

SHARING REPRESENTATIONS THROUGH COGNITIVE NICHE CONSTRUCTION

Emanuele Bardone^{1*} and Lorenzo Magnani¹²

¹Dept of Philosophy, University of Pavia, P.zza Botta, 6, 27100 Pavia, Italy

Email: bardone@unipv.it

²Dept of Philosophy, Sun Yat-Sen University, 510275 Guangzhou, P.R. China

Email: lmagnani@unipv.it

ABSTRACT

As a matter of fact, humans continuously delegate and distribute cognitive functions to the environment to lessen their limits. They build models, representations, and other various mediating structures that are thought to be good constructions. In doing this, humans are engaged in a process of cognitive niche construction. More precisely, we argue that a cognitive niche emerges from a network of continuous interplay between individuals and environment, in which people alter and modify the environment by mimetically externalizing fleeting thoughts, private ideas, etc., into external supports. This can turn out to be useful, especially for all those situations that require information transmission, shared knowledge, and more generally, cognitive resources.

Keywords: Cognitive niche construction, Docility, Mimetic activity, Distributed cognition, Ecology

1 INTRODUCTION

As a matter of fact, humans continuously delegate and distribute cognitive functions to the environment to lessen their limits. They build models, representations, and other various mediating structures that are thought to be good constructions. The aim of this paper is to shed light on these activities. In the first part of the paper, we will argue that these activities are closely related to the process of niche construction. That is, we will point out that in building various mediating structures, such as models or representations, humans alter the environment and thus create *cognitive niches* (Pinker, 2003). In the second half of the paper, we will illustrate how cognitive niche construction can have a social dimension, that is: once externalized through niche construction, information, ideas, and private thoughts can be shared with others and thus become a basis for making decisions. We will articulate this point by relying on the notion of docility.

2 COGNITIVE NICHE CONSTRUCTION AS A DISTINCTIVE TRAIT OF HUMAN COGNITION

One of the main forces shaping the process of adaptation is natural selection. That is, the evolution of organisms can be viewed as the result of a selective pressure that renders them well-suited to their environments. Adaptation is therefore considered as a kind of *top-down process* that goes from the environment to the living creature (Godfrey-Smith, 1998). In contrast to this perspective, a small fraction of evolutionary biologists have recently tried to provide an alternative theoretical framework by emphasizing the role of niche construction (Laland et al., 1999; Laland et al., 2001; Day et al., 2003). According to that view, the environment is a kind of global market that provides living creatures with unlimited possibilities. Indeed, not all the possibilities that the environment offers can be exploited by all the animals that act on it. For instance, the environment provides organisms with water to swim, air to fly, flat surfaces to walk, and so on, but no creatures are able to take full advantage of all them. Therefore, organisms try to modify the surroundings in order to better exploit those offerings that suit them and eliminate or mitigate the effect of the negative ones.

This process of *environmental selection* (Odling-Smee, 1988) allows living creatures to build so-called “ecological niches.” An ecological niche can be defined as a “setting of environmental features that are suitable for an animal” (Gibson, 1979: p. 129). In any ecological niche, the selective pressure of the *local* environment is drastically modified by organisms in order to lessen the negative impacts of all those offerings that are not suitable to them. However, this does not mean that natural selection is somehow halted. Rather, this means that adaptation can be regarded by referring not only to the agency of the environment but also to the one of the organism that acts on it. In this sense, humans like

other creatures are *ecological engineers* (Sterenly, 2004) because they do not simply live within their environment, but they actively shape and change it.

Our contention is that the notion of niche construction can be usefully applied also to human cognition. More precisely, we claim that cognitive niche construction can be considered as one of the most distinctive traits of the human brain. It emerges from a network of continuous interplay between individuals and the environment, in which humans more or less tacitly manipulate what is occurring outside to the structure of the environment in a way that is suited to them. In so doing, they exhibit an *epistemic agency* (Sterenly, 2004). Accordingly, we may argue that the creation of *cognitive niches* is the way cognition evolves; for humans can be considered as *ecological cognitive engineers*.

