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The Role of Cognitive Niches in Mediating Knowledge, Entropy & Violence

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Abstract

The aim of this paper is to briefly illustrate how the theoretical framework of *cognitive niches* can prove useful to frame not only the cultural development of human beings, but the naturalization of morality as well.

Keywords: Cognitive niches; Coalition enforcement hypothesis; Violence; Morality; Naturalization.

Human Beings as Eco-Cognitive Engineers

Human beings usually make decisions and solve problems relying on incomplete information (Simon, 1955). Having incomplete information means that 1) our deliberations and decisions are never *the best* possible answer, but they are at least *satisfying*; 2) our conclusions are always *withdrawable* (i.e. questionable, or never final). That is, once we get more information about a certain situation we can always revise our previous decisions and think of alternative pathways that we could not “see” before; 3) a great part of our job is devoted to elaborating conjectures or hypotheses in order to obtain more adequate information. Making conjectures is essentially an act that in most cases consists in manipulating our problem, and the representation we have of it, so that we may eventually acquire/create more “valuable” knowledge. It is obvious that a great part of human conjectural activity is devoted to guessing hypotheses (that can be moral as well) about situations and events able to help subsequent decisions and actions. Conjectures (and thus “moral” conjectures) can be either the fruit of an *abductive* selection in a set of pre-stored hypotheses or the creation of new ones: in this sense, abduction – a term from the Peircean tradition – must be understood in an eco-cognitive perspective, which has been fruitfully applied in studies concerning Distributed and Embodied Cognition (Hutchins, 1995; Magnani, 2009). In order to make conjectures, human beings often need more evidence/data: in many cases this further cognitive action is the only way to simply make possible (or at least enhance) a way of reasoning that relies on “hypotheses” that are often hard to produce successfully.

Consider, for instance, diagnostic settings: often the information available does not allow a physician to make a precise diagnosis. Therefore, she has to perform additional tests, or even try some different treatments to uncover otherwise hidden symptoms. In doing so she simply aims at increasing her *chances* of making the appropriate decision. There are plenty of situations of that kind: for example, scientists are continuously engaged in a process of manipulating their research

settings in order to get more valuable information (Magnani, 2009). Most of this work is completely tacit and embodied in practice. The role of various laboratory artifacts is a clear example, but also in everyday life people face complex situations which require knowledge and manipulative expertise of various kinds – no matter who they are, whether teachers, policy makers, politicians, judges, workers, students, or simply wives, husbands, friends, sons, daughters, and so on. In this sense, human beings can be considered *chance seekers*, because they are continuously engaged in a process of building up and then extracting latent possibilities to uncover new valuable information and knowledge (Magnani & Bardone, 2008).

Furthermore, as chance seekers, humans are also *ecological engineers*. Not only technologies and other artifacts are part of this ecology but also morality and, of course, violent modes of problem-solving. That is to say, humans (like other creatures) do not simply live *in* their environment, but they actively shape and change it while looking for suitable chances. In doing so, they construct *cognitive niches* through which the offerings provided by the environment in terms of cognitive possibilities are appropriately selected and/or manufactured to enhance their fitness as chance seekers (Tooby & DeVore, 1987; Pinker, 1997, 2003). Hence, this ecological approach aims at understanding cognitive systems in terms of their *environmental situatedness* (Clancey, 1997; Magnani, 2005). Within this framework, “chances” are that kind of “information” which is not internally stored in memory or already available in an external resource, but that has to be “extracted” and then *picked up* upon occasion.

It is well-known that one of the main forces that shapes 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 sort of *top-down process* that goes from the environment to the living creature (Godfrey-Smith, 1998). In contrast to that, a small fraction of evolutionary biologists have recently tried to provide an alternative theoretical framework by emphasizing the role of niche construction (Laland, Odling-Smee, & Feldman, 2000, 2001; Odling-Smee, Laland, & Feldman, 2003).

