

## ECONOMICS AS A SCIENCE OF THE ARTIFICIAL

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### **Abstract**

*This article explores Herbert A. Simon's view on economics as described in his first work "The Sciences of the Artificial". Although the book is less famous than his 1945 book "The Administrative Behavior", it still contains important ideas about the human behaviour, relevant today not only for economics, but also for other disciplines such as design and ergonomics. Economics is presented as a science of the artificial and its core concept – the man is seen as an artificial or behaving system. Simon's perspective is placed in a historical context, underlying his critique of neoclassical economics and his ideas on rationality and decision making.*

**Keywords:** *Herbert A. Simon, Bounded rationality, Human behavior, Decision making, Behavioural economics*

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### **1. Introduction**

At the beginning of the 20th century there were voices arguing against the mathematization of the economy (Veblen, 1898; 1909). Among them, one of the most vehement voices was Herbert Simon, who from the very first pages of his book *The Administrative Behavior* ([1945] 1997) draws attention to the fact that unlike natural sciences in which the economy has often sought examples of in its way of becoming a science, economics lacks realism and its theories are hard to reproduce: In his own words: "This state of affairs constitutes a serious indictment of our science, and of ourselves as scientists. An experiment in chemistry derives its validity-its scientific authority-from its reproducibility; and unless it is described in sufficient detail to be repeated it is

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useless. In administration we have as yet only a very imperfect ability to tell what has happened in our administrative <experiments> - much less to insure their reproducibility.” (Simon, [1945] 1997: pp. xi) Moreover, Simon criticizes the static character of neoclassical economic analysis. In his opinion, just like a liquid poured into an irregular bowl, man lives in the natural, dynamic environment. In the absence of vessel equilibrium - the primordial state of all neoclassical theories, it is easy to assume what happens to the liquid and what form it will take without the need for additional information about the properties of the liquid in question. (Simon, 1959) This vision is insufficient for Simon because it does not say anything about the situation when the environment is a dynamic one, i.e. what happens to the liquid when the vessel is moved? and equally, what happens to a man in a dynamic environment? So, in his view, in order "to predict the short-term behavior of an adaptive body, or its behavior in a complex and changing environment, it is not enough to know only its purposes. We also need to know a great deal about its internal structure and, in particular, about its mechanisms of adaptation." (Simon, 1959: pp. 255) Another criticism brought by Simon to its predecessors is related to the neglect of microeconomics in their analyzes and theories. Simon notes an interest of classical and non-classical economists for macroeconomics at the expense of microeconomics, the latter being in their attention only when it forms the basis of macroeconomic analysis. When considered, microeconomics analysis is a normative one, "the <normal> microeconomist does not need a theory of human behavior; he wants to know how people should behave, not how they behave." (Simon, 1959: pp. 254) Moreover, economists have studied with more interest areas such as the production of goods, the allocation of resources, and product distribution and neglected areas such as decision theory.

## **2. Man as an artificial system**

With regard to human decision making, Simon (1996) views it as an empirical phenomenon, one that is more “artificial” than natural. By defining the human behavior as “artificial”, Simon points out that people behave in an adaptive way according to certain goals and purposes. Just as an artificial system, man is behaving systems defined by an inner and an outer environment. His entire behavior is determined by the two, and when he successfully adapts his behavior, this takes the form of the outer environment, revealing little about the inner. In contrast, when he fails to adapt his behavior reveals the limits of its rationality. So, in his view man is not rational as an

homo oeconomicus as the neoclassical economists used to define it, but having a bounded rationality, which he defines as “ simply the idea that the choices people make are determined not only by some consistent overall goal and the properties of the external world, but also by the knowledge that decision makers do and don't have of the world, their ability or inability to evoke that knowledge when it is relevant, to work out the consequences of their actions, to conjure up possible courses of action, to cope with uncertainty (including uncertainty deriving from the possible responses of other actors), and to adjudicate among their many competing wants.” (Simon, 2000: pp. 25) This bounded rationality determines a bounded behavior determined by the “inner” and “outer” environment. The limits of global rationality promoted by the standard decision making model correspond to both the individual to whom the decision falls and to the environment to which it belongs at the time of the decision. (Simon, 1955; 1956)

First of all, Simon considers the boundaries of objective rationality as a characteristic of the decision-maker. (Simon, 1955) Global rationality implies that man knows and anticipates all the consequences that follow each of his decision, when in fact, knowledge is incomplete and fragmentary.

