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From individual minds to social ones. Cooperation and the structure of animal and human societies.

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Abstract

The aim of this paper is to highlight the role of the social factors among the different forces which influence natural selection. To do this, we’ll start analyzing an example of highly complex society, like that of the baboons, in order to show that the building-up of a society depends on extremely flexible and continually negotiated social relations, rather than on features that are genetically determined. However, in our view, when we shift from animal societies to the human ones, we have to recognize the central role of language. In fact, even if the role of social influence appears to be relevant in other animal species, in humans it was language that provided the way to make this social influence much more important, to redefine the roles, to reverse the genetic dominances even more, and to make human cooperation something unique.

Keywords: cooperation; social influence; evolution; language.

Introduction

The concept of cooperation can be particularly useful to throw a new light into the building-up of societies both in animals and humans. A more in-depth analysis of the ways in which cooperation works in different animal societies, can allow us to assign the right role, in the evolutionary perspective, to social influences and non-deterministic factors like chance, history and the single choices of the individuals belonging to one group. Our framework is the one suggested by Weiss and Buchanan, which provides “an alternative view of natural selection in which there is more slippage and tolerance, multiple solutions with larger acceptability spaces, and the possibility that an adaptive fit will be ‘good enough’ rather than seamless” (Weiss and Buchanan 2009, p. 305). In this perspective, we’ll start analyzing an example of highly complex society, like that of the baboons, in order to show that the building-up of a society depends on extremely flexible and continually negotiated social relations, rather than on features that are genetically determined. Baboons’ society seems to be a good example of the way cooperation can modify, and even reverse, the genetic dominances. Our examination of the role played by social influence in these non human primates will bring us to look to the interaction between society and biology in a different way, both in animals and humans.

The survival of the fittest. Or not?

The law of evolution is that the strongest survives. This seems to be what Darwin (1859) has taught us. The fittest do survive, and produce offspring, the others simply don’t. At first glance, baboon males, with their aggressive anatomy, seem to be the perfect image of the law of the strongest, and the perfect match between anatomy and behavior (Washburn and DeVore, 1961; DeVore and Hall, 1965): remarkable canines, big mantle of hair, large body size, all seem to suggest that the social rank, and therefore the reproductive success, is determined by the males’ fighting ability. But then, why, on a closer inspection, the social structure turns up to be matrilinear, where females have political functions (besides motherhood) that are not defined in terms of their relationships with males? Why the male hierarchies, based on the phyrsical structure, can’t predict the priority of access to resources (including the females), and not even the winner in a fight?

Clearly, in Darwinian (and also in NeoDarwinian) terms fittest is not necessarily the strongest, but often the smartest, the swiftest, the most patient, and so on. Darwin would agree that not always the strongest survives (as claimed by hyperdarwinism). Various authors recently focus on a more general “multilevel selection” theory, and on the compatibility between individual selection, kin selection and group selection (Pievani in press). They identify the level of the population structure as the key factor, offering a
pluralistic perspective within the theory of evolution. Here, we suggest to focus on the relationship among individuals (including the ecological constraints) rather than on the single member of a species. And, in the case in question, if we want not to miss these factors, we must take into account something else, apart from the role of competition; we have to refer to the role played by cooperation if we want to have a clearer idea of the way the baboons’ society works. Baboons have some alternatives to aggression, social strategies that are less risky and that settle competition and defense. These alternatives are based on “special relationships”. For example, a potential loser can come back to the aggressor with a baby on his belly, and thus leading the aggressor to back off. In order to be successful, however, a special relationship between the male and the baby is needed, and this relation must be grounded on trust. Thanks to this special relationship, thus, the infant will start screaming when becoming closer to the aggressor, making him the object of mobbing by the group. But without trust, the infant could scream at “the false friend” rather than at the opponent, and the male could run the risk of himself becoming the object of mobbing.