According to this view, the environment is a sort of “global market” that provides living creatures with unlimited possibilities. Actually, not all the possibilities offered by the environment can be exploited by the human and non-human an-

imals populating a peculiar environment. For instance, the environment provides organisms with water to swim in, air to fly in, flat surfaces to walk on, and so on. However, there are no creatures able to take full advantage of all of those possibilities.¹ Moreover, all organisms try to modify their surroundings in order to better exploit those elements 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 rebuild and shape “ecological niches”. An ecological niche can be defined, following Gibson, as a “setting of environmental features that are suitable for an animal” (Gibson, 1979). It differs from the notion of habitat in the sense that the niche describes *how* an organism lives its environment, whereas the habitat simply describes *where* an organism lives.

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 elements toward which they are not suited. Indeed, this does not mean that natural selection is somehow halted, rather, this means that an adaptation cannot be considered only by referring to the agency of the environment, but also to that of the organism acting on it. In this sense, animals are ecological engineers, because they do not simply live their environment, but they actively shape and change it (Day, Laland, & Odling-Smee, 2003).

It is well-known that, from the point of view of physics, organisms are far-from-equilibrium systems relative to their physical or abiotic surroundings.² Apparently they violate the second law of thermodynamics because they stay alive, the law stating that net entropy always increases and that complex and concentrated stores of energy necessarily break down. It is said that they are open, dissipative systems (Prigogine & Stengers, 1984), which maintain their status far from equilibrium by constantly exchanging energy and matter with their local environments. Odling-Smee, Laland and Feldman quote Schrödinger, contending that an organism has to “feed upon negative entropy [...] continually sucking orderliness from its environment” (Schrödinger, 1992, p. 73). To create cognitive niches is a way that an organism (which is always smartly and plastically “active”, looking for profitable resources, and aiming at enhancing fitness) has to stay alive without violating the second law: indeed it “cannot” violate it. In this sense

¹In a way, it can be argued that, thanks to material culture, human beings have managed somehow to take advantage of most environments on Earth (and outside of it), but it is a partial success which requires a continuous implementation of resources and knowledge in order to maintain those achievements as persistent.

²It is important to note recent research based on Schrödinger’s focusing on energy, matter and thermodynamic imbalances provided by the environment, draws the attention to the fact that all organisms, including bacteria, are able to perform elementary *cognitive functions* because they “sense” the environment and process internal information for “thriving on latent information embedded in the complexity of their environment” (Ben Jacob, Shapira, and Tauber (Ben Jacob, Shapira, & Tauber, 2006, p. 496)). Indeed Schrödinger maintained that life requires the consumption of negative entropy, i.e. the use of thermodynamic imbalances in the environment.

cognitive niches can be considered *obligatory*: “To gain the resources they need and to dispose their detritus, organisms cannot just respond to their environments [...] to convert energy in dissipated energy” (p. 168).

Evolution is strictly intertwined with this process and so it has consequences not only for organisms but also for environments. Sometimes the thermodynamic costs are negligible (like in the heat loss caused by photosynthesis that is returned to the universe, “which is in effect infinite” – p. 169), sometimes they are not, in this case *abiota* of the environment have no capacity to contrast the niche-constructing activities of organisms (like for example, the atmosphere, which is in a new physical state of extreme disequilibrium in relation to exploitation of the Earth’s limited resources). The only no-costs exception is when organisms die – and lose their far-from-equilibrium status). In this case the dead bodies are returned to the local environment in the form of dead organic matter (DOM), still a kind of niche construction, so to say, also called “ghost niche construction” (Odling-Smee et al., 2003, p. 170). Of course *biota* can resist most thermodynamic costs imposed on them by other niche-constructing organisms, often performing counteractive niche-constructing activities.

