steps* 399-410]
Whales, Dolphins & Porpoises [*Steps* 364-78]



May 10, 1968

John C. Lilly, M.D.
Communication Research Institute
3430 Main Highway
Miami, Florida 33133

Dear John:

I thought you might be interested in the enclosed. What I have tried to do is to turn information theory upside down to make what the engineers call "redundancy" but I call "pattern" into the primary phenomenon. I think this begins to make some sense. But it needs to be married off to corresponding hypotheses about what happens in the brain.

If a pattern is that which, when it meets another pattern, creates a third - a sexual characteristic exemplified by Moire patterns, interference fringes, and so on - then it should be possible to talk about patterns in the brain whereby patterns in the sensed world can be recognized.

I have just phoned Tap to find out what he did about your offer of four porpoises which I had relaid to him when you phoned. He went into a tail spin. It seems he left for the mainland and forgot all about it. However, the answer to the porpoise question is no, thank you, because our tanks have just been filled with six naval *Tursiops truncatus*. Tap sends his apologies.

Our family news is the birth of a 6-lb. daughter named Nora. She is very sweet and what they call "good."

Best greetings to all.

Yours sincerely,

Gregory Bateson

GB:me
Enclosures: Cybernetic Explanation
Primitive Art

—And in another letter to Lilly a year later: "What I have tried to do is to turn information theory upside down to make what the engineers call 'redundancy' but I call 'pattern' into the primary phenomenon."

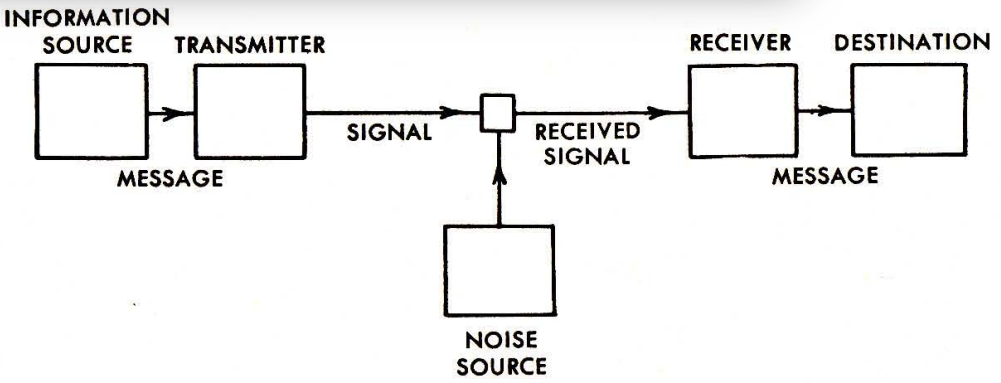
(Bateson's "family news": the birth of Nora Bateson, whose Warm Data Lab training Jonn recently completed.)

An Information Theory Primer

—Claude Shannon and Warren Weaver's *The Mathematical Theory of Communication* (University of Illinois Press, 1949), is considered the definitive general introduction to information theory.

2.1. A Communication System and Its Problems

The communication system considered may be symbolically represented as follows:



The *information source* selects a desired *message* out of a set of possible messages (this is a particularly important remark, which requires considerable explanation later). The selected message may consist of written or spoken words, or of pictures, music, etc.

The *transmitter* changes this *message* into the *signal* which is actually sent over the *communication channel* from the transmitter to the *receiver*. In the case of telephony, the channel is a wire, the signal a varying electrical current on this wire; the transmitter is the set of devices (telephone transmitter, etc.) which change the sound pressure of the voice into the varying electrical current. In telegraphy, the transmitter codes written words into sequences of interrupted currents of varying lengths (dots, dashes, spaces). In oral speech, the information source is the brain, the transmitter is the voice mechanism producing the varying sound pressure (the signal) which is transmitted through the air (the channel). In radio, the channel is simply space (or the aether, if any one still prefers that antiquated and misleading word), and the signal is the electromagnetic wave which is transmitted.

The *receiver* is a sort of inverse transmitter, changing the transmitted signal back into a message, and handing this message on to the destination. When I talk to you, my brain is the information source, yours the destination; my vocal system is the transmitter, and your ear and the associated eighth nerve is the receiver.

Order, Probability, Measurement

—from Norbert Wiener, "What is Cybernetics?" in *The Human Use of Human Beings* (1950):

The problem of measuring the amount of information was of a piece with the related problem of the measurement of the regularity and irregularity of a pattern. . . . The irregular is always commoner than the regular. Therefore, whatever definition of information and its measure we shall introduce must be something which grows when the *a priori* probability of a pattern or a time series diminishes.

