

4 Loops, Goals, and Loopholes 51

I Am a Strange Loop

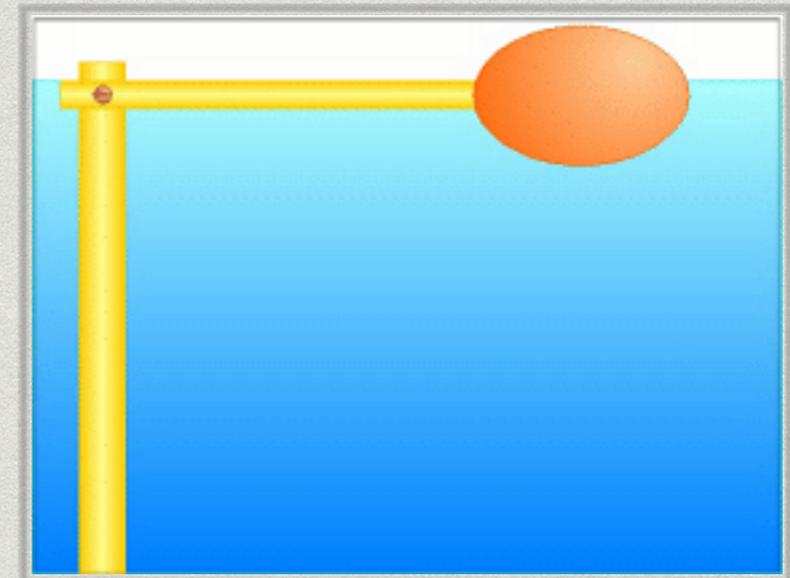
by Douglas R. Hofstadter

4 Loops, Goals, and Loopholes

The First Flushes of Desire

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WHEN the first mechanical systems with feedback in them were designed, a set of radically new ideas began coming into focus for humanity.

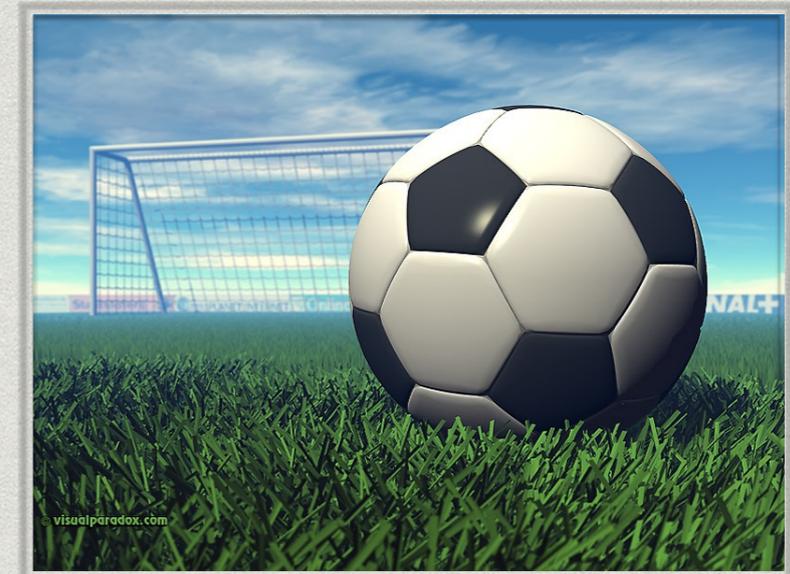


4 Loops, Goals, and Loopholes

A Soccer Ball Named Desire

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**But what
kinds of
systems have
feedback,
have goals,
have desires?**



4 Loops, Goals, and Loopholes

The Slippery Slope of Teleology

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The presence of a feedback loop, even a rather simple one, constitutes for us humans a strong pressure to shift levels of description from the goalless level of mechanics (in which *forces* make things move) to the goal-oriented level of cybernetics (in which, to put it very bluntly, *desires* make things move).



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“The type of feedback with which we are all most familiar, and probably the case that gave it its name, is audio feedback, ...” and from here DH goes on a positive feedback loop birdwalk (IMHO)



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Feedback — making a system turn back or twist back on itself, thus forming some kind of mystically taboo loop — seems to be dangerous, seems to be tempting fate, perhaps even to be intrinsically *wrong*, whatever that might mean.



