Self-Organization, Embodied Cognition and the Bounded Rationality Concept

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Abstract

This research has aimed to debate some decision making theoretical principles, in particular the bounded rationality concept. The conceptions of cognition subjacent to this concept, its main limitations for understanding the human decision process and the possible contributions from two other theoretical perspectives- the self-organization process and the embodied cognition concept have been methodologically analyzed. The concluding comment claims that: a. other forms to conceive the human cognition are still necessary to better understand the cognitive basis of human making decision process; b. the Self-Organizing and Embodied Cognition Theories, as understood here, might constitute themselves as relevant contributions to the development and reflection concerning the making decision process and the Bounded Rationality concept.

Keywords: decision making; bounded rationality; self-organization; embodied cognition.

Introduction

Electing perspectives for acting and making decisions are critical aspects of the human life and theoretical explanations about these topics could be retraced to the Greek Antiquity. A common characteristic to several of these explanations is concerning the conception that the decision making is essentially a logical-rational process, in which utility principles are prevalent. This conception has became historically stronger and influenced by four sources: the Illuminist thought from XVII century, the probabilistic mathematical theories elaborated from XVIII century, the Utilitarian philosophical-economic theories from XVIII century, and the Neoclassic Economic theories, developed from XIX century on (Buchanan & O'Connell, 1996; Taleb, 2007; Glimcher, Camerer, Fehr & Poldrack, 2009). Since the middle of XX century the approaches that conceive the decision making process under the *expected utility* premises - like those that have been derived and influenced by F. Ramsey, von Neumann e Morgestern (1944), L. Savage (1954) e R. Jeffrey (1956) works – have obtained a wide and important diffusion. These theories have constituted an important scientific advance for understanding the human decision process, presenting for the first time questions about the decision maker preferences, the capacity to order among several variables and rationally choice the *best decisional option*. They have thus created conditions to think more deeply and systematically about the role of the decision maker subjectivity to the decision process. However since the last years from XX century the Expected Utility Theory has been the target of a strong criticism, mainly concerning: a restrictive conception of the human cognition, understanding it basically as an "algorithmic machine", b. the idealization of the decision maker as a super-rational agent, omniscient and omnipotent within the decision process and c. the concept of information on which this theory relays, quantitative and syntactic, making the relation between the informational input and the value attribution to the decisional variables a paradox[1]. These critics have stimulated other theorizations characterized by reconsidering two principal questions: the optimized reason principle and the Maxim Expected Utility principle.

The Bounded Rationality Concept: cognitive presuppositions

H. Simon when contesting the conception of rational/optimized decision considered its substitution for the concept of satisfactory decision; founded on three main issues: a) the human beings are cognitive and perceptually restricted, never being able to fully apprehend the environmental complexity, b) these restrictions impact the decision making process, generating a "cost", compelling the decision maker to find alternative actions that satisfy the decision requirements at other levels ("satisficing" principle) and c) the difficulties and restrictions found in making a decision disclose and clarify its significance, making the process to find satisfactory alternatives adjustable to the decision maker limitations and to the environmental parameters.

These statements sustain the bounded rationality concept developed by H. Simon and formalized in *A Behavioral Model of Rational Choice*, in Models of Man, 1957. In Simon's definition this is the term used "to designed rational choice that takes into account the cognitive limitations of the decision maker- limitations of both knowledge and computational capacity" (1997, p. 291).

[1] See Kahneman & Tversky, 1979; Simon, 1989, Juarrero, 1999; Gigerenzer & Selten, 2001.

The bounded rationality concept is widely used at present and has been employed in several areas "to relax" the strong rational view (decision optimized paradigm) concerning the Classical Decision Theories. Despite that, the comprehension about the *nature* of human cognition upholds the same principles in both approaches, mainly: a. the appeal to the symbolic-normative reasoning, b. the ontological and epistemological gap between subject/object and c. a tight relation among the conception of rationality, truth criteria and a necessary coherence (consistency) between the decision maker and their purposes.

In an article from 1993 A. Vera and H. Simon explained the conception of cognition underlying to the bounded rationality concept. The reasoning process is understood as a sequential and symbolic (internal) computational processing of information[1], recursively operating within this basis: input - processing of information - output (reply/behavior). Symbols, on this perspective, are patterns: "(…) when we say that symbols are patterns, we mean that pairs of them can be compared (by one of the system's processes) and pronounced alike or different, and that the system can behave differently, depending on this same/different decision."(Vera&Simon,1993,p.03).

The information/symbols processing is thus conceived: a) inputs are received from the exterior environment as patterns of sensorial stimulations and codified by perceptual processes in symbols; b) these symbols are indexed and stored in the long term memory; c) the elicitation of the meaning denoted by the symbols is made by another symbol, used as input, to get access to a referring object stored in the memory, to affect it or to be affected by it.