BC] Information can also be measured from *set* and *selection*:

—from Claude Shannon and Warren Weaver, *The Mathematical Theory of Communication* (1949):

Information is a measure of one's freedom of choice when one selects a message. . . . The amount of information is defined, in the simplest cases, to be measured by the logarithm of the number of available choices. . . .

In the physical sciences, the entropy associated with a situation is a measure of the degree of randomness, or of "shuffledness."

BC] Note that, when defined in terms of message probabilities, "information" *can* be measured. But this quantification is an engineering matter detached from the *significance* of the message.

In contrast, there is no specific measurement for *meaning*, which, as Bateson will note, "depends on where you sit."

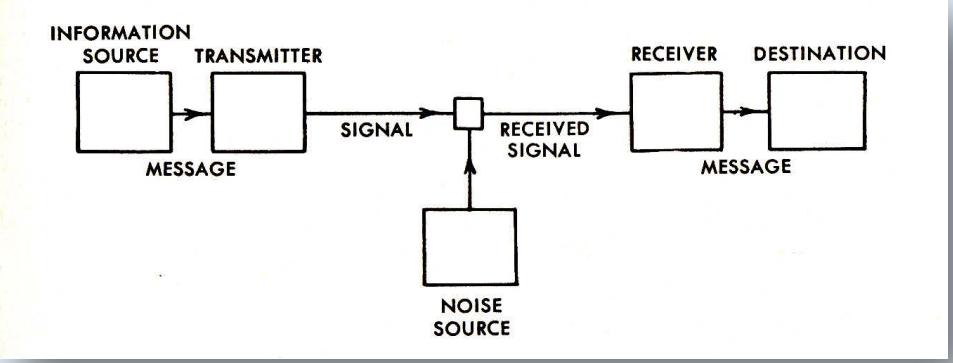
"Most commonly, a **time series** is a sequence taken at successive equally spaced points in time. Thus it is a sequence of discrete-time data. Examples of time series are heights of ocean tides, counts of sunspots, and the daily closing value of the Dow Jones Industrial Average." (*Wikipedia*)

Thermodynamics and Information Theory

—Wiener, "What is Cybernetics?":

This range of ideas [regarding order and randomness] was already familiar in the branch of physics known as statistical mechanics, and which was associated with the famous second law of thermodynamics, which asserts that a [physical] system may lose order and regularity spontaneously, but that it practically never gains it. . . . The notion of information has proved to be subject to a similar law—that is, a message can lose order spontaneously in the act of transmission, but cannot gain it.

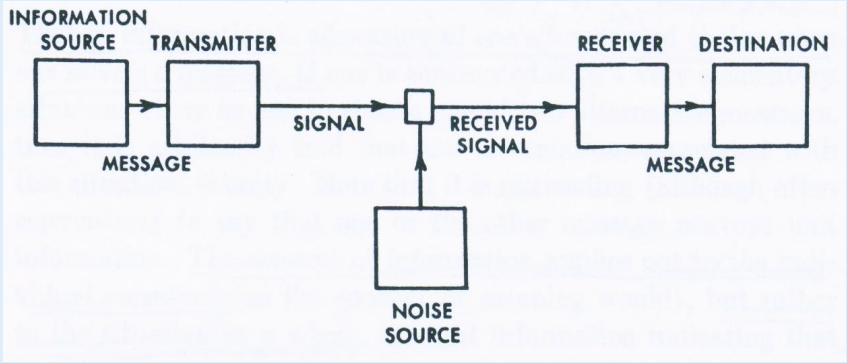
—On statistical mechanics, see Ludwig Boltzmann



Noise and Redundancy

—Shannon and Weaver, *The Mathematical Theory of Communication*:

[***Noise*** occurs when] certain things are added to the signal which were not intended by the information source. . . . [However,] When there is **noise** on a channel . . . there is some real advantage in not using a coding process that eliminates all of the **redundancy**. For the remaining redundancy helps combat the noise.



The **redundancy** . . . is the fraction of the structure of the message which is determined not by the free choice of the sender, but rather by the accepted statistical rules governing the use of symbols in question. . . That is to say, this fraction of the message is unnecessary (and hence repetitive or redundant) in the sense that if it were missing the message would still be essentially complete, or at least could be completed. [For instance,] the redundancy of English is just about 50 per cent, so that about half of the letters or words we choose in writing or speaking are under our free choice, and about half . . . are really controlled by the statistical structure of the language.