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This suspicion of loops just runs in our human grain, it would seem. However, as with many daring activities such as hang-gliding or parachute jumping, some of us are powerfully drawn to it, while others are frightened to death by the mere thought of it.



4Loops, Goals, and Loopholes

God, Gödel, Umlauts, and Mystery

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Gödel's Proof

by [Ernest Nagel](#)
(Author), [James
Newman](#) (Author),
[Douglas R.
Hofstadter](#) (Editor,
Foreword)



4Loops, Goals, and Loopholes

God, Gödel, Umlauts, and Mystery

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So here was a book talking about how language can talk about itself talking about itself (etc.), and about how reasoning can reason about itself (etc.).

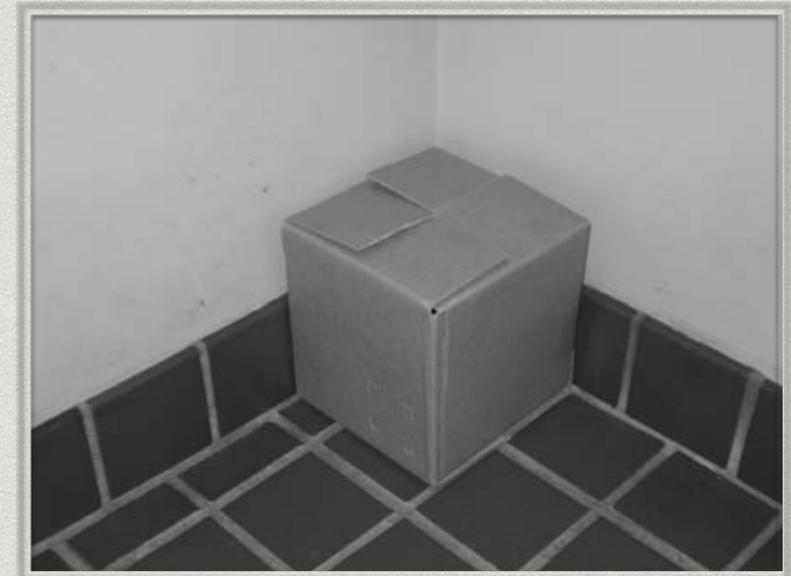


4Loops, Goals, and Loopholes

Savoring Circularity and Self-application

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The point is that among my earliest memories is a relishing of loopy structures, of self-applied operations, of circularity, of paradoxical acts, of implied infinities. This, for me, was the cat's meow and the bee's knees rolled into one.

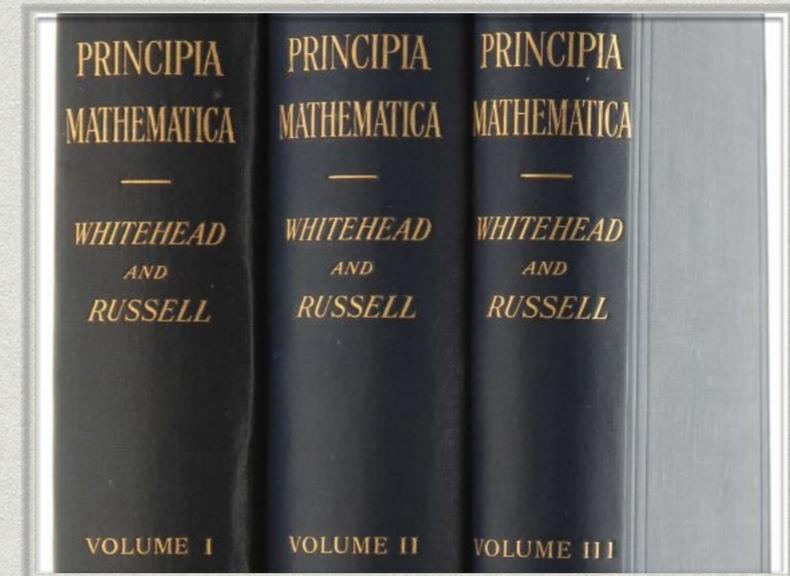


4 Loops, Goals, and Loopholes

The Timid Theory of Types

60

The foregoing vignette reveals a personality trait that I share with many people, but by no means with everyone. I first encountered this split in people's instincts when I read about Bertrand Russell's invention of the so-called "theory of types" in *Principia Mathematica*, his famous *magnum opus* written jointly with his former professor Alfred North Whitehead, which was published in the years 1910–1913.

