

"CYBERNETICS"

by

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An elementary discussion of feedback circuits in cybernetics leading to some preliminary hypotheses regarding equivalent feedback circuits in human relations.

Electronic negative feedback amplifiers

Steam engine governor

Feedback circuits in human communication

Homeostat or Ultrastable system

Freud's use of the concept of homeostasis

Negative feedback circuits and large groups

Religious education of children and feedback loops

References

I- Cybernetics

The feedback amplifiers of electronic engineering have analogous counterparts in mechanical and thermal systems and also in biological and social systems. A block diagram of a negative feedback amplifier is shown in figure 1-1. Consider the amplifier represented by the block which amplifies a small input voltage to produce a large output voltage. If we take part of the output voltage and feed it back to the input, the behavior of the circuit will be changed. If the output voltage adds to the input voltage (positive feedback) the amplifier produces a still larger output voltage. This results in the circuit going into oscillation in which the output voltage increases on each cycle, making an unstable system unless some limiting controls are

introduced: If we design the feedback loop so that the part of the output signal ^{is} coupled back to the input ^{so that it} subtracts from the input voltage (negative feedback), ~~reducing~~ the amount of amplification, ^{is reduced} but ~~making~~ ^{is made} the amplifier stable. An example of electronic amplifiers and feedback amplifiers is given by Sluckin (Sl 1, pp. 75-79).

The example discussed so far is drawn from the field of electrical engineering. There are negative feedback circuits in mechanical and heating systems having the same functions. The governor on a steam engine has a set of weights which are pulled away from the center of a rotating shaft as the speed increases. These weights operate levers which close the steam valve as the steam engine goes faster so that the engine will be slowed down to the desired speed. Illustrations of heating systems and steam governors are illustrated in the Scientific American Books (Sa 1, pp. 5,12).

A possible use of the negative feedback circuit idea in understanding the relationship between two people is proposed as a "working hypothesis" in figure 1-2. This illustration should not be considered as a "fact" or "scientific law" but as an idea to be tested for its validity in nature and history. If this analogy is found to be consistent with the facts which we know about nature and human history, we should use it to help us ^vmove forward from the here now into the future. If it is found to be ⁿincompatible with the accessible facts it should be discarded.

In ^ffigure 1-2, the use of two feedback circuits has been questioned by some engineers. Perhaps the verbal and non-verbal channels should be separated. The nature of human communication is such that much more information than the literal or dictionary meaning of the words ~~is~~ conveyed. For the present, I propose leaving the double set of negative feedback loops in figure 1-2 to help remind us of the existence of both verbal and non-verbal communication.

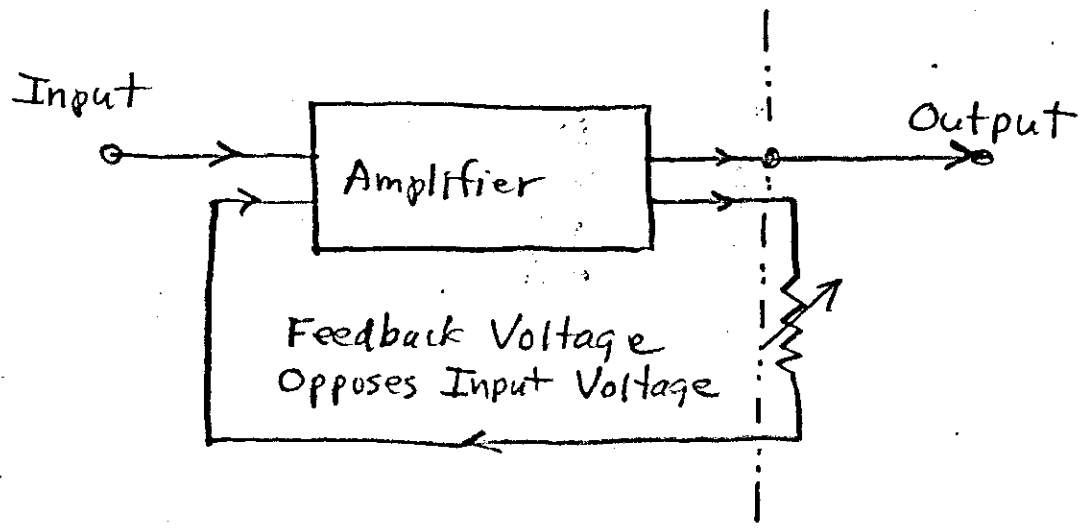
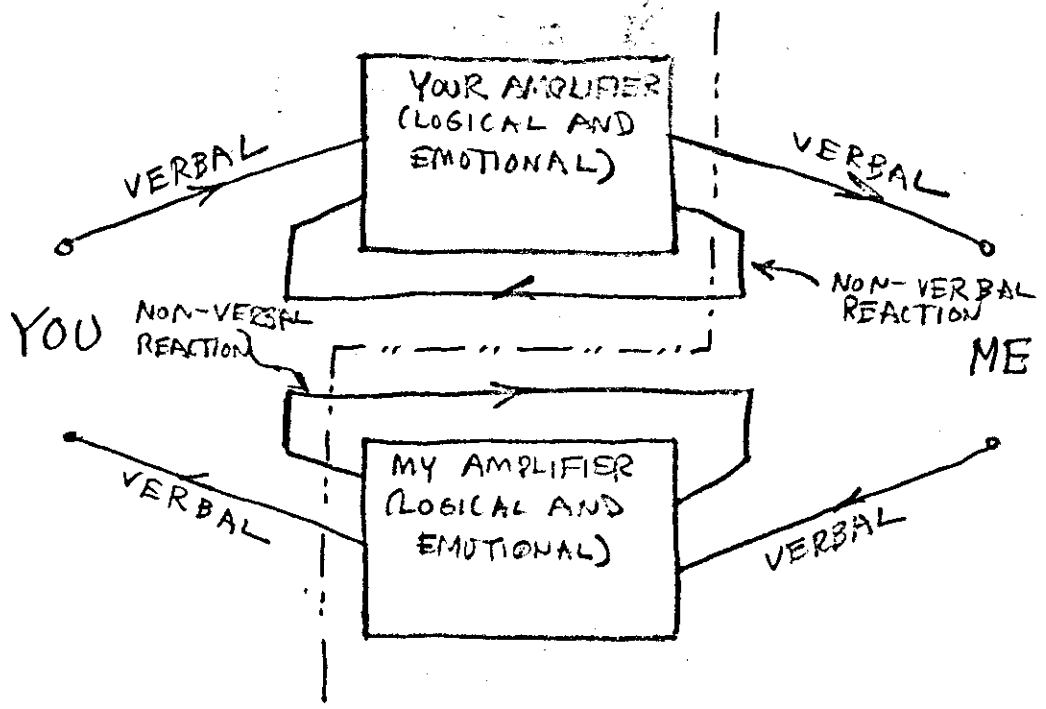


