

VARIETIES OF SELF-REFERENCE

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INTRODUCTION TO

SELF-REFERENCE: REFLECTIONS ON REFLEXIVITY

Edited by Steven James Bartlett and Peter Suber

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Self-reference: Reflections on Reflexivity, edited by Steven James Bartlett and Peter Suber, is the first published collection of essays to give a sense of depth and breadth of current work on this fascinating and important set of issues. The volume contains 13 essays by well-known authors in this field, written on special invitation for this collection. In addition, the book includes the first general bibliography of works on self-reference, comprising more than 1,200 citations.

Even before the early twentieth century, when the first semantic and set-theoretical paradoxes were felt in logic and mathematics, an ever-widening circle of disciplines was affected by problems of self-reference. Problems of self-reference have become important topics in artificial intelligence, in the foundations of mathematics and logic, in the psychology of reflection, self-consciousness, and self-regulation. Epistemology, logic, computer science, information theory, cognitive science, linguistics, legal theory, sociology and anthropology, and even theology have faced explicit self-referential or reflexive challenges to research or doctrine.

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Steven J. Bartlett

Varieties of Self-Reference

Theory of Reference

The motivation to do philosophy seems to come from a need to grasp the most basic, the most general, features of the intelligible world. During the last half century, an increasingly encompassing perspective has developed due to this motivation. Theory of reference began as a comparatively narrow and specialized examination of elementary linguistic forms, such as definite descriptions and proper names. Much work in theory of reference still reflects this focus. At the same time, there is a growing realization in technical literature in the field that referring is not wholly reducible to linguistic mechanisms. Without a wide range of *abilities to refer*, we would be bereft of thoughts, memories, and sensations: The world as we perceive it, remember it, and conceptualize it would, in the absence of appropriate referring capacities, collapse into impossibility. All that we are, have been, and would be receives its form and sense in terms of a multitude of ways of referring which together make it possible for our individual worlds to possess an order, for us to contact others, interpret events, and identify a structure of common experience.

A general theory of reference represents one way among others of realizing, in the contemporary idiom which every age requires, the perennial desire for comprehensive philosophical understanding.

General theory of reference seeks to study, with universal theoretic inclusiveness, an essential constitutive ingredient of human reality: the phenomenon of referring which, in different forms, is involved in all study, all reflection, all discourse. It appears to be an inescapably fundamental basis of all that can be thought and expressed. General theory of reference itself must make use of the language, ideas, and realities of referring in order to investigate them. This fact exhibits reflexivity, or self-reference, the common theme of the papers in this volume.

Historically, studies of self-reference had a comparatively limited focus as did general theory of reference, restricted to problems arising in formal systems when self-reference was permitted, and to problems in linguistic analysis. It is my intention here and a main purpose of this collection to begin to show that reflexivity is an important and pervasive phenomenon, beyond logic

and philosophy of language, and beyond the discipline of philosophy itself.

Studies of reflexivity have gone on for some time in a variety of disciplines, but often in total ignorance of one another, an undesirable state of affairs in any branch of learning.

The present collection of papers on reflexivity is the first publication of its kind: It is the first scholarly anthology to represent, as much as it has been possible to do so in a single volume, some of the diversity of studies of self-reference.

Self Reference

When we employ thought to understand the nature of thinking, when we seek to know the presuppositions involved in knowing, we define a task that essentially involves the subjects we would study. Reflexivities of this kind are widespread: Sociology, anthropology, biology, and many other disciplines, as we shall see, exhibit varieties of self-reference.

Attempting to understand reflexivity gives one the sense of trying to lift oneself by the bootstraps. Reflexivity is often clearest to us in the case of categories which must themselves be used if we are to explicate them, as in thought about thought, or knowledge about knowledge. Logician Paul Lorenzen has identified a similar form of reflexivity which comes to light in connection with "elementary sentences", which reveal certain undeniable conditions of discourse. He notes that the "decision to accept elementary ways of speaking is not a matter of argument. It does not make sense to ask for an 'explanation', or to ask for a 'reason'. . . . If you ask such questions, . . . you have already accepted at least the use of elementary sentences."¹

As we shall see, reflexivity takes many forms. In philosophy, self-implicating categories and preconditions of discourse have inspired a good deal of interest. In psychotherapy, a paradigm of reflexivity is found in the psychological attempt to bring about changes in one's own psychological makeup. And it appears that it is just this reflexive capacity to initiate self-change which characterizes much of creative thought: It may underlie basic creative problem-solving abilities, and it identifies a special property of the mental adaptiveness that has gained one organism undisputed control of a planet.