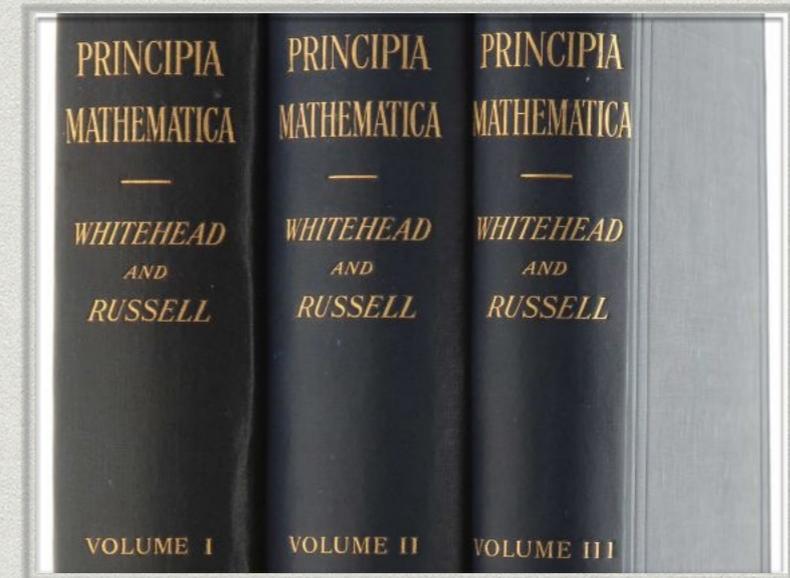


4 Loops, Goals, and Loopholes

The Timid Theory of Types

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In *Principia Mathematica*, there was to be no twisting-back of sets on themselves, no turning-back of language upon itself. If some formal language had a word like “word”, that word could not refer to or apply to itself, but only to entities on the levels *below* itself.

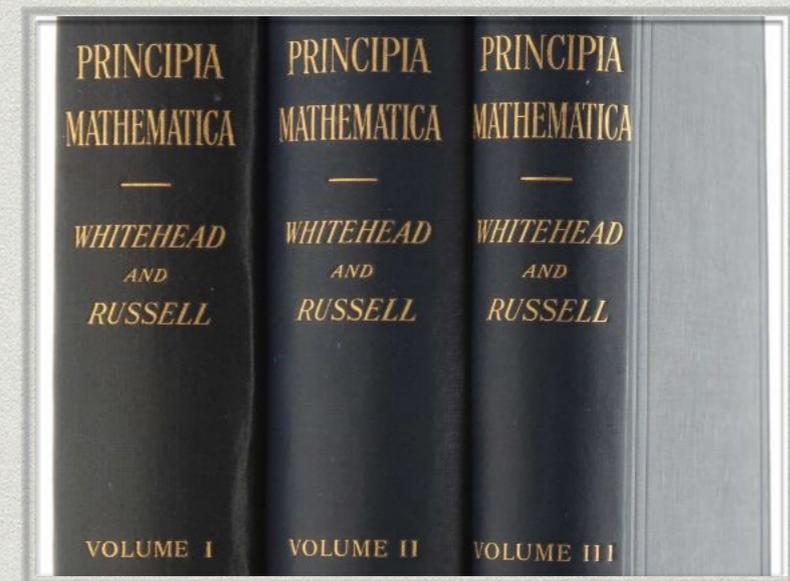


4Loops, Goals, and Loopholes

The Timid Theory of Types

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**Categorically
banishing all loops of
reference struck me
as such a paranoid
maneuver that I was
disappointed for a
lifetime with the
once- bitten twice-
shy mind of Bertrand
Russell.**