H rdndnc f nglsh s js b 50 pr cn, s h b hlf f h lrs r wrds w chs n wrng r spkng r ndr r fr chc, nd b hlf . . . r rll cnrlld b h sscl srcr f h lngg.

Information Theory Upside Down

—BC: Now let's look at the ways that Bateson brings key information-theoretical concepts into his own system of thought. Recall that he told Lilly, "What I have tried to do is to turn information theory upside down to make what the engineers call 'redundancy' but I call 'pattern' into the primary phenomenon."

Viewed at wide angle, **Bateson transformed information theory through his cybernetic focus on relationship rather than control.**

First, in "Cybernetic Explanation," Bateson redefines *redundancy*, converting what in Shannon and Weaver is a secondary matter of signal formation into a primary matter concerning *relationship* between the sender and the receiver.

- He inverts the engineering emphasis on transmission by concentrating instead on reception, response, and observation.

- He embeds messages within a potentially infinite play of contexts.

Next, in "Form, Substance, and Difference," Bateson naturalizes information theory by redefining its fundamental unit not simply as a mathematical or statistical entity, a transmissible digital bit, but as a "difference that makes a difference," in whatever medium that may be conveyed.

—Bateson, "Cybernetic Explanation" (1967), in *Steps to an Ecology of Mind*

The subject matter of cybernetics is the propositional or informational aspect of the events and objects in the natural world.

> —BC: For Bateson, the object of cybernetics is not things in themselves but the cognitive matters of their systemic uptake—the ways in which they are sensed, perceived, coded, and relayed within mental and communicative processes.

Of special interest . . . is the relationship between context and its content. A phoneme exists as such only in combination with other phonemes which make up a word. The word is the context of the phoneme. But the word only exists as such—only has "meaning"—in the larger context of the utterance, which again has meaning only in a relationship. This hierarchy of contexts within contexts is universal for the communicational (or "emic") aspect of phenomena and drives the scientist always to seek for information in the ever larger units. It may (perhaps) be true in physics that the explanation of the macroscopic is to be sought in the microscopic. The opposite is usually true in cybernetics: without context, there is no communication. . . .

> —BC: Or again, physics may well proceed through reduction of wholes to parts, but cybernetic explanation seeks always to place parts and wholes into more encompassing wholes.

> **And in the immediate situation, however elaborate the technological apparatus may be, the context of communication is two or more living beings establishing or maintaining a relationship.**

—Bateson, “Cybernetic Explanation” (1967), continued:

We might regard pattern or predictability as the very essence and *raison d'être* of communication . . .

The idea that communication *is* the creation of redundancy or patterning can be applied to the simplest engineering examples. Let us consider an *observer* who is watching A send a message to B. The purpose to the transaction (from the point of view of A and B) is to create in B's message pad a sequence of letters identical to the sequence which formerly occurred in A's pad. But from the point of view of the observer this is the creation of redundancy. If he has seen what A had on his pad, he will not get any new information about the message itself from inspecting B's pad.

Evidently, the nature of "meaning," pattern, redundancy, information and the like, depends on where we sit. . . .

If then we say that a message has "meaning" or is "about" some referent, what we mean is that there is a larger universe of relevance consisting of message-plus-referent, and that redundancy or pattern or predictability is introduced into this universe by the message.

> —BC: Redundancy or pattern or predictability increases within this “larger universe of relevance” by the circulation of the message. And what redundancy produces, or at least makes possible, in that universe is a world of shared meaning—for instance, “love, play and courtesy,” or equally profoundly, *trust*.

—Now let's review Bateson's conceptual revision of information as the recursion of difference in "Form, Substance, and Difference" (1970) and align that with the matter of redundancy:

> *. . . The map is not the territory.*
>
> . . . Let us go back to the map and the territory and ask: "What is it in the territory that gets onto the map? . . . What gets onto the map, in fact, is *difference*, be it a difference in altitude, a difference in vegetation, a difference in population structure, difference in surface, or whatever. . . .
>
> But what is a difference? A difference is a very peculiar and obscure concept. It is certainly not a thing or an event. . . . **When you enter the world of communication, organization, etc., you leave behind that whole world in which effects are brought about by forces and impacts and energy exchange. You enter a world in which "effects" . . . are brought about by differences**. That is, they are brought about by the sort of "thing" that gets onto the map from the territory. This is difference.
>
> There is an infinite number of differences . . . . Of this infinitude, we select a very limited number, which become information. In fact, what we mean by information—the elementary unit of information—is a difference which makes a difference . . . .
>
> BC] Of course, one can also ask, "a difference that makes a difference" *to whom, or to what?* Say, to the cognitive formation of some observing system that constructs the matter at hand as *meaningful* information. . . .

