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## IMAGES AND ECONOMIC BEHAVIOUR

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*Abstract.*

This paper is based on the hypothesis –put forward by the cognitive approach to economic phenomena- that behaviour of economic agents is driven by their mental representations.

We develop thus the insight that such representations include not only beliefs and linguistic statements but also iconic information in the form of mental images. When the symbolic meaning of mental images is taken into full account the whole process of knowledge construction appears to be more complex than economic literature has held.

In the traditional approaches to economic decision-making, agents can develop only linguistic knowledge that may be represented through "mental propositions" (Fodor, 1975). Already within the boundaries of this perspective, individuals process identical sensory stimuli in subjective ways, and therefore obtain different knowledge. Our claim is, however, that the relevance of subjectivity in the context of economic choice is much wider, as the inclusion of imaginative thought in the cognitive repertoire of agents can help explain.

The paper is organized as follows. In the first part, mental images are interpreted as a method of knowledge representation characterized by symbolic specificity and not reducible to language. On this theoretical ground, we then extend the "Image Theory" proposed by psychologists Beach and Mitchell (1987; 1998) to economic decision-making. As a main consequence, a different "vision" of the economic agent emerges.

**"Imagination of the future,  
like imagination of the past, are devices for  
living in the present"  
(J. March)**

1. IMAGES IN THE ECONOMIC AGENT'S  
MIND

Although mental images have been almost completely neglected by contemporary economic theory, in the history of economic thought distinguished scholars, such as Simon, March, Shackle<sup>1</sup> and Boulding, have attributed a significant role to imagination, intended as production and representation of information in form of images. For reasons of synthesis, it is not possible to carry out a detailed historical reconstruction of this contributions. In this paragraph we will limit our attention to the pathbreaking book entirely devoted to this topic by Kenneth Boulding, "The Image" (1956)<sup>2</sup>. "The Image" conceives mental images as a filter for perceptual data and mostly as interface between human perception and knowl-

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<sup>1</sup> According to Shackle (1955; 1972), the choice process can be thought of as being structured into the three following steps: the first, sequences of potential actions are imagined; the second, they undergo a screening process which tests their chance of becoming "real" in the decision maker's vision of the world ("*must be tested for possibility*"); the third, each deemed possible sequence is evaluated on the basis of its desirability.

At that last step, emotions and affects are deeply involved and function as choice criteria. Among the anticipations of future emotions "attached" to each deemed possible scenario, the one which offers "*a good state of mind*" is selected.

To summarise:

- Choice is among imagined options.
- Imagination has limits.
- It is used to build choice options.
- It is constrained by subjective knowledge and interpretation of external reality.
- It has emotional and affective roots.

<sup>2</sup>For a critical review of this book, see Patalano and Rizzello (2003).

edge. The author's ideas refer to biology, economics, political philosophy, organisation theory, history and sociology, with a chapter dedicated to each of these disciplines. As a result, the book provides a wide and rich interdisciplinary excursus.

Every man has a self-image, which includes a picture of his place in space, his acknowledgement of being part of a time flow, the perception of the universe around him as a world of regularities and the sensation of being part of a human relational network. He then has an image to evaluate reality ("*value image*") which intervenes in his relationship with the external environment embedding information with meanings, an "*affectional or emotional image*" which provides him with feelings, attitudes and motivations, and an image concerning the degree of reality of his own perceptions. Finally, he has a public image in which he compares his images with collectively shared images at different levels of consciousness.