I do not have an exhaustive enumeration of varieties of reflexivity to offer here. I will make no attempt to specify defining properties of self-reference which are invariant over all of their

manifestations. The ideas and terms which we use to describe reflexive realities will be defined here only by the contextually determined meanings they possess in the variety of uses to which the reader himself is accustomed. Awareness of reflexivity ought properly--i.e., self-referentially--to begin at home, in individual mental space: It is something best understood informally by its experience, rather than by stipulated or hypothetical definition.

In the following section, I have brought together forms of self-reference which are encountered in diverse disciplines; many comprise separate varieties of self-reference, and not simply formally equivalent examples in different garb. I have, however, not been concerned here to establish their independence. What follows is an annotated inventory of varieties of reflexivity. I have tried to keep the annotations to a minimum. For some readers, I will doubtless say too much, and for others, too little. My purpose is to identify main forms of reflexivity which may interest some readers sufficiently to explore further.

This broad but self-avowedly incomplete enumeration of varieties of self-reference offers perhaps the clearest and strongest evidence--sometimes only through the simple act of pointing, through ostensive reference--of the extent to which reflexivity permeates our intellectual and practical worlds.

We begin with a review of several varieties of self-reference which have become most familiar in the literature:

Better-Known Varieties of Self-Reference

- *Reflexivity of indexical signs, egocentric particulars, and token-reflexive words:*

Indexical signs (C.S. Peirce) refer in a manner that is relative to the speaker: The referents of 'I', 'here', 'now', and 'you' are relative to the individual who uses them, to the place, to the time, and to whom he speaks.

Egocentric particulars consist of pronouns, demonstratives, and tenses. Russell called them 'egocentric particulars' because their reference, like that of indexical signs, is determined relative to the speaker who uses them. But Russell sought, unlike Peirce, to reduce all such expressions to the logically proper name, the egocentric particular, 'this': For example, 'I' refers to the set of memories, enduring physical features, and abilities which make up *this*. 'Now' refers to events simultaneous with *this*.

Token-reflexive words (H. Reichenbach) refer to physical tokens or instances of an individual act of expression, whether in speech or in writing. Each token of a specific token-reflexive word refers to a different physical token--that is to say, each refers to itself: 'I' refers to the person who utters *this token*; 'here' refers to the place where *this token* is uttered. The identifier 'this token' is token-reflexive: every token of it is a different token, a physically distinct sound or ink pattern.

- *Semantical reflexivity:*

Natural as well as a few formal languages possess ways of referring to their own semantical concepts. These concepts normally link a language to the class of objects to which the language can refer, as do the semantical concepts truth and falsity. When a language is allowed to become semantically self-referential, inconsistencies may or may not be produced. The most famous of the semantical paradoxes is that of the Liar, also called Epimenides' paradox, attributed to Eubulides: "This man says he is lying. Is what he says true or not?"

- *Tautological reflexivity:*

Tautological propositions have been considered to be reflexive in an extended sense: Each comprises a closure over a truth-functional domain expressed by the proposition. Phenomenology of immediate experience suggests a form of tautological relation, between the description of such an experience and the experience itself. The so-called incorrigibility of certain claims about immediate experience may be understood in this way.

- *Set-theoretical reflexivity:*

When set-membership is used reflexively, paradoxes may again be generated. Of these, Russell's paradox, formulated by him in 1901, is probably best known, resulting from the specification of the set of all and only those sets that do not contain themselves as elements. A set so defined will contain itself as a member if and only if it does not.

During the last few years of the 19th century, and the first decade of the 20th, semantical and set-theoretical paradoxes

magnified greatly the difficulties attributable to self-reference.

This was a period of heightened paradox-sensitivity. The landmarks were:

- the first published modern paradox, the *Burali-Forti paradox* (1897), concerning the greatest ordinal number;
- *Cantor's paradox* (1899), concerning the greatest cardinal number;
- *Russell's paradox* (1901);
- the *Richard paradox* (1905), identified by Jules Richard at a *lycée* in Dijon, concerning the nondenumerability of real numbers;
- the *Zermelo-König paradox* (1905), relating to the finite definability of real numbers;
- *Berry's paradox* (described by Russell in 1908), relating to "the least integer not nameable in fewer than nineteen syllables"; and
- *Grelling's* (or the Grelling-Nelson) *paradox* (1908), produced by the self-predication of the predicate

"heterological": a predicate is heterological if a sentence ascribing the predicate to itself is false.

As formalized semantics fell into step with set theory, an earlier division made among these paradoxes (by logician Paul Ramsey, into "syntactic" and "semantic" categories) gave way to their being grouped under the single category of set-theoretical paradoxes.