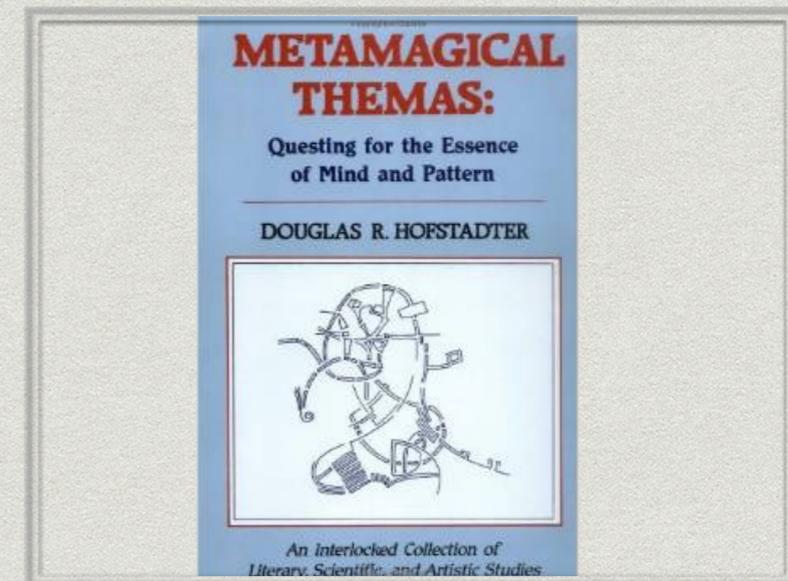


4Loops, Goals, and Loopholes

Intellectuals Who Dread Feedback Loops

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Many years thereafter, when I was writing a monthly column called “Metamagical Themas” for *Scientific American* magazine, I devoted a couple of my pieces to the topic of self-reference in language, and in them I featured a cornucopia of sentences invented by myself, a few friends, and quite a few readers, including some remarkable and provocative flights of fancy...