Cognitive Niche Construction and the Mediation of Aggressivity

It is important to clarify the concept of cognitive niche that is at the basis of the possibility to grasp human moral and axiological systems in a naturalistic way, and the intertwined violence, which in this perspective still appears in all of its “banality”. A recent book by Odling-Smee, Laland and Feldman (Odling-Smee et al., 2003) offers a full analysis of the concept of cognitive niche from a biological and evolutionary perspective. “Niche construction should be regarded, after natural selection, as a second major participant in evolution. [...] Niche construction is a potent evolutionary agent because it introduces feedback into the evolutionary dynamics” (Odling-Smee et al., 2003, p. 2).³ By modifying their environment and by their affecting, and partly controlling, some of the energy and matter flows in their ecosystems, organisms (not only humans) are able to modify some of the natural selection pressure present in their local selective environments, as well as in the selective environments of other organisms. This happens particularly when the same environmental changes are sufficiently recurrent throughout generations and selective change: “Even though spiders’ webs are transitory objects [...] the spiders’ genes ‘instruct’ the spider to make a new one” (Odling-Smee et al., 2003, p. 9). The fact that spiders on a web are exposed to avian predators suggests that webs can be a source of selection that produces further phenotype changes in some species, such as the marking of their webs to enhance crypsis or the creation of dummy

³Attention is drawn for the first time to the idea of niche construction by important researchers like Schrödinger, Mayr, Lewontin, Dawkins, and Waddington. Firstly in the field of physics and subsequently in the field of the theory of evolution itself. Waddington particularly stressed the influence of organism development.

spiders probably to divert the attention of the birds that prey on them. Hence, also spiders adopt what humans call *cheating* and cognitively alter their cognitive niches to this aim. Cheating is part and parcel of aggressive predatory behavior (Bertolotti, Magnani, & Bardone, 2013). It is of course not appropriate and clearly anthropomorphic to call these kinds of non human animal behavior “violent”, but it remains clear that both in human and non human – especially gregarious – animals the construction of cognitive niches is related to the importance of triggering cooperation and of attacking, more or less violently, other living beings. So the cognitive niches also play, constitutively, the role of carriers of aggressiveness, and in humans, who intentionally build them, they can be legitimately called “moral” and “violent”. This general description of cognitive niches is extremely interesting if matched with Gibson’s definition of a niche as a “set of affordances” (Gibson, 1977). Relying on his concept of affordance, Gibson stresses how the niches characterizes how a peculiar individual *acts* within the niche itself and can be summed up in that individual’s possibilities for action: one’s cognitive niche is indeed made up of a series of possibilities extending between the agent and her environment.

While general inheritance (natural selection among organisms influences which individuals will survive to pass their genes on to the next generation) is usually regarded as the only inheritance system to play a fundamental role in biological evolution, niche construction may play a role over various generations, thus introducing a second general inheritance system (also called *ecological inheritance* by Odling-Smee). In the life of organisms, the first system occurs as a one-time, unique endowment through the process of reproduction (sexual for example); on the contrary, the second system can in principle be performed by any organism towards any other organism (“ecological” but not necessarily “genetic” relatives), at any stage of their lifetime. Organisms adapt to their environments but also adapt to environments as reconstructed by themselves or other organisms.⁴ From this perspective, acquired characteristics can play a role in the evolutionary process, even if in a non-Lamarckian way, through their influence on selective environments via cognitive niche construction. Phenotypes construct niches, which then can become new sources of natural selection, possibly responsible for modifying their own genes through ecological inheritance feedback (in this sense phenotypes are not merely the “vehicles” of their genes). Of course we have to remember that humans are not unique in their capacity to modify their environment, as we have already seen when referring to the case of the spiders that build “dummy spiders” (Wilcox & Jackson, 2002): other species are informed by a kind of proto-

⁴This perspective has generated some controversies, since the extent to which modifications count as niche-construction is not clear, thus entering the evolutionary scene. The main objection regards how far individual or even collective actions can really have ecological effects, whether they are integrated or merely aggregated changes. On this point, see (Sterelny, 2005) and the more critical view held by (Dawkins, 2004). For a reply to these objections, see (Laland, Odling-Smee, & Feldman, 2005).

cultural and learning process that is very often intrinsically social, even if we have to say that animals seem to lack the ability to accumulate information as seen in the human cultural/technological case: Andy Clark ranks human language as one of the most powerful cognitive niches ever developed (Clark, 2006).