It is observed that this conception is, essentially, the same used for computational mind theories[2]; that have not been satisfactorily successful to explain the plasticity and flexibility of the human cognitive – and decision making- process. Simon and Vera (1993) have added contributions from the Behavioral Psychology to this conception of computational mind, relaxing thus some of the hardest cognitivist arguments. This Behaviorist basis can be especially observed when the authors argued for a semantical basis in their conception of computational cognition[3]: the patterns received/perceived for a system are already abstracted, represented and stored with an aggregated meaning. This meaning, not being universal, which would be opposite to the concept of bounded rationality, would follow the material and cultural surroundings in which the (symbolic) system is inserted. In such a way it would –circularly- justify, for example, the different attributions of meaning that exist among/within distinct cultures.

[2] See also Argyris, 1973; Walczack, 1998 e Patokorpi, 2008.

[3] See Rastier, 1996; Floridi, 2004.

Simon had aimed during his academic life to understand *how* human cognition and decision making process really *work*. But does the juxtaposition of elements of two theories (computational mind theory and Behavior Psychology) both of that understanding the cognition and the behavior in terms of causal or functional relations, based in input/output or stimulus/response, appropriately elucidate the human cognitive processes? Or the making decision process? Does the human cognition really "operate" on a computational-representational model? Could the information, at least in the scope of the living beings, still continue to be narrowly understood as a "data flow"?

The concept of bounded rationality, while circumscribing the rationality and decision process limits, situating them as context-time dependents, modified the general comprehension about the human decision-making process. But this "new" focus does not seem yet satisfactory to *really* understand the human cognition; at least not under the behaviorist-rationalist perspectives that remain underlying to it. For a more "realistic" theoretical approach about the decision and cognitive human processes other ontological and epistemological bases are fundamental. We discuss that these bases must be searched in a conception of embodied cognition, which conceives the cognition as a vital self-organizing process.

Cognition: an embodied self-organizing process

The self-organization concept is intended as concerning to the natural process of trends ordering observed in complex systems, both artificial and natural (Debrun, Gonzales & Pessoa, Jr., 1996; Haken, 2000; Piers, Muller & Brent, 2007). It was a term "coined in the 1940s to label processes in which systems become more highly organized over time, without being ordered by outside agents or by external programs" (Shalizi et. al., 2004). A concept strongly attached to this is that of emergence, here understood as the appearance (materialization) of qualities not yet observed in a system from its self-organizing interaction and that cannot be understood by the analysis (on an individual basis) of the relations or elements of the system[4].

Within the scope of this paper both concepts the one about self-organizing process and the one about emergence are relevant for representing by which the organization of a system modifies itself; reaching other levels of complexity. This complexity alteration that enables a system to diversify its surrounding coupling is the definition here conceived to the embodied cognition concept, or "vital cognition". In the core of this conception (and following Hutchins, 1995, Clark, 1997, Zunda, 1999, Wheeler & Clark, 2007, Calvo & Gomila, 2008), the cognitive process is qualified by some undissociated attributes: it's situated, social and

[4] See Bissoto, 2007, 2008; Halley & Winkler, 2007.

distributed. It's observed that within this conception it is not necessary to dichotomously disembody the affective/rational attributes from the human cognition. As embodied beings situated and embedded in a physical circumstantiality, whose comprehension is semantically and socially constructed, reason and emotion/affection are imbricated, mutually influencing themselves, being not possible to disentangle one from the other.

Some theoretical approaches between the bounded rationality and the embodied cognition concepts are possible. The (behavioral) premise of the first concept implies in an interactive relation system/environment and in a situated and embodied action - in the sense that there is a material "body", natural or artificial, acting in a determined time/space. However there is a fundamental difference between both the proposals concerning to *how* the system-environmental interaction occurs.

The bounded rationality concept, when epistemologically considered, can be described as a meaning-sign appropriation one. The system is always acting to apprehend the reality "really" existent in the exterior world, generating diachronically a response/a behavior resulting of the symbolic decoding. When understanding the embodied cognition as a self-organizing movement of a system the main epistemological assumption is that the interrelation system/surrounding is an *interpretative* one. Although it does not discard the assumption of an existent materiality that sustains, displays and sets parameters for the embedding system/environment, there is not in the embodied cognition concept the comprehension that this materiality contains any meaning that could *objectively* be abstracted by a system. According to these considerations signs - and information - are not entities that "carry" an aggregated meaning. They are rather material elements that arise modifications: they provoke the formation of an interpretation, implying in a systemic attribution of value and in changing perspectives for the interacting system. There is not, in this optics, incomplete or badly-structuralized information: everything that can be perceived/selected and meant/interpreted as relevant, from the vital dynamics of each system, comes to be meaningful; guiding the action of this system in the space-time of its surroundings[5].

The making decision process

Decision, within the embodied cognition perspective as here understood, is the *choice* executed by a system concerning to its adaptative efforts. This adaptative process is, by the way, understood as integration, as relational adjustment to the changing enviroment, rather than forced behavior of adequateness. It is a process to make the world meaningful[6] and must address the dynamical self-organizing system "health" and not just looking for a satisfactory or excellent platform of stability. A "good" decision is one that prepares the system to get energy and informational resources, which will lead it to other (richer, in the system's optics) possible organizing openings.