Knowledge is built up through a process of subjective selection and interpretation of external data whose organising principle is represented by the image; in this sense it functions as an interface between input and output, where the latter can be either new knowledge or actions<sup>3</sup>. Boulding's excursus points out some identifying regularities of the image, apart from the conceptual context in which it is analysed, mainly its plasticity, its path-dependence and its resistance to change. These constitutive features express both its temporary stability and its dynamic potentiality at the same time; the image contains elements which enhance its evolutionary tendency as much as internal obstacles to its own development. In the meanwhile, individual imagery

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<sup>3</sup> "...between the incoming and the outgoing messages lies the great intervening variable of the image. The outgoing messages are the result of the image, not the result of the incoming messages. The incoming messages only modify the outgoing messages as they succeed in modifying the image" (Boulding 1956, p.28).

has a relevant social function because it enables collective sharing of values and meanings. From this point of view the image has cohesive power which may acquire a strategic value in organisational contexts and in cooperative interaction. At the same time it may enhance the building up of collectively shared expectations about future market performance, to the extent to which a society is provided with a widespread information structure which reaches a large number of market niches. These phenomena of cohesion at the imaginative level can, however, consolidate existing images thus making them more stable through self-enforcement processes, even when they are not adequate for interpreting external reality.

Despite its strong evocative power, in Boulding's analysis, the concept of image does not have a clear definition and, most of all, its relationships with other forms of mental representation, such as beliefs, schemas and propositions is not specified.

## 2. IMAGES OR WORDS?

The *nature* of mental images is a very controversial issue in the history of cognitive science<sup>4</sup>. In this paper we define mental images as representational formats that are characterized by a symbolic specificity which makes them different from linguistic statements.

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<sup>4</sup> The most inflamed controversy is between two opposite lines of thought: one is the so-called "pictorialist", which argues that reducing mental images to more abstract forms of representation will result in losing their figural peculiarity (Kosslyn 1980; 1981; 1990; Pinker, 1984). On the contrary, according to the "propositionalist" line of thought, images do not have symbolic autonomy, and their nature is substantially propositional (Pylyshyn 1973, 1978, 1981, 1984). A strong point in the pictorialist argument is the idea that the cognitive content depends on the means through which it is conveyed, while the propositionalists maintain that the content is independent of the form of representation that conveys it.

In Kosslyn's theory (1980; 1983), mental images have a visual-spatial nature that differentiates them from language. They are generated on an interior screen with "grain" and more or less bright areas, the visual buffer. An image is produced on the buffer when given areas are operated, and is then lost, unless it is retained through a process of "visual rehearsal".

Before Kosslyn's theory, pioneer experimental works on the connections between vision and imagination were carried out by Paivio<sup>5</sup> (1971). Moreover, this connection is at the centre of a classical and long-debated issue in the philosophy of perception known as "Molyneux's question" (Ferretti 1998)<sup>6</sup>, whose basic question is whether or not we can assume that senses share common properties. This debate has been very diversified, and for a long time there has been no convergence towards a definitive solution. Instead, today, psychological research allows us to come to an interesting conclusion based on the idea that vision is a complex system with a vertical and a horizontal dimension (Ferretti, 1998). At the level of low vision the perception of objects generates retinal images (this first process is impaired in a blind person); the data imprinted on the retina undergo further cognitive processing before creating the image which is the

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<sup>5</sup> In his experiments, Paivio underlined that it is easier to memorize a word list if one associates words with figures, and that the same effect can be reached by substituting real mental images for these figures.

<sup>6</sup> In the second edition of the "Essay Concerning Human Understanding" (1694) John Locke added the *jocose problem* his friend William Molyneux had suggested to him in a letter of March, 2 1693. Let us imagine a grown-up congenitally blind person, who was taught how to tell a cube from a sphere of the same size and made of the same metal by touching them, so that he/she can say which is which; let us now assume that we put the sphere and the cube on a table and that the blind person is given back his/her sight; will he/she be able to tell which is the sphere and which is the cube *by means of the sight and before touching them?*" (Ferretti 1998, pp.120-121)

final product of vision (this second processing, characterizing high vision, is usually unimpaired in a blind person). Therefore, if we can convey the same sensory information as included in the retinal image through an unimpaired perceptive canal - touch, for instance - to a congenitally blind person, he/she would be able to process it and "see" it in his/her mind (Cornoldi et al. 1992). Interesting experiments have confirmed this result<sup>7</sup>. A congenitally blind person can process figural images, since visual-spatial information, acquired through non-visual canals, is stored in his/her unimpaired visual buffer (Cornoldi et al. 1992). Imagination and vision share similar information processing procedures, and the visual properties of mental images (creating their figural character) are developed by processing sensory data. The experimental results obtained using PET (Farah 1988) and studying patients whose visual cortex had been damaged (Farah et al. 1988; Kosslyn 1994) have confirmed, also at a neurological level, the presence of a verticalising structure in the visual system<sup>8</sup>.