Indeed, it has to be noted that cultural niche construction alters selection not only at the genetic level, but also at the ontogenetic and cultural levels as well. For example the construction of various artifacts challenges the health of human beings:

Humans may respond to this novel selection pressure either through cultural evolution, for instance, by constructing hospitals, medicine, and vaccines, or at the ontogenetic level, by developing antibodies that confer some immunity, or through biological evolution, with the selection of resistant genotypes. As cultural niche construction typically offers a more immediate solution to new challenges, we anticipate that cultural niche construction will usually favor further counteractive cultural niche construction, rather than genetic change (Odling-Smee et al., 2003, p. 261).

With a broader explanatory reach than sociobiology and evolutionary psychology, the theory of niche construction simultaneously explains the role of cultural (and so moral) aspects (transmitted ideas), behavior (and so moral behavior, which directly orients the construction of niche construction itself), and ecological inheritance (artifacts, to be intended also as moral/violent mediators). Of course niche construction may also depend on learning. It is interesting to note that several species, many vertebrates for example, have evolved a capacity to learn from other individuals and to transmit this knowledge, thereby activating a kind of proto-cultural process which also affects niche construction skills: it seems that in hominids this kind of cultural transmission of acquired niche-constructing traits was ubiquitous, and this explains their success in building, maintaining, and transmitting the various cognitive niches in terms of moral systems of coalition enforcement. “This demonstrates how cultural processes are not just a product of human genetic evolution, but also a cause of human genetic evolution” (Odling-Smee et al., 2003, p. 27). From this viewpoint the notion of *docility* (Simon, 1993) acquires an explanatory role in describing the way human beings manage ecological and social resources to make their own decisions.

(Lahti & Weinstein, 2005) and (Magnani, 2011, chap. 6) refer to the concept of viscosity to provide an explanation of the gap between the absolutism of morality and the empirical evidence that moral regulations are often infringed with no major consequences either for the whole moral system, or for the very individual who performs the infraction – alas, generating conflicts and violence. Viscosity is certainly constrained by docility, which favors the formation of “the state of being thick, sticky” but also of the state of being “semi-fluid in consistency, due to internal friction”. We said that

the fact that morality is viscous hints at its thickness and being glue-like, thus meaning its capability to be deformed, stressed, pulled apart and reassembled without showing decisive harm to its own stability and reproducibility: this aspect also relates to docility. Viscosity and docility explain how our objectified moral cognitive niches are stable, and at the same time also vulnerable and modifiable. Thus it is easy to see in, a human individual, the stability of moral convictions depending on his stable moral niches, *together with* the spontaneous attitude to “disengage” them – for example resorting to a “re-engagement” in other moral conducts which are not dominant in his present moral cognitive niche, but still present as vestigial traces of previous – no longer dominant – moral cognitive niches (Bandura, 1999; Magnani, 2011).

(Woods, 2013) touches a similar problem, related to docility, when, analyzing fallacious reasoning, he stresses the fact that “Whether full or partial, belief states are not chosen. They befall us like measles”, in other words, “say so” induces belief (doxastic irresistibility). Similarly moral cognitive niches too “befall us like measles”. The problem is related to the effect of what Gabbay and Woods call *ad ignorantiam rule*: “Human agents tend to accept without challenge the utterances and arguments of others except where they know or think they know or suspect that something is amiss” (Gabbay & Woods, 2005, p. 27). The individual agent also economizes by unreflective acceptance of anything an interlocutor says or argues for, short of particular reasons to do otherwise, by applying the *ad verecundiam* fallacy. Accordingly, the reasoner accepts her sources’ assurances because she is justified in thinking that the source has good reasons for them (the fallacy would be the failure to note that the source does not have good reasons for his assurances). Peirce contended, in a similar way, that it is not true that thoughts are in us because we are in them; “beings like us have a *drive* to accept the say so of others” (Woods, 2013).

