Feedback Mechanisms and Self-Regulatory Processes in the Social Sciences

Beginning in the 1940s, the engineer's concept of feedback entered the social sciences. The essence of the concept is a circle of interactions, a closed loop of action and information. Something, presumably causal pressures or information, "feeds around" a hypothesized loop of interactions and eventually "feeds back" to its point of origin. Such loops are essential for automatic control devices ranging from Watts's centrifugal governor for a steam engine to modern thermostats, toilet tank fill valves, and automobile cruise controls. But the thinking that underlies the notion of feedback loops is not simply an engineering idea, but rather a much more general and pervasive perspective with a rich history in the social sciences.

The notion traces back implicitly at least two hundred fifty years in social science literature, and more than two thousand years more generally. When the loop character of societal reasoning has been explicit, it has been variously characterized as mutual or circular causality, homeostasis, control, recursion, self-reference, reciprocal relations, interdependence, and the like. Thus feedback loops, by whatever name they are known, are at the heart of the social and policy sciences. It is not an exaggeration to say that great social scientists are feedback thinkers, and great social theories are feedback thoughts.

Feedback and Self-regulation

Self-regulation is the tendency of an individual or group to try to hold itself in some preferred condition. The generic idea postulates a goal of some sort and a perception that may align with the goal or create a discrepancy. A discrepancy between the perceived and preferred states creates pressures to take some actions to close the gap and bring the system back into some balance. Figure 1 captures the general idea.
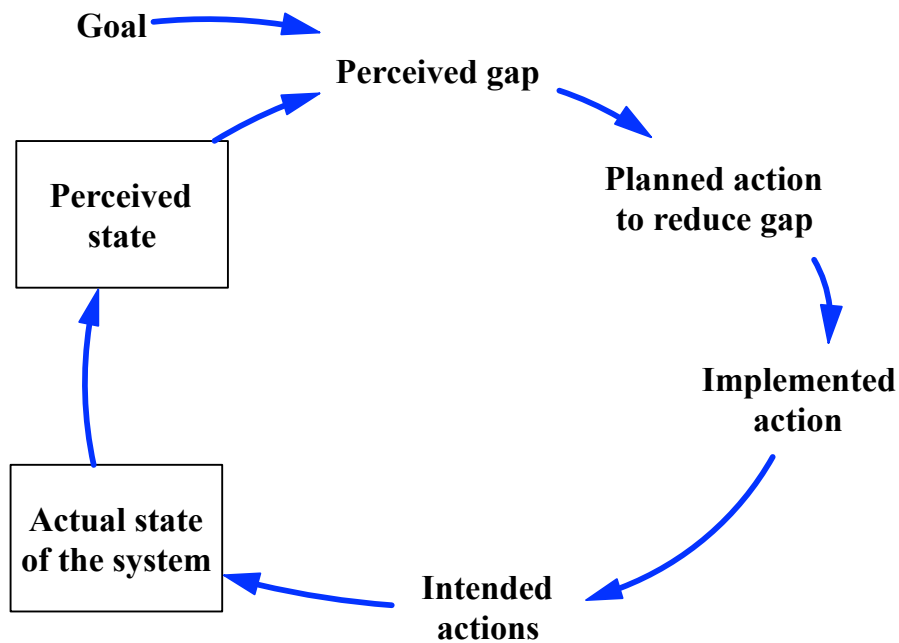
Figure 1: Generic self-regulating feedback loop – a goal-seeking "balancing" loop for an individual or group.

Early terminology called such loops "negative" feedback loops, because tracing around a change in such a loop produces pressures that try to counter or negate the change. Current terminology calls such loops "balancing" or "counteracting."

Examples abound: If one is too cold (a gap between desired and actual conditions) one puts on a sweater or coat, thus working to close the gap and be comfortable. If the supply of some commodity is insufficient to satisfy demand, price would tend to rise, pulling demand back closer to supply (one of Adam Smith's "invisible hands" at work). If a population outstrips its ability to feed itself, various mechanisms would act to limit growth (if the food supply can't be increased fast enough, Thomas Malthus saw socially conscious "preventative" checks and nasty unavoidable "positive" checks, both of which create balancing loops). If government excesses emerge in a democracy, the self-interests of the governed should produce actions that would control the excesses (the authors of the Federalist papers explicitly

argued for such self-regulatory governmental mechanisms in the United States Constitution). More modern social and behavioral science examples include Festinger's notion of the motivating power of cognitive dissonance, the importance of vision, mission, and monitoring to guide planned action in strategic management, and the actions of the Open Market Committee of the Federal Reserve to adjust interest rates to try to keep inflation in check and the economy on a stable growth path.