The relevance of these results for economic theory may be clarified by building a connection between the visual nature of images and the theory on human perception put forward

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<sup>7</sup> In these experiments the TVSS (Tactile Visual Substitution System) was used and designed by Paul Bach-y-Rita. It is made up of three elements: a closed-circuit camera fitted on glasses; a circuit transforming images recorded by the camera into electric impulses; a matrix of mechanical pins (tactors) which reproduce the shape of the object recorded by the camera, according to the stimulus of electric impulses. During the experiment this matrix was laid on the back of a congenitally blind person, so that he/she had a tactile description of the object he/she had to make out. After a few attempts the subjects could guess what the camera was recording and they said they could even *see* the objects (Ferretti 1998). The visual processing used data received through tactile perception, to the point that it became possible to "see through the skin".

<sup>8</sup> The main reference is to Kosslyn's model (1994).

by the Nobel laureate in economics F. Hayek (1952). In "The Sensory Order" (Hayek, 1952) the mind is compared to a classifying structure which does not receive sensory stimuli passively but directs and interprets them. The processing of sensory stimuli is a subjective phenomenon that differentiates economic agents from each other. Even in contexts which - for reasons of simplicity - we might assume are identical for everybody, each agent's behaviour depends on his/her previous perceptive experience and genetic inheritance. This thesis radically changes the traditional microeconomic view on the individual, as seen as a standard person (the representative agent) who is by definition deprived of his/her own individuality. Recent neurobiological research (Damasio 1995; Fuster 1997; Paller 2001) has confirmed Hayek's major intuitions

We suggest that imaginative thought may be interpreted in the light of Hayek's perspective on perception. According to Hayek, the differences between economic agents are due to the subjective nature of perception. Image production adds a new root for subjectivity, as it involves genetic inheritance and perceptual experience built up in personal living at several levels, which go from the lowest retinic level to the subsequent processing of visual stimuli. This result deserves, however, further investigation since the literature on cognitive dynamics in economics has so far assumed that individuals develop mainly propositional knowledge.

In the following paragraphs we will argue that many of Boulding's intuitions, and specifically the close connection between images and behaviour, are still valid in the light of a new approach to decision-making that emerged in psychology.

### 3. "IMAGE THEORY"

"Image Theory" was proposed by the psychologists Beach and Mitchell in the middle 80s as a descriptive theory of human decision making in which individual knowledge is rep-

resented through mental images. When faced with a decision problem, the decision-maker refers to four images:

1. The *self image* which consists of personal values, beliefs, ethics that guide one's adoption (or rejection) of goals and contribute to the generation of potential new ones;
2. The *trajectory image* which is a mind picture of one's desirable future, given the self image;
3. The *action image* which basically consists of plans (intended as sequences of actions) currently used by the subject to achieve his goals;
4. The *projected image*, which mirrors the expected future (in terms of the anticipated results of plans), if one persists with plans that are currently adopted.

A decision consists of adopting or rejecting new candidates as constitutive elements of one's images ("adoption decision"), or of evaluating whether progress towards goals has been made or not ("progress decision"). Decisions are made according to two evaluative criteria, one based on compatibility and the other on profitability. Both these criteria are implemented through computational tests (Beach 1998). As a result of the compatibility test, a candidate is rejected for adoption if the number of its violations of the relevant image constituents exceeds a subjective rejection threshold: in other words, it is rejected if its compatibility turns out to be too low in the personal evaluation of the decision maker. Among the compatible candidates, the one which maximizes the probability of reaching the desirable goals is selected: it is in fact the potentially most profitable candidate.