It is noteworthy that all these information resources do not only come from other human beings. This would clearly be an oversimplification. Indeed, the information and resources that we continuously exploit are – so to speak – *human-readable*. Both information production and transfer are dependent on various *mediating structures*, which are the result of more or less powerful cognitive delegations, namely, niche construction activities. Of course, it is hard to develop and articulate a rich culture as humans did, and still do, without effective mediating systems (writing, artifacts, material culture, etc.). Hence, we can say that, first of all, docility is more generally concerned with the tendency to lean on various *ecological* resources, which are released through cognitive niches. Secondly, social/moral learning cannot be seriously considered without referring to the agency of those mediating structures, whose efficiency in storing and transmitting information far exceeds, from many perspectives, that – direct and non-mediated method – of human beings.

Cognitive Niches as Moral Niches

In the previous section we have tried to show that the concept of cognitive niche is an extremely appropriate intellectual instrument to grasp human cultural and moral systems, and their violent punishment counterparts, in a naturalistic way. It is important to present the moral and potentially violent dimension of cognitive niches. We have said that the activity of niche construction may enter evolution insofar as it modifies the selective pressures humans and other animals have to cope with. From this we can draw two major consequences.

First of all, the activity of cognitive niche construction potentially affects all those who participate and live in the same local environment in terms of cognitive chances made available (or not). That is, eco-cognitive modifications – brought about collectively (like herd-like behaviors) or by certain groups – may affect our shared cognitive repertoire amplifying it but also constraining or even impoverishing it. On certain occasions, eco-cognitive modifications may be considered by some individual (or particular groups of individuals) as threatening, impoverishing, or detrimental for their possibility to solve problems. Basically, they can perceive their cognitive system as if it is externally *hacked* so that they have to partly re-engineer their relationship with the environment, for instance, by modifying their previous habits or simply forcing them to cope with habits perceived as maladaptive or threatening for them or their group.

The second point deals with the role of the *coalition enforcement hypothesis* in cognitive niche maintenance. In fact, the construction of cognitive niches and the preservation and their maintenance through coalition enforcement has indeed a moral (and thus violent) dimension: that is, punishment, control and persecution of in-group free riders, and regulation of out-of-group conflicts (Magnani, 2011). The coalition enforcement hypothesis, put forward by Bingham (Bingham, 1999), aims at providing an explanation of the “human uniqueness” that is at the origin of human communication and language, in a strict relationship with the spectacular ecological dominance achieved by *H. Sapiens*, and of the role of cultural heritage. From this perspective, and due to the related constant moral and policing dimension of *Homo*’s coalition enforcement history (which has an approximately two-million-year evolutionary history), human beings can be fundamentally seen as *self-domesticated animals*. In hominids, cooperation in groups (which, contrary to the case of non-human animals, is largely independent from kinship) fundamentally derived from the need to detect, control, and punish social parasites, who for example did not share the meat they hunted or partook of the food without joining the hunting party (also variously referred to as free riders, defectors, and cheaters) (Boehm, 1999). These social parasites were variously dealt with by killing or injuring them (and also by killing cooperators who refused to punish them) *from a distance* using projectile and clubbing weapons. In this case injuring and killing are cooperative and remote (and at

the same time they are “cognitive” activities). According to the coalition enforcement hypothesis, the avoidance of proximal conflict reduces risks for the individuals (hence the importance of *remote killing*). Of course, cooperative morality that generates “violence” against unusually “violent” and aggressive free riders and parasites can be performed in other weaker ways, such as denying a future access to the resource, injuring a juvenile relative, gossiping to persecute dishonest communication and manipulative in-group behaviors or waging war against less cooperative groups, etc.

From this perspective, the role played by morality (and, thus, violent punishment) is manifold: any activity that involves and signals a commitment toward cognitive niche construction and maintenance is potentially perceivable as violent against concurrent niches. To develop and to maintain some eco-cognitive modifications typical of a certain community implies that those modifications are indeed worth being preserved because they are perceived as good and useful, which immediately clashes with other possible ways of organizing an homologue cognitive niche. If a cognitive niche displays a univocal relationship with the group who developed it and cares for its maintenance, participating in the niche also involves a more or less public endorsement of the group that supports it. Of course one can partake of several niches (and hence of several groups) as long as they do not compete (or are perceived as not competing) in the same area, since no matter how polite the context may be, any conflict is ultimately about violence.