• *Pragmatical, or performative, self-reference:*

When a statement is made, there are two dimensions of its assertion which may or may not conflict. One dimension has to do with *what* the statement asserts; the other, with the *way* in which the statement is made, or *how* the speaker intends the statement to be understood. A statement made in such a way that these two dimensions come together and refer the one to the other is *pragmatically, or performatively, self-referential*. The implicit claim to truth, "There are no truths", is self-referentially inconsistent in a pragmatical or performative

sense. Uttering the word 'cake' in Ramsey's claim, "I can't say 'cake'", similarly is pragmatically self-defeating or self-refuting. On the other hand, a person who, with face beet-red, yells, "I'm really mad", utters a statement that is pragmatically reflexive but not self-referentially inconsistent. A substantial literature has been devoted to the study of pragmatic self-reference: One might begin with works by John Passmore, Henry W. Johnstone, Jr., and J.L. Mackie.

• *Metalogical, or transcendental, reflexivity:*

There is a special kind of relation between a truth-functional referring proposition and the set of conditions which are necessary in order for the proposition to be capable of referring at all. The relation is *metalogically, or transcendently, reflexive*, and it forms a distinct variety of self-reference first studied by Steven J. Bartlett.

This relation, interpreted in diverse ways, has been the often not clearly defined object of attention of various philosophers and logicians, over a long period of time. Kant, for example, was especially fond of a similar relation, and made it the basis for his transcendental deduction: He attempted to demonstrate the existence of what may be regarded as expressing such a metalogical (in Kant's terms, transcendental) relationship between his Categories and the possibility of objective knowledge. The relationship is reflexive: To assert objective knowledge while denying one or more of the Categories would, provided Kant was right, result in a metalogically self-referentially inconsistent proposition.

A general *metalogic of reference* makes it possible to undertake a logically compelling, theoretically neutral, and reflexive evaluation of many philosophical and other positions.²

We now move on to a more inclusive enumeration of varieties of self-reference:

* * *

Linguistic Reflexivity

The discipline of linguistics has studied general reflexive aspects

of languages, including

- self-referential capabilities of natural and formalized languages, and the paradoxical consequences of their unbridled use;
- reflexive properties of generative grammars; and
- linguistic and conceptual limitative hypotheses concerning the structure of natural languages, first formulated by Benjamin Lee Whorf in his linguistic relativity hypothesis, and later qualified by other theorists.

Philosophical Reflexivity

In philosophical argument, pragmatical self-reference has been used to make evident what one *in fact* is committed to in making a given assertion; metalogical self-reference makes clear what one *must* be committed to if an assertion *in principle* is to be meaningful. Philosophical arguments using pragmatical self-reference are, accordingly, normally expressed as *ad hominem* arguments. Argumentation involving metalogical reflexivity has an unmistakable transcendental orientation.

Other examples of self-reference used in philosophical argument include *petitio principii*, circular reasoning, *reductio ad absurdum*, and applications of semantical and set-theoretical reflexivity.

Reflexive approaches to philosophical argument are inclined to focus on

- the self-application of principles, predicates, and categories;
- the self-justification (self-validation) or self-refutation of theories, inferences, or individual propositions; or
- the self-supporting character of certain inductive arguments.

Reflexivity has been significant to philosophy, beyond its application in argumentation, in the descriptive context of phenomenology. Husserl's theory of phenomenology is essentially reflexive: For him, phenomenology is a science of science, a theory of theories, which contains itself within its own proper subject matter, as it attempts to reach a radical degree of self-understanding.

Reflexivity also appears as a specific phenomenological topic of research in connection with reflective experience, specifically

self-consciousness and reflexive knowledge.

Proof-Theoretical Reflexivity

Some of the most dramatic 20th century contributions to mathematics and the theory of formal systems have resulted from self-referential techniques of proof. The family of limitative theorems has grown appreciably since the foundational work of Cantor and Gödel, relating to incompleteness, undecidability, and unsolvability.

In addition to limitative results obtained through reflexive techniques of proof, important contributions by Frederic Brenton Fitch and Raymond Smullyan, contributors to this volume, have examined ways in which formal systems may be constructed so as to permit self-reference without thereby automatically becoming inconsistent.

Another major area in which reflexivity plays a central role in mathematics should also be mentioned, namely, the theory of recursive functions, also known as computability theory, which immediately leads into:

Artificial Intelligence: Mechanizing Reflexivity

Several varieties of self-reference currently form a part of the subject matter of artificial intelligence. They include studies of

- self-correcting systems
- self-regulating systems
- systems capable of self-initiated learning
- self-organizing systems
- self-reproducing systems.

A variety of results now exists which relates to reflexivity in the context of computability theory. John von Neumann and C.E. Shannon, for example, have studied self-correcting procedures for general computations and information transmission, respectively. (See *Reflexivity in Information Theory and General Systems Theory*, below.) Thoralf Skolem, A.M. Turing, Kurt Gödel, Alonzo Church, Emil Post, Andrzej Mostowski, and others have made contributions to recursive function theory that are basic to current research on reflexive systems in the field of artificial intelligence.