Recent studies on distributed cognition seem to support our claim (Zhang, 1997; Hutchins, 1995; Clark & Chalmers, 1998; Wilson, 2004; Patel & Zhang, 2006; Magnani, 2007). According to this approach, cognitive activities (for instance, problem solving or decision-making) cannot be regarded only as internal processes that occur within the isolated brain. Through the process of niche creation, humans extend their minds into the material world, exploiting various external resources. For “external resources,” we mean everything that is not inside the human brain and that could be of some help in the process of deciding, thinking about, or using something. Therefore, external resources could be artefacts, tools, objects, and so on. In this sense, human cognition cannot be taxonomized individualistically, but it is shaped by (leans on) external resources. That means cognitive activities (for instance, problem solving or decision-making) cannot be regarded only as internal processes that occur within the isolated brain (Clark & Chalmers, 1998). In this sense, they cannot be “taxonomized individualistically” (Wilson, 1994). Problem solving, such as general decision-making activity, for example, is unthinkable without the process of connection between internal and external resources (Bardone & Secchi, 2006).

In other words, the exploitation of external resources is the process that allows the cognitive system to be shaped by environmental (or contingency) elements. According to this statement, we may argue that external resources play a pivotal role in any cognitive process. Something important, however, must still be added, and it deals with the notion of representation: the traditional notion of representation as a kind of abstract mental structure is misleading (Zhang, 1997; Gatti & Magnani, 2005; Knuutilla & Honkela, 2005). Some cognitive performances can be viewed as the result of smart interplay between humans and the environment. The representation of a problem is partly internal, and it depends on the smart interplay between the individual and the environment.

In sum, cognitive systems can be viewed as a set of packages of resources and operations. This set is open to external upgrades and changes and, most of all, is distributed. Indeed, the brain operates on a package of basic cognitive resources. The reason we praise it so much is because of its *portability* (Clark & Chalmers, 1998).

3 MIMETIC ACTIVITIES AND COGNITIVE NICHE CONSTRUCTION

We argue that the process of cognitive niche construction can be considered as a *mimetic activity*. Mimetic activities are all those in which people modify what they find outside to *externally represent* fleeting thoughts, ideas, purposes, etc. and *then* solve problems not manageable with only the help of internal resources (Magnani, 2006b). A kind of process of *disembodiment* occurs because fleeting thoughts and private ideas are secured to external objects and made independent from their author. In doing so, humans create additional representation levels that are external (Donald, 1991). In order to make this point clearer, let us consider an example taken from cognitive paleoanthropology.

Several studies (Mithen, 1988, 1989 and 1996; Eastham et al., 1991; Barton et al., 1994; D’Errico et al., 1994; Lewis-Williams, 2002) on so-called *cave art* have shown that there is a close connection between what our ancestors painted and their hunting activities. More precisely, it has been pointed out that cave paintings were used as external memory supports that stored information concerning animals, locations, vegetation, and so on. Accordingly, we claim that cave paintings can be considered the first information technologies because they were designed for transmitting, distributing, and sharing natural knowledge about hunting and animals. The point we wish to make with this example is that cave painting can be viewed as the result of massive mimetic activities by which a huge amount of information was gathered and then released through a single medium: the paintings. Indeed, that was a kind of information revolution because a new system of transmitting information arose. As just mentioned, mimetic activities were involved in depicting information about animals (tracks, trails, marks on the ground, their locations) that humans could not precisely retain in memory and then communicate. There are also mural images that represent animals in the posture of defecation or while they were nibbling what appears to be vegetation (Mithen, 1988). It seems that all these external representations contributed to creating extremely portable and sharable knowledge storehouses that otherwise would have soon disappeared.

From a cognitive point of view, the possibility of having external representations of various elements of animals and their locations drastically changed the way hunting was carried out by our ancestors. More generally, we maintain that

powerful external representations brought about by mimetic activities contribute to simplifying the cognitive tasks an individual faces (Hutchins, 1995). That is, external representations provide humans with additional computational capabilities that the isolated brain cannot exhibit.

The products of these mimetic activities can also involve and facilitate *creative processes*. Once fleeting thoughts or private ideas are externalized in the environment, the invented structures and configurations not only support existing capabilities (such as remembering or planning) but also find room for new ones which do not have, so to say, “a natural home” within the mind (Magnani, 2006). For example, language, as an artefact, allows people to capture events in words (Donald, 2001; Harris, 2004). Consider for instance, what our consciousness or our thought capacity would be without it. As a matter of fact, talking about things or, better, writing about them drastically improves the quality of our thoughts and can promote creativity.

To sum up, in all these activities of niche construction the environment is materially set up to support and enhance those cognitive activities people are used to doing. From an analytical perspective, we may state the problem as follows: an activity of ecological cognitive engineering is a process in which an agent *A* uses *X* to mimetically represent an aspect of the world *W* for a cognitive target *T*. Moreover, the changes made upon the environment become a sort of *ecological cognitive inheritance* that can be exploited further by other humans. Let us illustrate these issues in the following section.