The main contention of Image Theory is that the foundation of individual decision making needs to be found in the compatibility desire with one's self-image; this desire drives human actions as much as the attempt to avoid self conflict acts as a guideline<sup>9</sup>.

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<sup>9</sup> "Whatever one's principle may be, they are the foundation of one's decisions (...). Our contention is that the motivation for profit, for gain, for ad-

In Beach and Mitchell's analysis<sup>10</sup> (1987) many isolated attitudes of the decision-maker are underlined but a synthetic portrait of his abilities and cognitive features is not explicitly developed. According to our interpretations, the Image Theory's subject could be described as follows.

- He has personal beliefs and basic values that are organised in a network of connections and built up over time; those principles are time dependent variables because they appear to be a product of the individual history and because they can be regarded as dynamic and continually exposed to change. He uses his imagination at least as much as his rationality.
- He has reasonable expectations about his future but also desires and dreams about the life which, potentially, could be his own.
- He has an innate ability to build imaginary scenarios and to regard himself as a part of them.
- He is able to change his self image throughout time.

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vancement, and the values of outcome that contribute to them derives from the degree to which those outcomes promote and comply with the decision maker's principles. It is compatibility that is the key" (Beach 1998, p.9).

<sup>10</sup> An interesting extension to organization theory was proposed by Mitchell, Rediker e Beach (1998) stemming from the idea that each organization has its own "identity" and acts to preserve it. From this point of view they share Selznick's following opinion: "The study of institutions is in some ways comparable to the clinical study of personality. In both personality and institutions, "self-preservation" means more than bare organic or material survival. Self-preservation has to do with the maintenance of basic identity, with the integrity of a personal or institutional "self"."(1957, p.141). Organizational identity, as well as individual identity, can be described with reference to four images: the organizational self-image, the organizational trajectory image, the organizational projected image and the organizational action image. A relevant meaning is attributed by the authors to the mechanisms of resistance to change, as much as to the role played by "doubt" and its appropriate expression in organizational contexts.

- He needs "stories" more than single data. In making a decision he does not examine a list of disconnected information but imaginary plots that are embedded with emotions and affective dispositions.
- He tries to avoid conflict and to act in coherence with his personal living.

#### 4. DECISION-MAKING MODELS COMPARED

In the neoclassical paradigm, choices are intended as results of a computational process which maximises the expected utility of outcomes that are weighted in term of probabilities. This approach involves an axiomatic concept of rationality, according to which rationality is a behavioural rule and consists of selecting that strategy which best solves the maximisation problem. In this paragraph the neoclassical approach is called "traditional decision-making". We would rather classify those branches of decision theory that have been developed as an alternative to the neoclassical one, starting both from experimental research programs and Herbert Simon's work and legacy as "non traditional". The most significant difference between the image based approach, IT, traditional decision-making, TDM, and non traditional decision theories, NTDM, may be found in the decision-maker's description. These approaches will be now compared, in order to suggest a fuller understanding of their theoretical implications. In the comparison we make reference to five conceptual categories: decisional mechanisms; choice criteria; context influence; relevance of past experiences and space for individuality.

##### 1. *Decisional Mechanisms*

TDM: the representative agent is provided with an abstract decisional mechanism, maximisation of utility, and with the "instruments" needed to apply it: perfectly distributed information, instrumental rationality and unlimited computational abilities. When the maximisation procedure is used, it leads to an optimal choice whose subsequent shifting from the

abstract model to the external environment is identified with taking the best possible action. NTDM: the decision-maker has incomplete information, limited computational abilities and bounded rationality. He is influenced by the modality and channels of information transmission, and beginning from external data, develops his knowledge through a personal and context dependent mental process. His choices are sub-optimal but "satisficing", in accordance with a subjective and variable aspiration threshold.