Morality can be considered as part of the niche’s distributed knowledge, and it precisely concerns violence insofar as it regulates (also violent) relationships between individuals in the niche and with those that are confronted with it without actually partaking of it. Such a regulating activity is permitted by the dimension of violence embodied in rules and regulations and related punishments but also tacitly conveyed by the cognitive as we just observed: the most patent case of such in-niche morals are deontological codes typical of highly specific cognitive niches, but to different degrees they are traceable in every cognitive niche. Of course, the explicit dimension of normativity is concerned in this characterization of the cognitive niche as moral knowledge expressed in the different registers of rules and regulations is one of the pillars of niche maintenance. Even if a niche is not primarily involved in prescribing certain behaviors to its members, a contextual decency is required in order to obtain a state of homeostasis in intersubjective relationships. Should a niche seem to be totally devoid of general normativity, it would thrive insofar as it was laid upon a wider cognitive niche that is in turn heavily concerned with morals and norms, namely, religions, political and legal institutions and so on.

Concluding Remarks

It is easy to see that the violent potential constitutively embedded in any cognitive niche actually displays the underlying dimension of structural and symbolic violence (Magnani,

2011, chap. 1). Structural violence is seen as morally legitimate insofar as it plays a crucial role in the activities of niche maintenance. Immediately we have to note that when parents, policemen, teachers and other agents inflict physical or invisible violence for legal and/or moral reasons, those reasons do not cancel the violence perpetrated and violence does not have to be condoned in so far as it is not always perceived as such. On the other hand it must be analyzed how in the case of structural violence those perpetrating agents do not seem to act only on their own behalf but on that of larger institutions that can be political, industrial, economic or religious. Such institutions populate structural violence not with actors but rather with what we call “violent mediators” (or in the extreme case of human beings that have turned themselves into violence mediating socio-cultural “artifacts”, as in the role of the policeman in the framework of structural violence).⁵

Structural violence may acquire its most subtle and omnipresent form as the symbolic violence perpetrated by language. As a device of social mediation language is necessarily a cognitive niche mediator (and hence distributor) of violence as well. The violent nature of language is a fact too easily admitted to allow serious reflection, as if every speaker were aware of this horrible truth and wanted to get rid of it as soon as possible, even by simply acknowledging it and leaving it at that. As we have already pointed out, a gentle cluster of speech forms innocently distributes harmful, abusive, destructive, and damaging roles, commitments, inclinations and habits. Language, which is the very moral medium of cooperation and non-violence, also involves unconditional violence even against the speaker herself, insofar as by language one acquires and imposes dominion not only over fellow human beings but also over one’s conscious and less conscious self, framing thoughts and emotions in the rigid crystallization brought about by words. The importance of symbolic violence should not be disregarded for one very simple reason: the only requirement to become a perpetrator is easy to meet as it consists in a basic knowledge of the niche language, and the very fact of speaking a language makes the speaker both potentially and actually violent in the symbolic dimension. Culture, knowledge and more highly developed speech abilities may not necessarily help, but conversely they positively turn an agent into an even more subtle perpetrator of violence: we already mentioned Gibson’s definition of a niche as a *set of affordances*: such definition could perfectly fit the case of a moral, violent niche. Knowledge externalizations may constitute moral affordances, becoming possibilities for an individual’s *moral* acting. Yet, should an individual not develop, or acquire, the correct moral affordances, she might be perceived as violent by the rest of the obliging community populating and maintaining the niche – and hence be *violently*

⁵The regulatory dimension of structural violence is often diluted in the pervasive form of narratives conveying “moral templates”: the fairytales that are told to children from early youth, novels, plays, dramas and – more recently – motion pictures are all involved in the dissemination of some moral, economic or spiritual teaching, but they also circulate via gossip (Baumeister, Zhang, & Vohs, 2004).

punished: what should be further studied is whether defining a moral niche as a set of moral affordances leads us to label it, as the other side of the coin, a set of *violent* affordances, of chances for violence.

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