The Origin of Morality: From Behavioral Synchronization to Moral Norm Internalization

Yijun Yang[1, *]

[1]Division of Social Sciences, University of Chicago, Chicago, Illinois, the United States of America

*Corresponding author: yijunyang@uchicago.edu

Abstract. The origin of human morality has always been a myth that draws the interest of research. Not until the flourish of the comparative approach to studying nonhuman social animals and infants did our understanding of morality start to develop. By reviewing the studies employed in this approach, the present review presents the first comprehensive synthesis of the evolved infrastructures that allow the acquisition and internalization of moral norms, with an expositional novelty that pictures the continuum of the origin of morality. By making phylogenetic and ontogenetic comparisons, the Nature-versus-Nurture debate surrounding morality is resolved: culturalization scaffolds the internalization of moral norms; while the evolutionary adaptations for prosociality and cooperation provide the biological basis that makes this internalization process possible. Hence, on the one hand, humans are not unique in possessing the evolved mechanisms that facilitate cooperation. On the other hand, however, humans excel other social animals in sharing and reading intention, seeking fairness, and creating and maintaining moral norms. Together, the reviewed evidence in the field of evolutionary psychology supports that morality is indeed a collection of both biological and cultural adaptations that facilitate cooperation and solve the problems occurred when cooperating.

Keywords: Morality; Comparative approach; Human evolution.

1. Introduction

The debate of *Nature-versus-Nurture* surrounding human morality has never ceased to attract the interest of academia. Although philosophers spent thousands of years and produced countless texts, the origin of it remains controversial [1]. Under the guidance of the Darwinian theory of evolution [2, 3], psychologists and anthropologists employed a comparative approach to understanding the origin of morality: Phylogenetically, inter-species comparisons are made to understand the evolution of basic infrastructures that facilitate cooperation and prosociality [4]; Ontogenetically, developmental scientists adopt both experimental and longitudinal approaches to investigating the maturation of morality in infants and children [5].

By taking those approaches to study human morality, morality, as a complex collection of both cultural and biological adaptations [1], has been dissected into basic components that are shared by nonhuman social animals and are manifested by infants at a very young age [5]. However, previous reviews either focused exclusively on the ontogeny or phylogeny of prosocality [5, 6], and only one of them [7] linked the evolution of prosociality ambiguously to morality (natural normativity). Thus, the present review attempts to fill this methodological gap by synthesizing the existing theoretical and empirical literature relevant to this issue. To make this review an integrated whole, two questions are addressed: First, what allows morality, and to what extent its' components are shared phylogenetically with other social animals; Second, on what biologically basis and mechanism do human culture scaffold the construction of culturally created moral norms.

2. Method

The present review synthesized abundant theoretical and empirical works on morality with a novel approach: under the theoretical guidance that morality is a collection of biological and cultural solutions to the problems occurred in cooperation (hereafter, MAC) [1], it follows that any adaptation that evolved facilitating cooperation is a potential component that constitutes and allow morality.

Thus, from the phylogenetic perspective, morals are indeed not a human-unique feature nor solely a product of cultural evolution; Instead, the necessary infrastructures of morality should be seen ubiquitously across not only different human societies but also all species of social animals, even eusocial ones [8]. Although offering a thorough review of these adaptations in all phylogenetic branches requires the volume of a textbook, the focus on the primate lineage requires much less effort. This decision is justified because the evolution of cooperation in the primate lineage is unique, in which new adaptations evolved, expanding the scope of cooperation by allowing one to form long-term reciprocal relationships with nonrelated others (i.e., friends) [6, 7, 9].

Instead of reviewing the socioecology of primates, this review focuses exclusively on the infrastructures that are responsible for the unique primate sociality, which includes the psychological adaptations that facilitate behavioral synchronizing, intention-reading, and norm-understanding. These adaptations are not only the developmental milestones of morality [10, 11] but also shared phylogenetically by monkeys [12] and nonhuman great apes [9-11]. Thus, phylogenetic comparison of them may explain the biological mechanisms of the innate human moral sentiments and cognition, including empathy, inequity aversion, and the ability to understand and share intention. On the other hand, an ontogenetic analysis focusing on the role of development and culturalization may explain on what basis and how morality is constructed, in which new morals are internalized by hijacking and exploiting the innate infrastructures.