Baboons use their social abilities in other different ways. For example, an older baboon can get copulation thanks to his social skills; he can monitor a male from a distance, manipulate aggression between this male and his closer followers, and then, while he’s engaged on a fight, he can dash to his consort, copulate with her and become her new partner. In general, one can notice the same trajectory through a male’s life history, “from socially unskilled maturing male with growing physical powers (using aggressive strategies) to the socially skillful mature male whose success depends entirely on social expertise when he is old (using social strategies of competition and defense)” (Strum 2012, p. 6). The possibility to use different alternatives to aggression makes baboons’ society more complex and less predictable. Among baboons, it is not always that the strongest wins.

**Evolution in action**

Strum (1987; 2012) had the opportunity to “test” natural selection. Because of the increasing encounters with humans, Strum and his colleagues had to translocate three groups of baboons to the arid savanna of Eastern Laikipia Plateau. This was a unique opportunity to test the baboons’ adaptability and to look at the moment where a behavior becomes crucial for survival and reproductive success, rather than infer it ex-post, as scientists usually do. Strum notes that “if ever there was a situation where survival of the fittest should operate, where competition should have had an upper hand, this was it. Instead […] the translocation, pointed out how evolutionary principles get embedded in a specific time and place and why context matters. Each group’s ‘natural history’ illustrated a variety of different paths” (Strum 2012, p. 8).

The process of adaptation was actually much more complicated than expected, and chance and individuals’ social abilities played an important role. Relationships between the immigrants and the indigenous troops were also crucial for survival, for examples an immigrant baboon could follow an indigenous one in order to “adjust” his diet or to find water. The possibility to observe the process of adaptation in action allows us to take a hard look at the natural selection, which can’t be reduced to the survival of the fittest. More precisely, when observing the behavior of a group, one can notice the large amount of flexibility (including the possibility of mistakes that don’t lead to extinction) depending on the group’s social complexity. Thus, we agree with Strum, when she claims that “evolutionary time speculations of cause and effect assume rather than clarify how evolutionary principles are situated by chance, contingency, and history. This is because they either lack the information or ignore the importance of context and ‘black-box’ the relationships between real behaviors and evolutionary outcomes” (Strum 2012, p. 10).

**Natural selection is not enough**

The idea according to which the survival of the fittest is not the unique force to guide evolution is not a new one. There are in fact many elements, coming from different fields of studies, which contribute to “soften” the adaptationist aspect that Darwin’s theory (especially in some of its contemporary versions) risk to endorse. For example, the evo-devo researchers highlighted the role of structural constraints. As a matter of fact, some forms are not present in nature even if their absence can’t be explained through natural selection, because they seem to be very small variations of other forms that are actually produced. These unexpected absences seem to suggest that natural selection can’t help but choose among the possible variations, for it can’t interfere with the fixed ways that are prescribed by the laws of development (Minelli 2009). The modern molecular biology, from its corner, seems to confirm the fundamental role played by the constraints, because the properties of very different living beings
are grounded on the same mechanism of molecular conservation. Genes involved in behavior are highly conserved during evolution (Gehring and Ikeo 1999, Carroll 2000) and one can find genetic and behavioral homologies even between traits that evolved convergently (i.e. not from an immediate common ancestor, cf. Shubin et al. 1997). As claimed by Gould (1997, p. 36) “most biologists feel that such stability acts primarily as a constraint upon the range and potentiality of adaptation, for if organisms of such different function and ecology must build bodies along the same basic pathways, then limitation of possibilities rather than adaptive honing to perfection becomes a dominant theme in evolution. At a minimum, in explaining evolutionary pathways through time, the constraints imposed by history rise to equal prominence with the immediate advantages of adaptation”.

Moreover, we must look at the role of adaptations from the perspective of long-term evolutionary trends. These trends show that evolution can’t be described as a gradual accumulation of adaptations within a population. The actual picture is much more similar to the punctuated equilibrium described by Gould and Eldredge (1977), long periods of stability (even million years of stasis) punctuated by the branching of new species, that only in limited cases can be described as adaptive improvements of some individuals within a species.

In this long-term perspective, the adaptations with immediate effect can even play no role in survival. In the North American Pleistocene megafauna extinctions the species that went extinct did not have characteristics that set them apart from those that survived; so these processes are not deterministic but they are contingent and complex because the individual’s behavioral responses are often unpredictable (cf. Gilbert and Epel, 2009 and their eco-evo-devo).