IT: the decision maker hasn't got any abstract decisional rule, but only a bunch of principles that are developed both through learning and personal experiences and are stratified over time in his self-image. He works on external data by including them in mental representations; through this process of adaptation of new incoming messages to formerly existing cognitive structures, he builds up his knowledge. His own network of goals, plans and beliefs can be recalled either by external stimuli, e.g. a new option to act, or internal ones, e.g. the perception of a discrepancy between expected and effective achievements of his performed plans. A search for the solution which best fits his images begins from this recall.

##### 2. *Choice Criteria*

TDM: constrained maximisation of expected utility.

NTDM: search mainly based on heuristics; breakdown of the original task into sub-problems that can be solved independently; exploitation of already experimented routines or attempts at developing new ones.

IT: two criteria are subsequently applied: according to the compatibility rule the principles, goals and plans that are most compatible with existing images are selected, while the profitability test leads the subject to choose the candidate from which the greatest closeness to desirable goals is expected.

##### 3. *Context Dependence*

TDM: the maximisation procedure is abstract and independent from the decision content, it may be applied in any situation and may be perfectly transferred from one context to another.

NTDM: the behavioural routines are selected case by case, according to the decision-at-hand requirements, and then they exhibit strong context dependence; the chance of partial transfer depends on their adaptability from experimented situations to analogous ones.

IT: each situation may activate different *working images* or connections among them, so choices appear to be strongly dependent on context and are weakly transferable.

#### 4. Past Experiences

TDM: personal history has no relevance at all since the decisional mechanism does not indeed depend on individuality, but is completely anonymous and immutable over time. Experience already acquired is not linked to decisional skills, it could exist in somebody else's mind and could be transmitted to the decision-maker in the form of new information.

NTDM: external stimuli are interpreted subjectively and the building up of knowledge is essentially based on interaction between mental schemes and experiences. This also explains why, when exposed to the same information, individuals may have diversified knowledge: decisions are strongly path-dependent as much as mental schemes are and as are the neural maps which contribute to them.

IT: personal experience represents the cognitive and affective background that enables the generation of images. The whole decision process depends on it.

#### 5. Space for Individuality

TDM: the link between choices and personal values is not a direct one, it reveals itself through individual preferences which are, however, considered as exogenous. Agents could be entirely replaced by each other and

their subjectivity has no place if not as a list of data.

NTDM: information processing, choice of heuristics and frame building are embedded with individuality as are the decisions that are based on them.

IT: images are an individual resource and their generation also involves unconscious elements which are subjective; on the other hand, image components are mainly connected by affective and emotional links. The theory makes explicit reference to personal beliefs, desires, motivations and goals. Relationships among these constitutive elements are endogenous.

#### 5. PROPOSALS FOR AN "EXTENDED VISION"

In this paragraph some possible connections between Hayek's theory, Boulding's ideas, and the new Image Theory will be highlighted, so as to suggest a possible interpretation.

Imagination has been included among the basic ingredients of economic decisions by theorists of world fame (Boulding, March, Shackle, Simon), although it was almost completely neglected in the traditional decision-making theory. These contributions contain important intuitions and can be fruitfully integrated with the recent neuropsychological achievements on the nature and function of mental images. In the light of these proceedings, imagination cannot be meant simply as an instrument to fill information gaps concerning the future. If, as underlined by Newell and Simon (1972), intermediate imaginary stages may be found between the initial stage of a problem and its final solution, IT suggests that images also contain the possible solutions, the paths that can be followed to reach them and the obstacles that might block the research process or lead them towards one direction or another. The solutions are chosen only among those elements that are considered to be compatible with the already acquired values, and the threshold of compatibility separates the paths that can be followed from the ones that cannot, within the set of existing images. This



situation in which a subject makes choices by minimising the conflicts with his/her own values may be compared to a kind of temporary equilibrium, since, in the long term, the feedback with the external reality and the plastic nature of the mind tend to modify those images and, as a consequence, it is possible that individual views evolve in unforeseen directions.