Reflexivity in Physics

Some of the most interesting conceptual puzzles in physics as well as in philosophy of science stem from theories in physics which apparently reveal forms of reflexivity in certain classes of physical phenomena. Reflexivity seems to be involved in both contemporary quantum mechanics and general relativity.

Quantum mechanics continues to encounter conceptually baffling phenomena: In the last several years, for example, physicist Alain Aspect has designed a group of experiments which study the apparent fact that quantum results are often determined by states of comparatively distant components of the measuring apparatus. Aspect's attempts to isolate quantum phenomena from the physically reflexive influence of the measuring system appear to confirm the role of a variety of physically reflexive determination. What seems to be in question is not an instance of physically propagated causal influence, but rather a situation in which the measuring apparatus, the observer, and the quantum phenomena to be measured functionally constitute a system which itself reflexively defines properties of the phenomena which may be measured.³

In a similar vein, quantum indeterminism and uncertainty appear to manifest relations of reflexivity that are involved in the system formed by the theoretical framework, the physical apparatus and observer, and the phenomena under study.⁴

General relativity offers two instances of reflexivity, the first of which exhibits the reflexivity of functionally interdependent descriptions, and the second, a variety of topological recurvature:

- the geometric-topological model which expresses density of matter and gravitation as functions of the metric of space curvature, and vice-versa; and
- closed universe models which, although unbounded, are finite.

Reflexivity of Space and Time

In topology, there are configurations formed by lines, surfaces, and volumes which exhibit spatial reflexivity: Some of these are frequently used as models of, or as spatial metaphors for, specific forms of self-reference.⁵ They include

- the closed loop, as in a circle, a line curving back on itself in a plane;
- the Moebius strip, a two-dimensional band curving back on itself in three-dimensional space;
- the Klein bottle, a three-dimensional container whose "inner" space recurves so as to be continuous with its "outer" space (a geometrical object not representable in three dimensions); and
- the Riemannian model of the closed universe, comprising one space-time continuum, unbounded yet finite in volume.

Also worth mentioning is a special area of topology devoted to the study of Banach spaces, in which properties of general reflexive spaces may be investigated.

As yet, we have not witnessed the development of a discipline whose special subject matter is time, as is space from the standpoint of geometry and topology. "Chronology" does not yet exist as an independent field of study. History and futures-studies do exist, but neither explicitly studies reflexive temporal structures such as closed temporal loops, which may be applicable in the context of particle physics, and cyclic and spiral periodicity.

Biological Reflexivity

Biology has encountered reflexivity in connection with

- self-replicating structures, investigated in studies of genetic replication, in particular in connection with viral reproduction; and
- self-organizing biological systems, for which functional analysis and a systems-approach to the study of living organisms (organismic biology) are essential: "[t]he whole acts as a causal unit. . . on its own parts."⁶

Reflexivity in Political Science

Systems of political administration may involve reflexivity in several ways:

First, there is reflexivity relating to the set of beliefs espoused by the administration, which is basic to a country's sense of self-identity as symbolized by flag and nationalistic creed. Here lies the reflexivity of ideology: It forms a self-validating belief-system

which is self-reinforcing, and self-isolating. Its self-isolating character precludes effective communication with alien belief-systems. Philosophical positions frequently are ideologically bound in this way,⁷ as are religious belief-systems.

Second, there is self-reference which concerns the self-limitation or self-augmentation of political power. (See Reflexivity in Law, below.)

Third, the internal dynamics of political systems may become dysfunctional and self-destructive. The study of reflexively destructive political systems is the focus of political theories of revolution.

Reflexivity in Law

Self-reference takes several forms in the context of jurisprudence, which will only be listed here.⁸ They include

- legislative approaches to self-limitation
- self-amendment, and paradoxes which self-amending laws may produce
- problems and puzzles engendered by self-referring laws
- circularity of liens
- mutuality in contract law.

Sociological Reflexivity

In recent years, sociologists have studied the question whether publicizing a prediction about public behavior will influence, positively or negatively, the events predicted. This is the so-called problem of *reflexive prediction* in behavioral science. It has direct application to whether public disclosure of results of a public opinion survey prejudices the survey's results by acting as a self-fulfilling prophesy. The problem of reflexive prediction is immediately relevant to the policy of releasing vote tallies from the east coast of the United States before voters on the west coast have gone to the polls.

An analogous reflexive problem in philosophy concerns the problem of *self-prediction*: Here, arguments have been advanced, as well as countered, to show that prior to the occurrence of a decision it is, or is not, impossible to know what that decision, or the behavior consequent to it, will be. These arguments form a contemporary

approach to the problem of the freedom of the will, and they have, in the context of philosophy of science, addressed the question whether objective knowledge in human behavioral science is actually possible.