But what we want to stress here is that, among the different forces which influence natural selection, the social factors have to be taken into account. Thus, to come back to this influence, we have to mention another kind of selection, the sexual one.

The idea that the stronger the male is, the more reproductive success he has, comes from Darwin’s theory of sexual selection. According to this theory, males and females obey to different behavioral patterns: the former would be passionate, the latter coy. “Males of almost all animals have stronger passions than females […] The female, on the other hand, with the rarest exception is less eager than the male” (Darwin, 1871, pp. 272-3). Males would fight over the possession of females, and females would be agents of selection, choosing only the most virile and showy males, because these features would guarantee many healthy descendants.

Evolutionary psychology, that applies sexual selection also to humans, gave us a very simplified (and quite grotesque) picture of the relationship between male and female (and therefore between man and woman). Males would be more promiscuous because sperm are supposed to be cheap and they would therefore spend all the time looking for females to fertilize. Females, on the other hand, would be more “choosy” because pregnancy is expensive and they would have to guard themselves from wrong investments into “bad” genes. But, as explained by Roughgarden in her book Rainbow (2004), what actually happens in nature proves these theories wrong. Males are not always passionate and females are far from being always coy. Once again, baboons’ society shows us that females often present to males, but are refused by them. Why should males refuse females in heat when sperm is supposed to be cheap? Moreover, females don’t select always the best genes. They can prefer mating with males who turn out to be good fathers (e.g., in protecting the eggs) rather than males that are dominant in competition with other males. For example, whether a male of sand gobies is dominant in competition for nests does not correlate with whether he is a good father in protecting the eggs. And the goby female knows it; in fact, an experiment reported by Roughgarden (2004) showed that the females of this species regularly select the males that would protect the eggs, and that they don’t care if the male they preferred won some fights against other males. These cases show us that male success rests on more than the male dominance hierarchy, and that it depends on different factors, including the relationships based on collaboration that he is able to build (as baboons have taught us). So, it seems that, as Strum says in her paper (2012, p. 15): “there are multiple ways for individuals to succeed, not just one optimal evolutionary path”.

From a complex society to a complicated one.

Language and cooperation

Nature provides us with various examples of strongest males that are not successful. But we would like to stress above all that it provides us also with examples of extremely complex societies, with constant negotiations about roles, where the strongest doesn’t always win over the weaker, and where a large amount
of intertwined relationships reverses the genetic hierarchy. These data show that society is nature, and that there’s no opposition between the two terms.

But there is no difference in complexity between the baboon’s society and the human one, then? We could say that baboons are pretty much human? It is evident that we won’t find, in the animal kingdom, something that compares to the social and technological complexity of Homo sapiens. Nevertheless, baboons’ society reveals the shared roots of social complexity which, in our continuistic framework, found our society, too. But what made human sociality all the more complex than baboons’ one?

We believe that what makes our sociality so complex is the presence of language. First of all, the faculty of language seems to be one of the variables that allowed that jump which 40,000 years ago gave rise to the first symbolic uses and to the sudden and explosive variation of human tools. As claimed by Spelke (2009), the technological abilities specific to humans probably descend from the possibility to combine representations of objects and representation of actions in a rapid and flexible way, and this ability depends on the combinatoriality typical of human language.

Moreover, language gave us the opportunity to shift from a linear transmission to a cumulative one. Horner and coll. (2006) described in an experiment that chimpanzees are able to spread learned techniques in a linear way. The authors examined a diffusion chain paradigm, whereby a behavior is passed from one individual to the next in a linear sequence: different methods used to obtain food were accurately transmitted along two chains of chimpanzees, with a remarkable fidelity of transmission within each chain. Faithful transmission is not therefore a distinctive feature of human species. But there is a significant difference between linear and cumulative transmission (Tomasello, 1999; Richerson and Boyd, 2008). If humans had only the possibility to faithfully spread a technique across multiple generations, the different practices of tool making would have been almost unchanged through the hominids’ evolution. Humans, on the contrary, are able to refine the acquired techniques and to transmit these improvements, so that we won’t have to start all over each time. According to our vision the cumulative transmission, which is possible thanks to the cognitive abilities specific to humans, changed its nature with the emergence of language. And this doesn’t mean that language simply “helped” to transmit the traditions and made this transmission more rapid. The simple fact that, thanks to language, it is possible to learn how to use a tool in its absence, inaugurated a completely new way to transmit knowledge. Moreover, a real technology implies the ability to plan and design combination of tools that are more and more complex, and it is also language that develops and improves this planning ability in a significant way.