Socially, the decisor's choices still within the embodied cognition perspective are understood as enlargement/disclosure of other interactive horizons which will impulse the enaction of new meaning attributions and therefore the institutions self-organizing vitality; rather than the statement of decisions that aims narrowly a prompt and short-termed efficiency of certain functions of those institutions.

In this scope the bounded rationality concept might be understood considering the perception and action limitations inherent to a determined system in the circumscription of the possibilities for the embedding of this system resulting of order parameters: those boundaries that once emerging from the system/surrounding coupling work as attractors, "forming"/enacting a decision pattern. The analysis of these order parameters by the system itself (or by an observer) can "materialise" for this system an *interpretative* understanding of this dynamics, causing it to be less "evanescent" and allowing the system to disclose which will be the next organizational parameters to be configured, making a dialogue with its trajectory possible.

Understanding the decision making processes under this embodied-self-organizing cognitive perspective is relevant for considering: a. that the "utilities" or preferences of the system are dependents from the historical of interactions system/surroundings already constituted for a system, b. how this system has been successful to perceive other organizing horizons and c. to make possible to think the decision making process as a decentralized one, systemic and surrounding distributed and not circumscribed to the logic-cerebral rationality. The "not-rational", "irrationals" or the "bad" decisions are not conceived as errors but as tied within the organizing perspectives of a system, any evaluation of that could just be thought *a posteriori*, and for the observer's perspective.

The actions assumed for a system (a decision maker) within the incessant informational and energetic flow that this access, are conflicting. Any decision attends to the certain states of the system, ignoring others. There is a momentary "pacification" of the system although a state of "unsated" is always latent, which pressures the system to levels of criticality. From these levels the system could organize itself in new relational situations. But it can be "crystallized" or also "paralyzed" when not obtaining informational and energetic resources that allow it to foment or to choose other organizing routes; which would stimulate the emergence of other systemic configurations. Furthermore a system could reach so high disorder levels

[5] See C.S.Peirce, 1972.

[6] See von Uexkhüll, s/d; Skarda & Freeman, 1987; Johnson, 1999; van Djik et. al., 2008.

(from inherent reasons, like a disease, or from surroundings reasons, like a catastrophic event) that its decision acts would attend just minimal organizational requirements, and its organizational continuity would become impracticable.

Concluding Comments

The decision making theories, including those that follow the bounded rationality principles, have traditionally supported the idea of a decisor agent that controls a data flow – received from the outside- by rational/intellective cognitive process, obtaining therefore a better decisional management. Nevertheless, other decision making process conceptions are possible, mainly when one considers that the decisor system/environmental relation involves more than the creation of syntactic mental models - or, still, as defended by the bounded rationality principles, a (weakly) semantic model.

Kunreuther & Meyer's research (2001) show us information relative to a survey about complex making decisions, which are referents to important aspects of our daily life like health, family, security and financial decisions. The authors analyzed the contrast between how this kind of decision should be made and how they are made (Kunreuther & Meyer, 2001, p. 05). The concluding comments claim that the human complex decision making are characterized for not adequately considering the available information about the probability of an event to occur, fail when differentiating these probabilities, in terms of relevance, attitudes showed for thoughts like "these things will not happen with me"; are strongly influenced by normative social rules, the social *status quo*, the present situation- "I'd better not think about this ever", emotions and affects, failing to learning from other decisional situations.

These remarks also allow us defend the assumption that the research for others ways to comprehend the human making decision process is still a strong scientific requirement. As has been discussed in this paper the embodied concept and the self-organization theory are serious theoretical alternatives for another understanding of the human cognitive and decision making process. The decision making process, as understood here, is closely cohesive within the system/surroundings embedding, in the scope of an embodied and self-organizing cognition.

Some theoretical decision-making perspectives have been incorporating both of the concepts here approached. The Embodied Cognition Theory has been employed in the Consumer Decision-Making Research (Malter, 1996), in the studies on Cognitive-Decision Making (Stewart, 2006) and Neuroeconomics (Hardy-Vallée, 2007) and the Self-Organizing Theory has been thought in the analysis of the collective making-decision (Johnson et. al., 1998) and on the descentralization in (economical) social networks (Roy, Nair & Venema, 2009). Despite of these new branches about the decision making process, the main focus of the Decision-Making field still "targets" the human cognition rational aspects.

In the perspective of this paper further researches could analyze if under this theoretical bases we could increment the human decision process a. debating alternative ways to theorize what is information and its role in the decisional process; b. understanding the cognitive process as "using" the information interpretatively, when this "usage" is nestled in a systemic organization and not relying just on rational capacities and c. widening the interpretative universe of a system, searching to better comprehend *how* the social and distributed cognitive attributes would favor to this system "disclose" organizing alternatives.

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