Reflexivity in Economics

In economics, reflexivity has taken several forms; a partial list includes

- reflexive monetary adjustment theory
- theory of business cycles
- self-correcting investment management strategies
- the dynamics of self-fueling inflationary and deflationary systems
- analysis of exponential growth, usually relating to compounding of reinvestments.

Game-Theory, Decision-Theory, and Reflexivity

Game-theory and decision-theory encounter varieties of reflexivity in connection with:

- rules permitting self-modification,
- self-undermining or self-guaranteeing strategies, and
- decision methods which concern the ordering of individual preferences.

In relation to the latter, Kenneth Arrow is known for his impossibility theorem, implied by Arrow's paradox, which demonstrates, for example, that the *order* of voting for or against bills, and on amendments to them, can seriously affect the outcome: hence there does not exist a rational and equitable general social decision method.⁹

In Anthropology

Probably the most famous variety of self-reference in anthropology occurs in Benjamin Lee Whorf's linguistic relativity hypothesis, briefly mentioned under the heading of Linguistic Reflexivity. According to Whorf, thinking

follows a network of tracks laid down in a given language, an organization which may concentrate systematically upon certain phases of reality, certain aspects of intelligence, and systematically discard others featured by other languages. The individual is completely unaware of their organization and is constrained completely within its unbreakable bounds.¹⁰

This claim about the determination of thought by language, upon which thought relies for its expression, is itself reflexive, for the linguistic relativity hypothesis is precisely a set of thoughts expressed by language.

Another more general variety of reflexive determination of special interest to anthropologists is the framework-relativity of culturally-based values: Culturally relative values appear to have the self-reinforcing and self-isolating character of political ideologies. The unquestioned acceptance of such values by members of a society, because these values *constitute* social experience from their point of view, is at the basis of our "culture-shock" when we find ourselves in a dramatically foreign society.

Reflexivity in Mythology and Theology

In mythology, reflexivity is found in myths having to do with

- the self-embodiment of a deity in the universe created by him,
- general cosmic periodicity, and
- the myth of eternal return (or eternal recurrence): the notion that there exist cosmic cycles which are such that each event in the universe will recur in exact detail an infinite number of times in the future as it already has in the past.

In theology, we encounter a certain reflexivity on the part of the predicate of perfection in ontological arguments. Also, in some religious rituals, for example, communion, there is an evident expression of reflexivity: The faith of worshippers at once is a means for, and a symbolization of, their own reflexive participation in the self-embodiment of god, i.e., his incarnation in his own creation, itself a second manifestation of reflexivity, as just noted.

In Literature

Literary imagination and ingenuity are especially evident in

certain works of poetry and fiction which have self-referential characteristics. Members of this class of literary works are known as self-begetting, self-describing, or self-reflexive.¹¹

I cannot refrain from including a specific reference here, one which was communicated to me by Martin Gardner. This is the delightful and extremely clever reflexive story by Max Beerbohm, "Enoch Soames".¹²

Some of the best science fiction has made reflexivity a theme of central importance, as in works which involve closed loops in time, paradoxes of self-identity, shifts in and out of higher dimensions, etc.

In Music

Because music exists sequentially in time--even though it has both the "diachronic" and "synchronic" dimensions of melody and harmony--music must rely on the auditory memory of listeners to attain the musical equivalent of reflexivity. Cyclical structures, recurrent thematic material, and forms such as the fugue and canon, offer opportunities for the expression of the varieties of reflexivity so far realized in music.

Close neighbors of music, physical acoustics and the physiology of hearing, have identified phenomena with reflexive characteristics: In acoustical resonance, for example, sound waves cause standing waves to be established in a resonating material, which contributes in a self-reinforcing loop to the propagation of sound waves of greater amplitude. In the physiology of hearing, it has been discovered that there is a kind of circularity in judgments which seek to determine musical pitch.

Reflexivity in Art

A self-depicting, recurrent subject in painting, for example, may consist of a picture of a scene containing an easel and canvas, on which is painted the same scene with easel and canvas, on which the picture recurs to the limits of resolution. Salvador Dali and M.C. Escher were skilled in their successful renditions of self-referential subjects. The picture-in-a-picture variety of self-reference in art has been examined by D. Carrier. B. Ernst has studied reflexivity in Escher, while Douglas Hofstadter has explored self-reference in the art of Escher, the music of Bach, and the limitative results of Gödel.

Humor

In humor, reflexivity is essential in certain puns and double-entendres: Here is a play on words, which potentially involves a cyclical oscillation between homonyms:

Three brothers move to California to start a cattle ranch. When they have bought the land, they phone their mother, asking that she name their ranch. The name she suggests is: "Where the sun's rays meet."