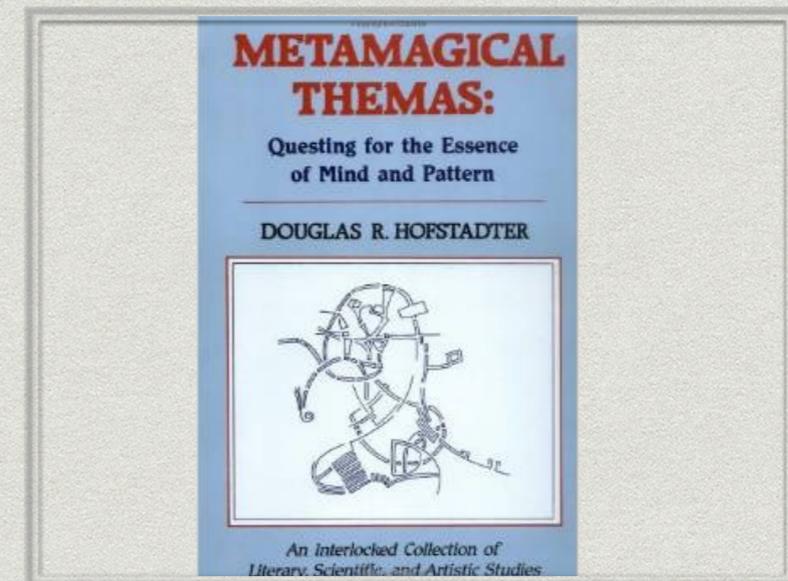


4 Loops, Goals, and Loopholes

Intellectuals Who Dread Feedback Loops

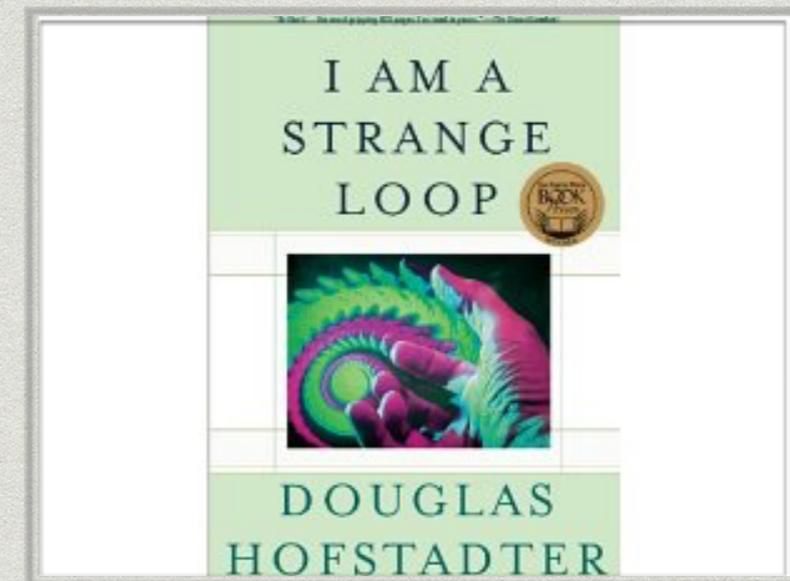
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What remained with me, however, was the realization that some highly educated and otherwise sensible people are irrationally allergic to the idea of self-reference, or of structures or systems that fold back upon themselves. ... The contrast between my lifelong savoring of such loops and the allergic recoiling from them on the part of such people as Bertrand Russell, B. F. Skinner, this education professor, and the TV salesperson taught me a lifelong lesson in the “theory of types” — namely, that there are indeed “two types” of people in this world.



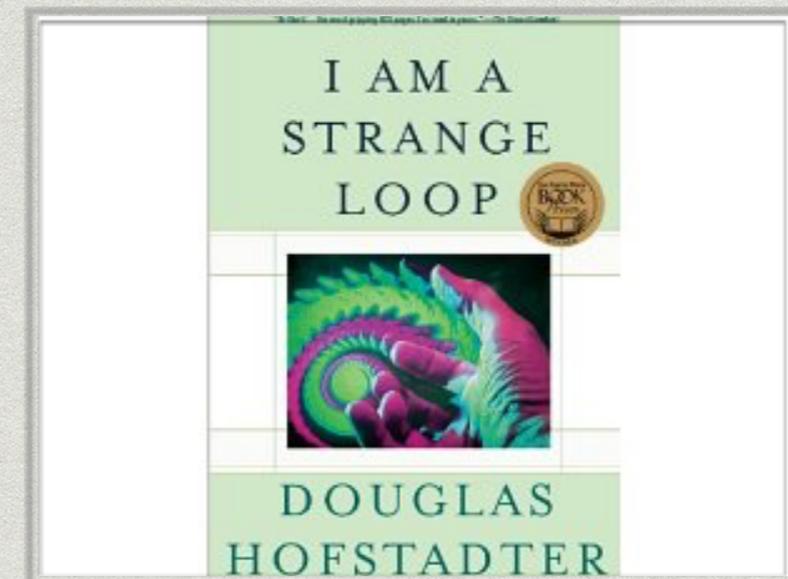
General Comments

DH doesn't distinguish positive from negative feedback (i.e. control) loops



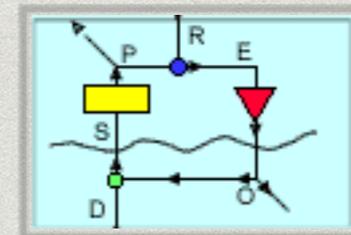
General Comments

DH gives his one 'stab' at a definition of a strange loop on 101-102: "What I mean by "strange loop" is — here goes a first stab, anyway — not a physical circuit but an abstract loop in which, in the series of stages that constitute the cycling-around, there is a shift from one level of abstraction (or structure) to another, which feels like an upwards movement in a hierarchy, and yet somehow the successive "upward" shifts turn out to give rise to a closed cycle. That is, despite one's sense of departing ever further from one's origin, one winds up, to one's shock, exactly where one had started out. In short, a strange loop is a paradoxical level-crossing feedback loop."