Self-Regulatory Loops in Context

Suffice to say, all purposeful self-regulatory action of an individual or group can be thought of in terms of one or more balancing feedback loops of the sort generalized in Figure 1 (sometimes without an explicit identified goal). In practice, things are much more complex than that single loop, for two reasons. First, in any social, economic, or political setting we have many actors, not just one, and thus many goals and many goal-seeking balancing loops interacting over the same issues. The picture becomes complex very quickly. Second, in any one of those balancing feedback loops there are often implicit goals that people have not surfaced, even to themselves; actions often have unintended consequences; and while efforts focus on closing some perceived gap between goal and perception, the system can move of its own accord under a host of other forces, including explicit resistance to implemented goal-directed actions. Figure 2 suggests this more complicated picture.
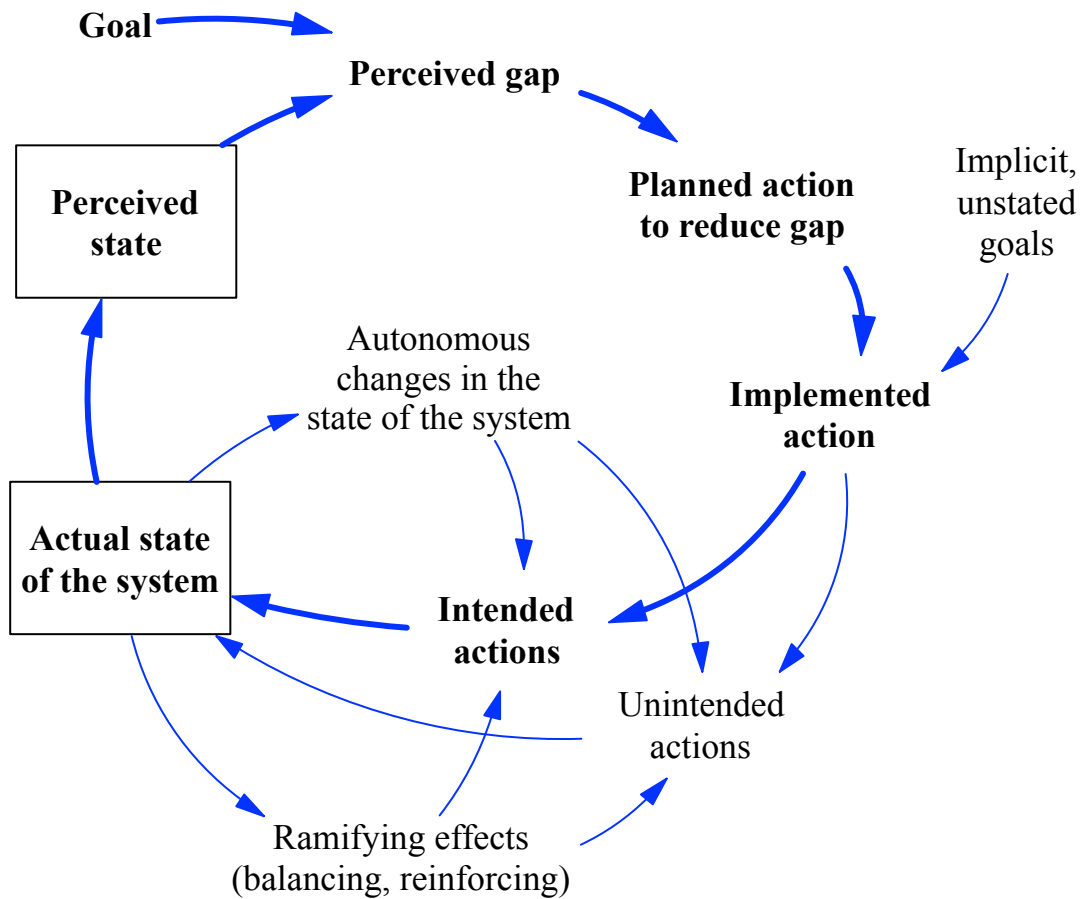
Figure 2: Goal-seeking balancing loop of Figure 1 complicated by implicit goals, unintended consequences and systemic changes that can, and often do, thwart attempts at self-regulation.

The picture in Figure 2 contains six feedback loops. With more actors or stakeholders and more interconnected sets of loops like Figure 2, the interacting complexity grows dramatically, and we have the complicated dynamics that social, economic, and policy sciences struggle to understand. Furthermore, some of the loops in Figure 2, or a more complicated version with more actors, may not have the balancing or self-controlling character of the loop in Figure 1. Some of those loops could be so-called *positive* or *reinforcing* feedback loops.

Reinforcing Feedback Loops

Unlike balancing loops, which tend to counter a change, reinforcing loops tend to move further in the direction of change and amplify it, adding instability. Again, examples abound, many of which were recognized in social science literature before the emergence of the engineers' uses of feedback: John Stuart Mill noted that speculators, seeing a rise in the price of a stock or commodity, come to expect the rise will continue and so increase their purchases, thus driving up the price still further. In a "vicious circle," a term that in the 1600s flagged faulty logic, we now have a bad situation that leads to its own worsening. And when supporters of some social or political movement grow and attract still more supporters simply because of growing popularity, we have what's called the "bandwagon" effect, named for the tendency of people attracted to crowds following the first vehicle in a circus parade. The self-fulfilling prophecy was so labeled by Robert King Merton to flag a prediction that starts out false but becomes true because people come to believe it. Merton's examples were predictions of the insolvency of a bank, the fear of failing a test, and the prejudices that discriminate and limit the accomplishments of a group or race and thus reinforce the prejudgments.