Reframing is frequently involved in humor, as when there is a sudden retroactive change of meaning, normally the purpose of the punch-line.

Humor, the capacity to apprehend different levels of meaning quickly, reframing, creativity, and play are interwoven abilities which can involve self-reference. These varieties of self-reference appear to make up one side of a coin, the other side of which represents conditions which come about when these "healthy" forms of reflexivity short-circuit, producing such dysfunctions as autism and schizophrenia.

Psychiatry and Psychotherapy: Reflexivity Awry

Reflexivity in psychiatry and psychotherapy is of more critical importance than perhaps in any of the other applied sciences. The assistance they attempt to offer is heavily dependent upon the reflexive capacity of patients themselves:

[O]ne's destiny is shaped from within. . . This is. . . a process of change that originates in one's heart and expands outward, always within the purview and direction of a knowing consciousness, begins with a vision of freedom, with an "I want to become. . .", with a sense of the potentiality to become what one is not. One gropes toward this vision in the dark, with no guide, no map, no guarantee. Here one acts as subject, author, creator.¹³

Psychiatry and psychotherapy treat certain conditions which either appear to be produced by reflexive incapacities of patients, or by reflexivity which has become distorted or excessive. Furthermore, as we shall see, some techniques used in non-pharmacological psychotherapy may themselves have a reflexive structure.

Conditions which appear to implicate reflexivity gone awry include:

- autism, the psychiatric equivalent of solipsism;
- narcissism, a form of adult-level autism which is self-isolating,

built upon layers of pretense, and marked by extreme willfulness;¹⁴

- schizophrenia, characterized by a breakdown of contact with reality, distorted and disjointed thinking, and behavioral confusion;
- a desire for self-destruction which, unchecked, may become suicidal; and
- self-undermining patterns of communication in troubled families.

Different hypotheses have been offered to explain how these conditions come about. Of particular relevance to a study of reflexivity are three hypotheses concerning, respectively, narcissism, schizophrenia, and families at war with themselves:

- It has been hypothesized that narcissism is brought about by a traumatic episode that precipitates a progressive flight inward: --a trauma of this kind, for example, might be the suicide of a boy's father after a quarrel between them.
- It is thought that schizophrenia may result either from a generalized breakdown of the capacity to distinguish levels of meaning in communications (Gregory Bateson's double-bind theory), or from a child's chronic experience of and involvement in conflict-based family impasses and blocks to open, undistorted expression (Ronald D. Laing's "knot" theory).
- Interactions between members of a family are thought to form a system which can short-circuit in pain and frustration, or--also through a feedback loop--can become integrated so as to offer a context for personal growth.

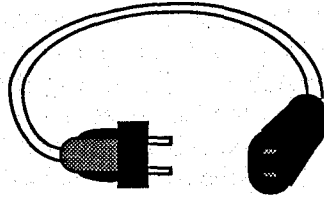
A reflexive psychotherapeutic technique which sometimes is dramatically effective is captured by the title of Allen Fay's book, *Making Things Better By Making Them Worse*.¹⁵ The technique is known as "symptom prescription" or "paradoxical injunction". It bears some similarity to the Eastern technique of using koans to force an individual, through the use of his established patterns of thinking, to break free from the constraints of his own conceptual system. In

symptom-prescription, for example, a former draftsman, whose hands now shake uncontrollably but because of no physical illness, may be asked to stand in front of a mirror at regular intervals, and *attempt* to shake. The theory, and the actual effect, is that, often, an uncontrollable pattern is thereby brought under voluntary control. Symptom-prescription has now been used extensively in the context of family therapy and individual behavior modification. Symptom-prescription may be understood as the use of controlled positive feedback (see below) to regain control of a system--here, the personal world of an individual--that has gone out of control.

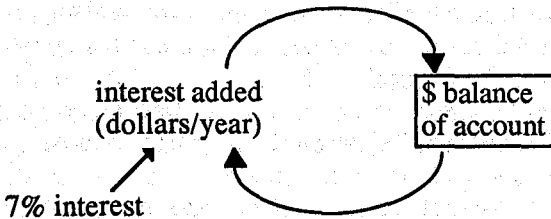
Reflexivity in Information Theory and General Systems Theory

These two disciplines share responsibility for the concept of *feedback*, which is of sufficient importance to the phenomenon of reflexivity that we should look at it somewhat closely.