General Comments

**What DH is
describing is
a negative
feedback
(i.e. control)
loop**



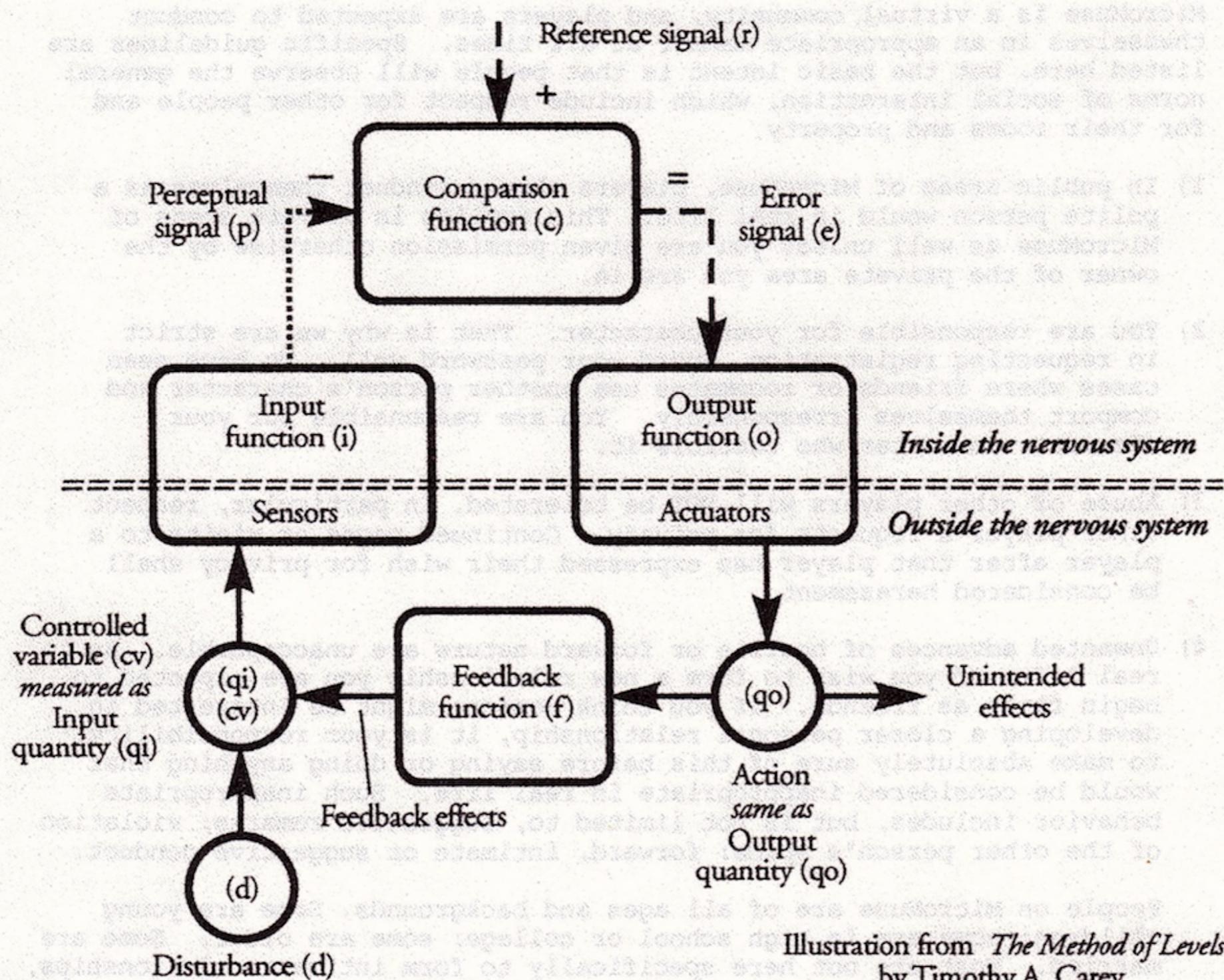


Illustration from *The Method of Levels*
by Timothy A. Carey.

Figure One A closed causal loop: A basic control system acting on the environment.

Note: This illustration can be seen as a single elementary control system, consisting of a few neurons and muscle fibers acting at the interface with the environment, or as a summary of an entire hierarchy, thousands of control systems at many levels, acting in complex ways on the environment.