BC] As we noted last week, Bateson's *difference* is a form of form, a pattern transmissible in an appropriate medium.

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Sagan's Conjecture

One intended function of The CQ is to be a conversation pit for cooked and half-cooked cybernetic ideas. For example:

SAGAN'S CONJECTURE

"If the energy-per-pulse flowing through and interacting with a system is greater than the binding energy of the least strongly bound component of the system, then there will be a net loss of order in the system.

Conversely, if the pulse energy is less than that of the weakest bond, there will be a net gain of order in the system."

Dear Ramón Margalef
Gregory Bateson
Howard Odum
Harold Morowitz
Heinz Von Foerster
Carl Sagan

I have been searching some while now for organizing principles on the conceptual barricades between energy and information.

During the course of a lecture last week at Cornell I quoted Harold Morowitz *(Energy Flow in Biology)*, "The flow of energy through a system acts to organize that system," and Ramón Margalef *(Perspectives in Ecological Theory)*, "Pumping more energy in and out of a system simplifies it."

Carl Sagan, exobiologist and space scientist at Cornell *(Intelligent Life in the Universe)*, said after the talk that the two apparently contradictory biological statements would make perfect sense to a physicist, and he stated why. That statement — attached — we're calling Sagan's Conjecture.

And I'm probing around with it. The principle would seem to explain why fire burns down and respiration builds up. Or why energy-intensiveness has over-simplified American agriculture. Carl says it explains why mild sparks in a jar of methane and other gases make for amino acids instead of ashes (gas ashes).

If the conjecture seems to hold up under scrutiny I expect to publish it in the Summer *CoEvolution Quarterly* (along with lengthy excerpts from Margalef's book).

This letter is to request your comments. Is the conjecture original, non-trivial, disprovable, accurate, well-enough-stated . . . is it interesting? Useful?

Stewart Brand
The CoEvolution Quarterly

—Let us apply Bateson's brand of cybernetics to the matter of *trust*. Trust is a fundamental meta-relationship maintained (or not) by meta-communications: "Let me earn your trust." Gestures of trust, or of no trust, build or break relationships.

Gregory Bateson was unthrilled by Sagan's Conjecture. He distrusted its ambition to span too many levels of organization. "Suppose you have a family or something — a group of people who trust each other. Then you introduce the assertion that one of them is a spy. Does Sagan explain the net loss of order in the group?"

—Bateson's reported remarks elegantly parry Sagan's blunt thrust. He simply conducts the pun in Sagan's idiom of systemic "bonds" away from physicochemical affinities and toward social ties. His implication is that the degree of social "order" in a family system or, say, in an animal community, may be gauged by the level of mutual **trust** in behavioral evidence there. Bateson's family-therapy application deflates Sagan's conjecture's physicalist bid for universal application.

—The matter of *trust also* comes up in a letter from Bateson to Warren McCulloch dated October 25, 1962, concerning the Cuban Missile Crisis. Bateson hoped to send a message through McCulloch to the American decision makers under JFK countering the Kremlin's nuclear provocation.

". . . It seems to me that nations having almost total distrust for each other's words in fact operate with non-verbal cues and therefore face problems which must closely resemble those which confront octopuses and pre-verbal mammals. 1. It appears to me that the discourse of these creatures (mammals, octopuses, and nations) focusses almost totally upon matters of a rather high order of abstraction, viz., what shall be the rules and the styles of relationship between the two communicating individuals. . . .

"2. These mammalian communications about relationship are in large measure analogic. In verbal communication, which is largely digital, it is possible to have words which will signify negatives. In non-verbal communication, very peculiar steps have to be gone through in order to get across a negative message to the other individual. . . ."