Self-reference, translated into the terms of dynamic systems analysis, and viewed as a liability rather than an asset, may be likened to:



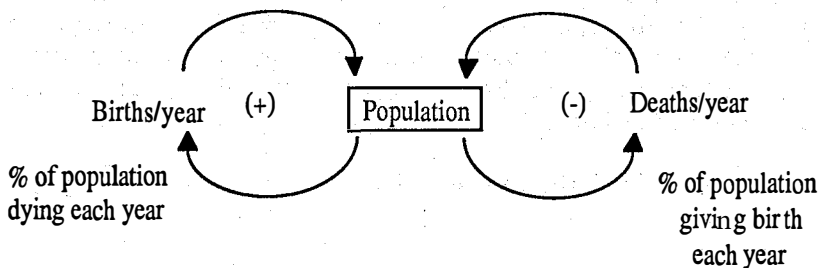
On the other hand, in a more constructive sense, here is an example of a positive feedback loop, representing the exponential increase of money in a savings account:



In a *positive* feedback loop, a chain of cause-and-effect relationships closes on itself, so that increasing any one element in the loop will start a sequence of changes that will result in the originally

changed element being increased even more.

In a *negative* feedback loop, a change in one element is propagated around a chain of events until it comes back to change that element in a direction *opposite* to the initial change. Consider, for example:



It follows that positive feedback loops tend to lead to runaway growth, while the addition of negative feedback loops tends to regulate growth and hold a system in a steady state.

Many of the varieties of reflexivity we have identified have this character: Some paradoxes may be understood as runaway logical feedback loops. Self-reference itself appears essentially to require a positive feedback loop. In formal logic, a restrictive theory of types acts as negative feedback, eliminating the runaway cycling of an original paradox. Further applications of feedback loops to other varieties of self-reference will likely occur to the reader.

Information theory has contributed to the study of reflexivity in two ways which will be mentioned here, and has collaborated with general systems theory in connection with two others:

C.E. Shannon and R.W. Hamming have contributed to the development of error-detecting codes, now used in telemetry, which help to insure accuracy in the transmission and reception of messages. An error-detecting code is reflexive, since the message transmitted is encoded so as to reveal errors not only in the message content but in the code check bits themselves.¹⁶

Gregory Bateson's double-bind theory of schizophrenia, already discussed briefly, strongly relies on concepts drawn from information theory.

General systems theory, in comparison, has sought to offer a method of analysis which can show how the components of a system possess the identity they do as a function of the system as a whole. General systems theory endeavors to construct abstract models which can make explicit the isomorphism of concepts, laws, and theories,

often as they are expressed in a plurality of more specialized disciplines.

General systems theory is presently working to develop reflexive models, for example, of

- the processes of development, specialization of organs, and growth of organisms; and
- the maintenance of homeostasis in biological systems (in medicine, called "health")

General systems theory and information theory have joined forces outside of their own individual frameworks, in connection with

- approaches in the field of family therapy which emphasize effective communication and a systems-based understanding of family dynamics; and
- the formulation of a theoretical basis for the psychotherapeutic technique of symptom-prescription.

Hermeneutics, Paradigms, and the Theory of Research Programs

Although Imre Lakatos' theory of research programs has become an area of independent interest in the philosophy of science along with Kuhn's studies of paradigm-shifts and the nature of theory change, both may be considered to belong to hermeneutics: both are theories of interpretative models. But, no matter how one wishes to make the classification, studies of paradigms, research programs, and general hermeneutics jointly examine a single form of self-reference which is at the root of tendencies of systems of interpretation so to construe their subject matters that they become self-validating, standing comparatively immune to "recalcitrant experience". One of the topics of central interest in hermeneutics is how rival systems of interpretation may be self-amending in the face of problematic experimental results, and yet continue to adhere, in a self-validating manner, to differing heuristics.

The variety of self-reference involved here is closely related to the reflexivity of position-taking in general, as in political ideology and religious dogma, psychological narcissism, and much

philosophical argumentation.

Reflexivity in Neurophysiology

From a phenomenological point of view, we appear to share an experience of forms of reflexivity in connection with self-referential thoughts and feelings such as pain and anxiety. It is perhaps natural to suppose that subjective experiences of reflexivity have associated with them underlying neurophysiological processes which are similarly reflexive in character.

As yet, studies of the neurophysiology of the human brain are inconclusive here. However, research conducted by Karl Pribram and others suggests that the junctional microstructure of the brain may serve as a substrate for holographic interference patterns or resonance circuits. Descriptions of these hypothesized processes, whose existence is not yet certain, are indeed unmistakably reflexive in character:

Recent developments in optical storage and information processing have been helpful to neurophysiology by offering theoretical models which may reveal a good deal about human cognitive abilities. For example, three-dimensional holograms are now possible, in which information is distributed throughout a *volume*; the applications of holography to model the human brain appear to be promising. The patterns of electrical activity involved in memory, vision, taste, smell, and touch appear to be of holographic nature.¹⁷

At present, these studies suggest that the brain responds as a general system to patterns of excitation which do not have localized paths of conduction. The entire system is organized as a network, involving a multiplicity of loops of different lengths and orders of complexity. There are neuronal circuits and holographic return loops which appear to be able to reexcite initial patterns of excitation. The resulting system exhibits a dynamic which involves feedback and feedforward. It may form the reality that underlies and sustains our perhaps distinctive abilities to utilize the contents of memory, to reflect upon our experience, to anticipate, and to gain a progressively integrated sense of personal identity.