*Image Theory* also leads one to reconsider the concept of rationality by outlining the close link between rationality and imagination, when the former is meant in a broader sense than the one that is traditionally fashionable among economists. The introduction of imagination among the basic ingredients of decision-making does not drive one to fantasy-drawn agents, instead of rational subjects, but rather it suggests a broadening of the cognitive substrates on which logic can exert its influence. It does this by including a set of imagined scenarios in the "traditional" list of informational data. Upon this set that is built up by the agent, logic intervenes to select one from among the possible choice options.

Images, as well as mental representations, seem to be structurally characterised by biases; the latter are due to their nature of incomplete substratum, a storehouse of impressions. Nevertheless, this characteristic rather than a limit is a resource which makes it possible to reach fluidity characterising, in Boulding's words, imaginative thought. In the literature on problem solving, re-framing is a key which makes it possible to come out of lock-in situations (Egidi 2002; Egidi and Narduzzo 1997). Similarly, the possibility to re-interpret is the key to the creative abilities that are inherent in imaginative processes. Actually, the mainly conservative inclination of the compatibility test indicates that, in this case as well as with reference to mental representations, subjects tend to resist changing their own views.

The presence of resistance mechanisms, one of the pioneer ideas in Boulding's analysis, is one more unifying element among different cognitive phenomena, and it sheds new light on the analysis of the processes of change. Specifi-

cally, Boulding proposes images which may not evolve or perceive external messages. IT attributes this possibility to a specific point in the interaction between images and possible decisions, i.e. the compatibility test. Subjects tend to act coherently with their own values and basic aspirations, trying to avoid a conflict with their self-image as much as possible. Change is therefore an essentially endogenous process, with its roots in the subject's mind, not only because mental patterns keep evolving - as already argued in literature (Rizzello 1999) -, but also because individual behaviour depends on the images directing it, and it can change only if those images change.

## 6. CONCLUDING REMARKS

The economic literature on decision-making has recently contributed to integrating achievements made in different fields, such as experimental economics, cognitive psychology, neurosciences and artificial intelligence, within a unique approach that is known as cognitive economics. Its research program aims at finding foundations for individual and collective behaviour in the functioning mechanisms of the mind.

Within this approach, however, an analysis of the roles played by imagination is still lacking. Such a topic is surprisingly neglected although it was once largely investigated by well-known economists, such as Boulding, Shackle, March and Simon. In Simon's work on problem solving, imagination is devised as an instrument which helps fill the informative gaps about the unknown future. In our opinion this way of dealing with the topic is too restrictive. As highlighted by *Image Theory*, imagination has many more substantial functions, most of all that of minimising cognitive and emotional conflict.

The analysis of imagining also allows a deeper understanding of the concept of differentiated cognitive agents, as initially shaped by Hayek. A "cognitive" agent may be identified with a subject that is endowed with mental represen-

tations that guide his behaviour. More specifically:

- He creates representations of the world in which he lives and of his desires and intentions by using means which include propositions, schemes and images;
- He has personal beliefs that are partially organised into coherent systems, his theories;
- He acts on the basis of his mental representations in a double sense. Both because his goals and plans are influenced by the contents and the format of his representation and because his behaviour is oriented towards the achievement of goals that have been pre-represented in his mind ("*representation-driven behavior*", Castelfranchi 2002);
- He acts in situations which exhibit structural uncertainty.

Among the mental representations that drive a cognitive agent's behaviour, images appear to be endowed with symbolic meanings which contribute to shape individuality. The subjective roots of economic behaviour are then enriched and actually represents a crucial endogenous element of the choice process<sup>11</sup>.

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<sup>11</sup>The inclusion of images among the mental representations of economic agents has remarkable methodological implications. For a critical approach see Patalano (2003; 2005).

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## Images and Economic Behaviour

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