4 SHARING REPRESENTATIONS AND THE ROLE OF DOCILITY

4.1 The notion of docility

As mentioned in the last section, modifications and changes made upon the environment can be passed on, becoming what we call *ecological cognitive inheritance*. That is, in constructing cognitive niches, humans unearth and uncover new possibilities and chances that become socially available to others. This concerns the way cultural, and also cognitive, transmission may happen. The concept of *memes*, commonly defined as units of cultural information, has been developed in the past to account for this transmission. Our concept of *ecological cognitive inheritance* has something in common with *memes* (Dawkins 1977) with two major differences. Although memes provide an intriguing idea about how culture and ideas can have an evolutionary impact on our lives without being codified genetically, they do not give us any hints about their cognitive relevance. We, however, connect the idea of ecological cognitive inheritance with decision-making and problem solving. That is, externalizations and modifications made upon the environment become the cognitive basis for making decisions and fostering collaboration and cooperation, i.e. most of our knowledge, practical thinking, learning skills, and relational capabilities depend on the others. In order to connect this point to cognitive niche construction we introduce the notion of docility.

Following Simon (1993, p. 156), humans are “docile,” in the sense that their fitness is enhanced by “the tendency to depend on suggestions, recommendations, persuasion, and information obtained through social channels as a major basis for choice.” Simon calls this tendency “docility.” In other words, we support our limited decision-making capabilities by receiving inputs, perceptions, data, and so on from the social environment. Docility can be defined as the tendency to depend on suggestions, perceptions, comments, and information from other individuals, on the one hand, and on the other hand to “provide” them to the others, via cognitive niche construction. We add to Simon’s definition another side of what being docile means: following Bardone & Secchi (2006), we agree that individuals’ docility is not limited to “gathering” something from the social context, but it is expressed also by the act of “providing” information, suggestions, and the like. This element is connected to one of the ways docility evolves in human social environments: that of developing altruism instead of selfishness (Simon, 1993; Secchi, 2005). However, this is not our focus here.

When we link social external resources to externalizations, it clearly appears that docility is the pathway through which cognition is shaped because it is the way to share externalizations. As already argued, the mimetic activities are fundamental in creating information storages from which almost everyone can *pick up* the piece of information he/she is looking for. This contributes to developing the notion of docility: it can be viewed as the standard way individuals gather information and shape their cognitive system through the external resources they find embedded in the environment. It is a kind of *mind set* made up of two main ingredients: 1) allowing the externalization and sharing of private thoughts and, in turn, 2) allowing individuals to gather information and cognitive resources from the others.

4.2 Sharing representations: the case of mathematics

The following is an example which clarifies our previous thesis. Consider the case of mathematics. It is certainly one of the most powerful tools for thought; the main task of mathematicians is trying to reproduce a world in mathematical terms. This is done because, once a world is represented in this way, it is possible to find new facts, relations, and laws about the world by manipulating symbols according to postulates, precise rules, and proved theorems: in doing this we

are crafting mathematics as a cognitive niche. Once an individual *A* represents something in mathematical terms, it can be re-used by and shared with individuals *B, C, D*, etc.; however, in order for the information to be re-used and shared, *B, C, D*, etc., must be docile in the sense that they must be involved in the process of externalization: that is, they must make an effort to adopt the same rules and logic of mathematics. It follows that they do not have as full a control over externalized thoughts as they have over their own. In this sense, docility has been passed on to the system, so that being docile is a necessary condition to be able to take advantage of the new cognitive chances brought about by externalizations. Accordingly, external supports (artefacts, tools, etc.) tend to pass their docility to the (social and cognitive) system they belong to, increasing the cognitive chances and communicability available.

5 CONCLUSION

We have argued throughout this paper that human cognition is shaped by a process of cognitive niche construction. Through this process, humans alter the environment by creating and/or uncovering hidden cognitive chances. The process of cognitive niche construction can be considered as the result of mimetic activities, in which humans create external counterparts, namely, representations, of what they find internally, such as private thoughts, ideas, and so on. Once externalized, private thoughts and ideas become socially available and thus can be suitably shared. In the second half of the paper we have illustrated how sharing representations is connected to docility, that is: docility is *that* tendency which allows humans to exploit all those resources that are socially available.

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