Fig 1-1



A more complicated feedback circuit called the "homeostat" has been designed and built by W. Ross Ashby. The "homeostat" has the property that it can operate in both directions, so it is called an "ultrastable" system. Reference to this work is given by Sluckin (Sl 1, pp. 79-81, 86-87).

Nigel Walker (Wa 1) has pointed out a similarity between "homeostasis" and Freud's psychiatric theories.

"Freud's use of the concept ^{of} homeostasis, in the hypothesis that the nervous system is an apparatus having the function of abolishing stimuli, is of great interest, not only because it represents the pessimistic core of his materialism but also because it appears to anticipate by a quarter of a century the notions of cybernetics. Although it is usually overlooked in psycho-analysis' expositions of psycho-analysis, it is the unifying concept that links together the wish-fulfilment explanation of dreams, the defence-mechanisms of the ego and the repetition compulsion. It also led Freud by a fallacious argument, to the notion of the death-instinct."

There are possibilities of the use of negative feedback circuits to understand the relationship between larger groups of people. Models of our economic system have been developed using electronic feedback amplifiers to represent our capitalist economic system (Sa 1).

In our own Church the religious education program is an illustration of the promotion of the development of the potential feedback circuit functions within our children. An examination of the Martin and Judy (EP 1) books or the Tuckers (EP 2) will show the stories in these books are planned to help the child observe the people and his whole environment in a way which helps him to grow in understanding of his

own and other people's feelings. Thus the child's sensitivity and creative ability to share his feelings are expanded through activities which permit these feedback channels to develop.

References

BP 1 Verna Hills and Sophia L. Fahs, Martin and Judy, Vol. II. Boston Beacon Press (1949).

CR 1 Irving R. Murray, "Automation: challenge to the churches, (our churches must change to cope with 1970's world of 'machines run by machines.')" Christran Register, Sept. 1955, pp. 13,30.

SA 1 Editors of Scientific American, Automatic Control. New York, Simon and Schuster (1955).
 Part 1 Feedback: The Principle of Control
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 II Feedback

SL 1 W. Sluckin, Minds and Machines, Pelican Books, A 308 (1959)
 B 69 Negative Feedback Amplifiers
 p79 Negative Feedback and ultrastability

SM 1 Otto J. M. Smith, "Economic Analogs" Proc. Inst. of Radio Engineers, Vol 41, pp. 1514-1519, October, 1953.

WA 1 Nigel Walker, "Freud and Homeostasis" British Jour. Philosophy of Science, Vol. 7, May, 1956, pp. 61,72.

BP 2 Katherine S. Wensberg, The Tuckers (Growing to Know Themselves) Boston: Beacon Press (1952) p 155, Mary Myrle Northrop "Helping Children Understand their feelings" (A Guide for Adults).

WI 1 Norbert Wiener, "Eight Years of Cyberetic and the Electonic Brain" Pocket Book Magazine, No 2 (1955 pp. 45-60. (Especially pp. 56- 60).

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