Arrows in the nervous system indicate neural signals carrying information from one function (neural network) to another. Arrows in the environment indicate physical links that give the output of one function a physical influence on a physical variable. The circles show where physical variables are, or where they could be measured. Functions in the environment usually indicate physical laws that determine how physical variables at the output of the function depend on physical variables at its input.

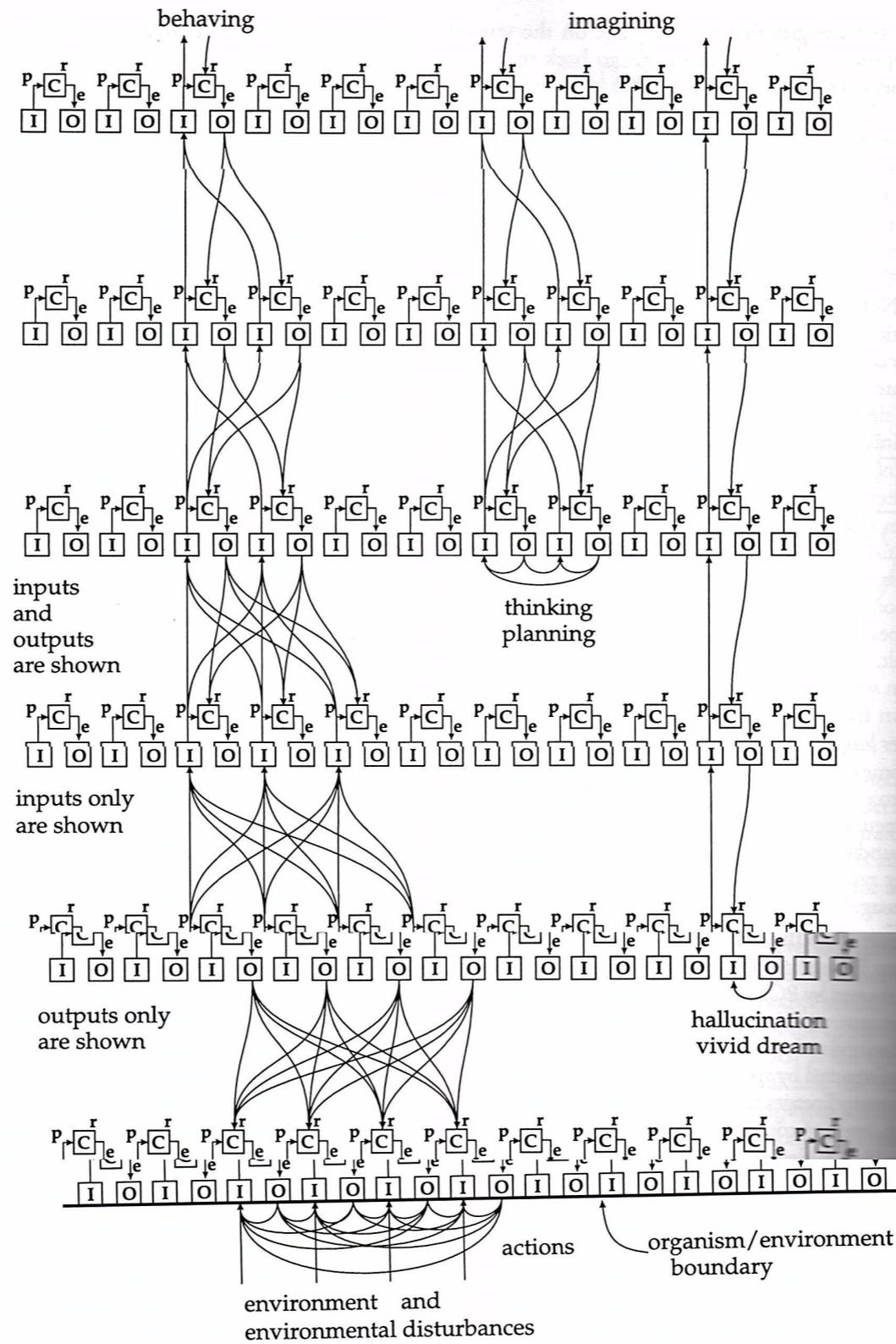
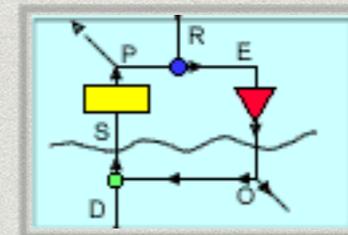