[cited in Guddemi, *Gregory Bateson on Relational Communication: From Octopuses to Nations* (Springer 2020)]

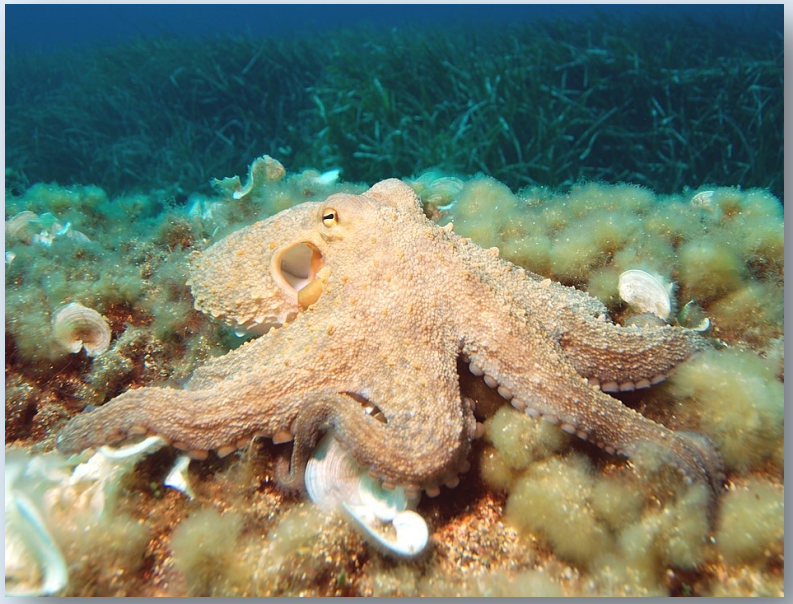
BC: What fascinates me here about Bateson's sensibility is his dogged pursuit of cybernetic communication theory well beyond Wiener's humanist concerns and straight into the embodied lives and presumed affects of social animals, from mammals to mollusks. Here there is no hesitation about crediting a nonhuman animal's ability to have and carry out purposes and intentions.

—In Bateson:

"analogic" = meaning is conveyed by nonverbal resemblance

"digital" = meaning is conveyed by presence or absence of (verbal) assignment

"3. This is especially true where the negative message concerns the rules and styles of relationship. In particular, the message "I shall not hurt you" or "I trust you not to hurt me" can obviously only be communicated in one of two ways: a. The individual may expose his vulnerable parts to possible attack . . . . [or b. . . .] the transmitter of the message must in some sense mention violence in some analogic code (e.g. by a hostile intention movement) and must somehow introduce a negative into this analogic statement about violence. . . .



"The Octopuses, starting from mutual hostility, pass through a sequence of minor battles in which nobody gets hurt much. After this the slightly stronger octopus very slowly and gently embraces the weaker, i.e. states, 'I can hurt you but I am not doing so.' Following this, the weaker comes over and attacks the stronger with his vulnerable backside, in response to which the stronger retreats. I.e., the weaker has now said, 'Yes, I know you are not going to attack me" and the stronger has said, 'That's right.'"

[cited in Guddemi, *Gregory Bateson on Relational Communication: From Octopuses to Nations* (Springer 2020)]

BC] Note that the truce rests on attaining a state of *trust* that establishes social *redundancy* in the form of a mutuality of understanding.

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BC] Let's try to apply Bateson's recursive formula for information to his concept of communication as the production of redundancy in the sense of shared meaning.

One way to convey *a difference that makes a difference* is with the formula *this, not that*, when *this* is the more unlikely (hence more informative or significant) selection.

In the messages "I shall not hurt you" and "I can hurt you but I am not doing so," the difference that makes a difference is the temporary negation of the threat of harm, signified by a "gentle embrace" now replacing previous acts of intimidation.

In the replies "I trust you not to hurt me" and "Yes, I know you are not going to attack me," the difference that makes a difference is the temporary negation of the prior state of apprehension, signified here by a bluff that is actually a gesture of submission, a miming of threat that is also a literal exposure and reminder of vulnerability.

—As Bateson's cybernetics of communication go beyond mundane informational exchanges, they unlock the resemblance between social behaviors in nonhuman animals and nonverbal ritual performances.

Figure 4 Women Enter With Krisses. By the time this scene from Trance and Dance in Bali was photographed in 1939, women were an accepted part in this village's presentations of the dance, though the custom had been first suggested by Bateson and Mead in 1937. Pagoetan, Bali; 8 February 1939; Gregory Bateson, photographer. Balinese Character: plate 56, fig. 8. Collapse

—from Gregory Bateson and Margaret Mead, *Balinese Character: A Photographic Analysis* (1942). At the end of the dance the Kriss women turn the knives on themselves.

BC] Every *x* implicitly denotes the temporary negation of *non-x*. In Bateson's octopus parable, a sort of nonhuman ritual for the suspension of hostilities, significant differences may be plotted as <stronger-weaker> and <threat-no threat>. A set of less probable pairings—

- strong, but no longer a threat (for real)
- weak, but still a threat (but not for real)

—creates *trust* when these messages are mutually taken to heart in a way that "saves face" (or backside) for the submissive party.