At the end of her paper, Strum asked herself what would happen to baboons’ society if they wore hats (Strum 2012). If they had the possibility to symbolize their roles this way, these roles would be stable in time and space and baboons wouldn’t need to point them out or continually negotiate them. But baboons don’t use these kinds of symbols, and therefore they can’t simplify their negotiations and they have to spend a lot of time making them evident and visible. In other words, they can’t manage more complexity and they can’t build a complicated large-scale society, which we sapiens can do thanks to language.

But, in our view, language isn’t just a set of labels that gave us the opportunity to spare time. Or, in other words, it is not just a tool of communication, as claimed by the vast majority of evolutionary linguistic theories (cf. e.g. Dunbar 1998, Bickerton 1990). Language is a kind of technology, that manages the manipulation of perceived elements into representations and can conversely express inner needs by linking them to the external world (Pennisi and Falzone, 2011). Language is species-specific to sapiens for it is an auditory-vocal technology (speech making) applied to symbolic needs and highly specialized, just like the manual technology (tool making). We don’t need to refer to a human specialty or uniqueness: the auditory-vocal technology relies on the evolution of structures and functions which come from a long evolutionary history, but that in non-human primates acquired an adaptive role thanks to the social organization (and to other aspects like passage to bipedalism, parental care or social learning).

The thesis according to which language is a modality to represent the world rather than just a tool of communication doesn’t belong only to the philosophical and phenomenological framework today. PET and ERP studies showed that language is heavily involved in the building-up of our knowledge about the world, that kind of knowledge which we build because we belong to a social and linguistic specific community. Hagoort (2005) found in the Broca’s area the neural locus where the “checking” between linguistic expressions and social reality would occur. These data seem to confirm our hypothesis according to which language is a technology that serves to
represent reality.
Since we have language, it’s not possible for us to choose another technological modality to express our symbolic needs, apart from the auditory-vocal technology. Humans can’t help but use language to represent the world. So the possibilities that modern sapiens’ biological features gave us granted the development and use of a function which worked as a catalyst for the others that were already present and phylogenetically inherited. These abilities have been improved thanks to the interaction with the possibilities of segmentation which language gave us. Finally, language provides a cue to social preferences, which in turn have an effect on cooperation. Experiments with children from five months to five years provided evidence for an early developing social preference for members of one’s native language group; even infants who have not begun to produce or understand speech show this preference. This implies that children prefer to play or work together with people of their native language, and that “infants and young children are selective social learners and cooperators, and language provides one basis for this selectivity” (Kinzler et al., 2012, p. 2). Thus, language isn’t simple a way to improve communication skills, but it conditions the way we perceive the others (familiar or not, friend or not) and the possibility to collaborate with them. This is a clear example of how language can have a cognitive function in humans, rather than simply a communicative one. In our view, this cognitive role is linked to the articulated nature (speech-making technology) of our language (Pennisi, in press).
Moreover, linguistic development seems to have an effect on the ability to cooperate with peers: children who are more skilled in talking about their own and others’ actions and internal states and who refer to themselves and others using personal pronouns are also better at cooperating with their peers (Brownell et al. 2006).
Thus, language seems to be the key factor of human sociality. Even if we can’t underestimate the role of social influence in other animal species, because it appears to be huge also without language, we have to consider that, in our species, language provided the way to make this social influence much more important, to redefine the roles, to reverse the genetic dominances even more, to create societies grounded on values, like money or institutions, which have been negotiated once for all, and, finally, it was language that made human cooperation something unique.

References