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The individual papers appearing in this collection study reflexivity from several perspectives:

From a general standpoint: Papers by

D.A. Whewell, on the reflexive flexibility of natural language;

Douglas Odegard, concerning the irreflexivity of knowledge;
and W.D. Hart, discussing a causal conception of self-reference.

On two philosophical theories of reflexivity: An essay by

Martin X. Moleski, describing retortion in Lonergan and Polanyi.

From a formal point of view: Papers by

Frederic B. Fitch, formalizing self-reference; and
Raymond Smullyan, on self-reference and quotation.

On semantical reflexivity: Papers by

Myron Miller, on the Liar's paradox; and
Graham Priest, discussing a recent theory of semantical reflexivity.

With pragmatical reflexivity in view: Essays by

Peter Suber, on the norms of debate; and
Henry W. Johnstone, Jr., on self-reference and *ad hominem* argument.

On specific applications: Essays by

Joseph M. Boyle, Jr., offering a self-referential argument for free choice;
Olaf Tollefsen, on the self-defeating nature of relativism;
and James Swearingen, characterizing reflexivity in the novel, *Tristram Shandy*.

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Notes

1. Paul Lorenzen, *Normative Logic and Ethics*, Bibliographisches Institut, 1969, p. 14. See also his conception of operative logic in *Einführung in die operative Logik und Mathematik*, Springer Verlag, 1969.
2. See citations under 'Bartlett' in the Bibliography. (This is a variety of self-reference not mentioned in this introduction.)
3. To this author, these experiments appear, in an almost obvious way, to point toward the relevance of a metalogical analysis of preconditions of possible quantum measurement of (i.e., reference to) the microevents in question.
4. Cf. Steven J. Bartlett, "Self-reference, Phenomenology, and Philosophy of Science", *Methodology and Science*, 13, 3, (1980) 143-167.
5. See, e.g., the essay by Graham Priest in this volume.
6. Wilfred Eade Agar, *A Contribution to the Theory of the Living Organism*, Melbourne University Press, 1943. See also Ludwig Bertalanffy, *Modern Theories of Development: An Introduction to Theoretical Biology*, trans. by J.H. Woodger, Oxford University Press, 1933; John Richard Gregg, ed., *Form and Strategy in Science*, D. Reidel, 1964; Joseph Henry Woodger, *The Axiomatic Method in Biology*, Cambridge University Press, 1937, and *Biological Principles: A Critical Study*, K. Paul, Trench, Trubner, 1929).
7. See Steven J. Bartlett, "Philosophy as Ideology", *Metaphilosophy*, 17, 1 (1986) 1-13.
8. For further information, see the section "Reflexivity in Law" in the Bibliography.
9. Kenneth J. Arrow, *Social Choice and Individual Values*, Wiley, 1951; *Collected Papers*, Harvard University Press, 1983; *Social Choice and Justice*, Harvard University Press, 1983. See also John von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behavior*, Princeton University Press, 1947; R.

- Duncan Luce and Howard Raiffa, *Games and Decisions*, Wiley 1957.
10. Benjamin Lee Whorf, "Langage, Mind and Reality", *ETC.: A Review of General Semantics*, 9, 3 (1952) 177.
 11. For works describing these, see the Bibliography, "Reflexivity in Literature".
 12. In Max Beerbohm's *Seven Men*, William Heinemann, 1926 (first published in 1919), pp. 3-48.
 13. Allen Wheelis, M.D., *How People Change*, Harper and Row, 1973, p. 105.
 14. See Steven J. Bartlett, "Narcissism and Philosophy", *Methodology and Science*, 19, 1 (1986) 16-26.
 15. Allen Fay, *Making Things Better by Making Them Worse*, Hawthorne Books, 1978.
 16. See, e.g., Richard Wesley Hamming, *Coding and Information Theory*, Prentice-Hall, 1980; Claude E. Shannon, *The Mathematical Theory of Communication*, University of Illinois Press, 1949; and Steven J. Bartlett, "Lower Bounds of Ambiguity and Redundancy", *Poznan Studies in the Philosophy of the Sciences*, 4, 1-4 (1978) 37-48.
 17. See Paul Greguis, ed., *Holography in Medicine*, IPC Science and Technology Press, 1976; and Karl H. Pribram, *Languages of the Brain: Experimental Paradoxes and Principles in Neurophysiology*, Prentice-Hall, 1971.