Balancing and Reinforcing Loops Together

The importance of self-regulating and self-reinforcing feedback loops in social science stems from what we can understand by employing a feedback perspective. Whether stated, implicit, or unrealized, interconnected balancing and reinforcing feedback loops are at the heart of our deepest social and economic theories and understandings. But it takes a complex view. Figure 3, for example, shows a glimpse of the complex interactions of feedback loops that computer simulation shows us by themselves can generate the patterns of growth, stagnation, and decay we observe in our urban centers.
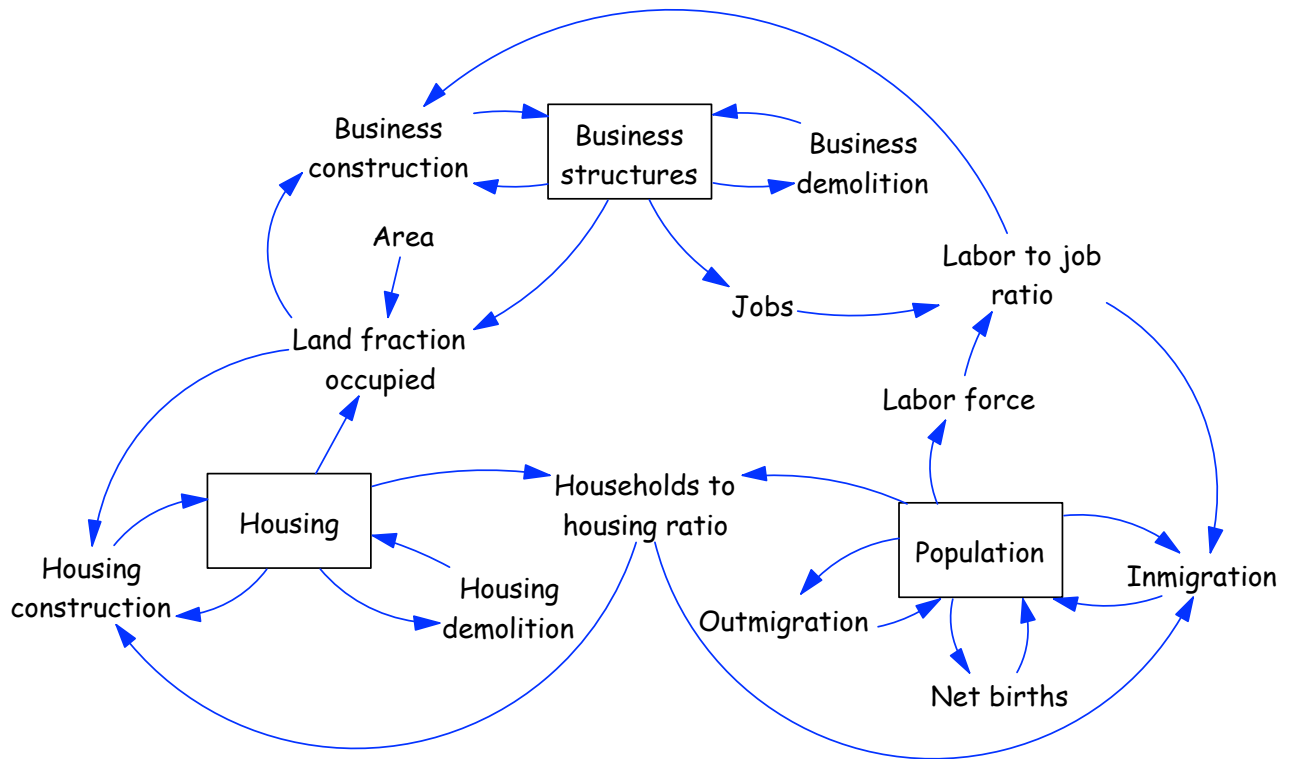
Figure 3: Self-regulating and self-reinforcing feedback loops in the dynamics of a city, creating an endogenous theory of urban growth, stagnation, and decline.

The importance of a feedback perspective in the philosophy of social science rests on the endogenous point of view exemplified in Figure 3. Our strongest social science theories are endogenous theories. Feedback loops enable the endogenous point of view and give it structure.

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Cross-references to other entries in the Encyclopedia of Philosophy and the Social Sciences

Causation in the Social Sciences, Complexity, Invisible hand explanations, Marxism and social/historical explanation, Mathematical models, Systems theory

Further Reading

Richardson, GP (1991). *Feedback Thought in Social Science and Systems Theory.* Philadelphia: University of Pennsylvania Press. Reprinted by Pegasus Communications, Waltham, MA.