Anticipating the exact results of each solution or quantification of expectations is also unlikely. The level of knowledge or information of the agent at the time of the decision can be regarded both as an element of the environment and as an element of the rationality of the decision-maker. Due to the lack of exhaustive information, the agent cannot take into account all decision options available at a certain time, which is why many of the possible options are not considered in the decision. Under these circumstances, the possibility of choosing the option that can maximize his utility is extremely small. At the same time, it is necessary to consider the time allocated to the decision. Another limit of global rationality related to the nature of the agent is the lack of unlimited computational capabilities. The process of probability calculation based on Bayes's model, as well as estimates of future utilities, appears to be unlikely in reality, where the agent performs a sequential assessment of them rather than a complete one. For these reasons, the agent resorts to simplifications, an operation that makes it easier for the decision.

The second type of limitations of the standard model are the limits of the environment in which the decision is made. The decision making environment is not equivalent to the real environment, as it is in fact a simplification of the latter. Moreover, simplifying the natural environment depends on the agent's needs, impulses and goals, as well as his perception of

the real world. (Simon, 1956) "The information of the decision-maker about his environment is much less than an approximation of the real environment. (...) In actual fact the perceived world is fantastically different from the "real" world. The differences involve both omissions and distortions, and arise in both perception and inference. (...) The decision-maker's model of the world encompasses only a minute fraction of all the relevant characteristics of the real environment, and his inferences extract only a minute fraction of all the information that is present even in his model." (Simon, 1959: 272) Perception is seen as a filter, but: "Filtering is not merely a passive selection of some part of a presented whole, but an active process involving attention to a very small part of the whole and exclusion, from the outset, of almost all that is not within the scope of attention." (Simon, 1959: pp. 273)

All these limitations, whatever their nature, make the standard model of rationality meaningless: "It is precisely because of these limitations on its knowledge and capabilities that the less global models of rationality described here are significant and useful. The question of how it is to behave <rationaly>, given these limitations, is distinct from the question of how its capabilities could be increased to permit action that would be more <rational>". (Simon, 1955: pp. 112) and as Simon points out, it must be replaced by bounded rationality. This, in contrast with the standard model, includes both substantive rationality – used mainly by economics - and procedural rationality used by other social sciences, especially psychology.

Moreover, the economic models of rational behavior must incorporate theories of adaptive behavior stated in psychology. All this changes are intended to provide a basis in the construction of economic theories of individual or organizational behavior that can also be valid in complex situations of uncertainty and imperfect competition to which the neoclassical model cannot respond.

With this new concept of bounded rationality, the man is not seen as a perfect computation machine, but as an information-processing being, and for this reason there is a need for a new model of decision making. The new model, the behavioral model of choice has different stages compared with the standard model. Thus, enumeration of all alternative strategies, their comparative evaluation and selection of the variant that maximizes utility or profit are replaced by the representation of the problem to be solved, the search for alternative solutions, their evaluation and the choice of the variant offering a satisfactory level of utility.

To illustrate the first stage of the behavioral model, Simon resorts to cognitive psychology. It claims that a person can organize an abundance of information so as to formulate a problem in such a way that it can be solved in the easiest way and with minimal effort. The second stage, the "design", assumes that alternative solutions are not known a priori, but rather are discovered and developed by agents. Inspired by the psychological theory of information processing, Simon argues that in solving problems, people are looking for solutions in a huge space of the problem. The search is guided by rules called "heuristics" that lead the agent only in certain places of the problem space, these heuristics being defined as "radical simplifications" (Simon, [1916] 1996: pp. 28). Evaluation is seen as part of the solution search process: "Evaluations take place, first of all to guide the search - to design itself. They provide the basis for decisions, leading the design in one direction or another." (Simon, 1972: pp. 172) Finally, complete designs are not evaluated among themselves, but compared to the standard defined by the aspiration level.