Figure 18-3. The hierarchy of control

General Comments

**PCT theory:
Behavior is the
control of
perception.**



General Comments

PCT theory:

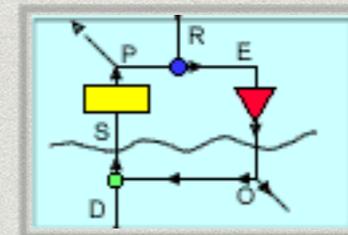
Stated mathematically by two simultaneous linear equations:

$$e = r - p$$

$$cv = d + a$$

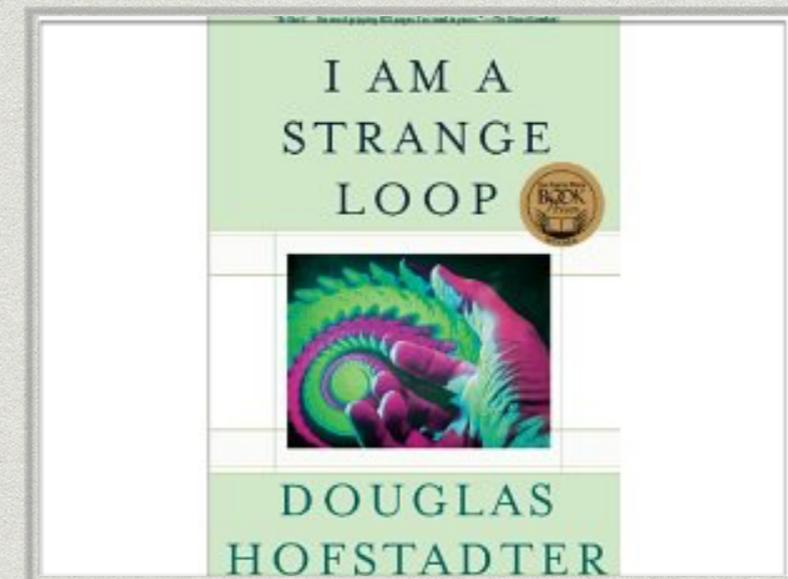
cv becomes i (a function of cv) which becomes p as it enters the organism as a perception

a is a function of e as it is expressed through motor activity into the environment



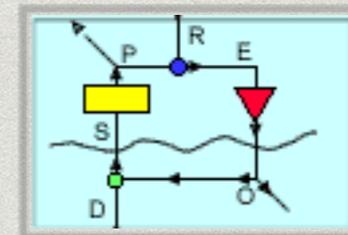
General Comments

DH in another approximation of describing his strange loop on 205-206 requotes Roger Sperry: "In the brain model proposed here, the causal potency of an idea, or an ideal, becomes just as real as that of a molecule, a cell, or a nerve impulse. ... And they also interact with the external surroundings to produce *in toto* a burstwise advance in evolution that is far beyond anything to hit the evolutionary scene yet, including the emergence of the living cell."



General Comments

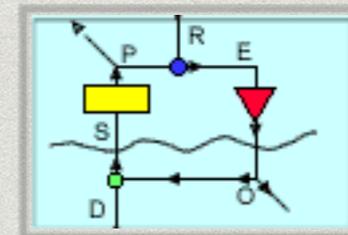
I would go further in the light of PCT the emergence of life IS the emergence of control - see The origins of purpose: the first metasystem transitions by William T. Powers



General Comments

Abstract

This speculative essay concerns the origins of purposive behavior and proposes that this is identically the origin of life. Negative feedback and control offer a self-selecting mechanism that accounts for the long-term stability of replication of the genome, and a related concept of reorganization offers a rationale for the progress of evolved forms into those which exert greater and greater control over the local environment. A picture emerges in which the basic principle of control runs like a unifying thread from the first living molecules to modern complex organisms.



General Comments

**So much for
Strange Loops
and life as we
may know it...**