Taken from the choice psychology, the aspiration level is a concept that designates a value at which it can be assimilated to a value of 0 on a thermometer that measures the temperature. Unlike the standard theory in which utility could only have positive values, psychology admits that satisfaction (utility) can also have negative values. Above zero, the agent feels some satisfaction, while below zero he feels some dissatisfaction. For each dimension, the possible expectations define the aspiration level that is compared to the present level of the dimensions considered. If expectations exceed the aspiration level, they will be felt to be positive, satisfactory.

Otherwise, the agent feels dissatisfaction. This component, the level of aspiration is also the one that gives the dynamic character of the behavioral model of decisions because it varies depending on the information that the agent possesses and on the environment - in a medium with good alternatives it tends to increase over time whereas in a difficult environment is diminishing. (Simon, [1916] 1996; 1978) Aspiration level is the one that provides a computational mechanism to the agent, the evaluation of alternatives and the decision depending on it. Thus, if an alternative is considered satisfactory, the agent will decide on it, otherwise he will continue to look for another alternative to satisfy him. We observe that in the behavioral model the decision rule has changed from maximization and to satisfying. (Simon, 1959) (Table 1)

Economics is in Simon's view "the science that describes and predicts the behavior of several types of economic agents - the consumer and the entrepreneur." (Simon 1959: 254), focusing on "a certain part of human behavior". (Simon, 1978: pp. 1). He also accepts Robbins's definition ([1932] 1935) that economy is the study of the allocation of resources limited to competing purposes, but points out that the allocation of resources is done under the postulate of rationality, rationality that has been misinterpreted in the economy. Simon defines rationality as "A mode of behavior that is suitable for the fulfillment of proposed purposes, within certain limits imposed by conditions and constraints." (Simon, 1972: pp. 161) emphasizing the fact that rationality is in fact a set of skills with which people can accomplish a goal proposed under certain conditions, so in his view, rationality is more a "selection of effective means" (Simon, [1945] 1997: pp. 72) The behavior is considered rational if it is well suited to the purposes. Decisions are rational if they lead to actions aimed at achieving the goals and presuppose "a selection of an alternative from among several." (Simon, [1945] 1997: pp. 72) and the action is to a certain extent rational if it is aimed at a purpose. (Simon, [1945] 1997) In contrast, irrational action is defined as "insufficiently adapted to the purposes." (Simon, 1993: pp. 393)

**Elements of standard model of choice and behavior model of choice developed by Herbert Simon**

<b>Decision Element</b>	<b>Standard model</b>	<b>Behavioral model</b>
<b>Rationality</b>	Global rationality, <homo oeconomicus>	Bounded rationality (substantive and procedural rationality)
<b>Environment</b>	Real	Affected by perception
<b>Choice alternatives</b>	Already known	Searched and created through <Design>
<b>Computational capacity</b>	Unlimited	Limited
<b>Informational level</b>	Exhaustive	Limited
<b>Nature of problem</b>	Given	Represented by man with the help of psychological process (memory, attention, motivation etc.)

<b>Dynamic element of model</b>	None	Aspiration level
<b>Decision rule</b>	Maximization	< Satisficing >
<b>Behavior</b>	Maximizer	Adaptive

Source: (Author's own elaboration)

### 3. Conclusions

Simon's view on man and Economics is different from other economist because he sees it as a science of the artificial, as when facing a decision, people create designs in order to reach their goals and purposes. They use the information from the outer environment and with their limited information processing capabilities try to find the best option to meet their needs. This view on human behavior and decision making has set the basis for the <old> behavioral economics (Sent, 2004) and later for the work of Kahneman and Tversky (1984; 1979), as Kahneman (2003) himself states, and Thaler (2008). Outside the economic field, Simon's perspective of the man as a behaving system has an important role in design and ergonomics. (Norman, [1988] 1990)

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