Finally, this review ends by offering a continuum of the evolution of moral infrastructures, in which cultural and biological adaptations for the origin of morality are pictured. From this continuum, the author attempts to resolve the lasting *Nature-versus-Nurture* debate surrounding morality: biological infrastructures provide the basis for the culturalization in human development, while arbitrary moral norms, as the novel creations of cultural evolution, are internalized by exploiting the basic biological infrastructures.

3. Literature review

Cooperation marks every major transition of evolution [13]: A union of functionally complementary replicators outcompete single replicators or functionally homogenous unions [2]; A cell gains a metabolic advantage by teaming up with a mitochondrion [14]; A multicellular organism combines the forces of functionally complementary cells; And finally, humans and other social animals form groups to accomplish tasks that are difficult if not impossible to be done by themselves individually [1, 6, 9-11, 15].

Morality, as a collection of biological and cultural solutions to the problems that occurred in cooperation (*Morality-as-Cooperation* hypothesis, hereafter MAC) [1], is thus a milestone of both biological and cultural evolution [11]. However, the encompassing scope of this hypothesis does not help identify the mechanisms that sustain morality nor provide clarification to what extent the full-fledged human morality is contributed by biological and cultural adaptations. To fill this gap, studying the solutions of cooperation in diverse phylogenetic branches helps identify the origin of the basic cognitive and affective infrastructures in humans; while observing the key moments of moral maturation at different ontogenetic stages of infants reveals how those infrastructures interact with the cultural environment, resulting in cross-cultural heterogeneity and homogeneity of morality [16].

In short, the basic infrastructure of morality is an intricate assembly of several biological adaptations that are shared by our primate relatives and other mammalian species; Starting from which, social learning takes place and scaffolds the acquisition and internalization of the culturally created moral norms.

3.1 Synchronization

3.1.1 Behavioral contagion

A key moment in the evolution of cooperation is when social animals started cooperating with nonrelated conspecifics. Because these cooperators gain no inclusive fitness by helping nonkins [8],

they are expected not to cooperate blindly in a manner that resembles programmed cooperative robots (e.g., bees and ants); On the contrary, to make cooperation possible, evolution first equipped social animals the ability to identify cooperators who are at least tolerant to their cooperative initiation.

Behavioral synchronization, as an emblem and measurement of empathy, correlates with the degree of tolerance in the social animals who cohabitate and cooperate predominantly with nonkins [7, 17]. For instance, yawn contagion, seldomly found in the social groups of closely related members or cobreeders, is characteristics of capuchins (*Cebinae*), macaques (*Macaca*), bonobos (*Pan paniscus*), and chimpanzees (*Pan troglodytes*); And the tendency to exhibit it is found closely related with the degree of within-group and between-group tolerance [17]. However, although, in humans, yawns are universally contagious, the studies on psychopaths and autistics reported negative findings, which is explained by the participants' lack of empathy and social responsiveness [18].

Behavioral contagion in primates is not restricted to manifesting social tolerance, it also indicates social and even communicative interest. In humans and chimpanzees, in particular, neonates imitate the facial expression of their caregivers in a turn-taking manner [19, 20], manifesting an inborn tendency to synchronize with conspecifics and an interest in receiving and responding to social stimuli.

3.1.2 Inequity aversion

In addition to identifying tolerant potential cooperators, also not seen in eusocial animals and cobreeding primates, evolution equipped nonrelated social animals with the ability to keep cooperation just and fair. After finishing the same task, very young infants, chimpanzees, macaques, and capuchins reject and protest unfair reward assignment in which they receive less than another conspecific sitting next to them (hereafter, disadvantageous inequity) [21, 22]. This behavior clearly is economically irrational because receiving a disadvantageously unfair reward is better than receiving nothing. In other words, if the participants were not compensated by a return of favor in the future or by an increase in inclusive fitness, it would be rational for them to receive whatever was offered. On the contrary, for the social animals cohabitating in a long-term and repeatedly cooperating with nonrelated others, their seemingly irrational rejection may only be a short-term loss to deter unfair cooperative attempts, resulting in the maintenance of a long-term fair, reciprocal relationship with their ingroups [21, 23, 24].

Existing phylogenetic and ontogenetic studies support this view: the aversion to disadvantageous inequity was seldomly found in the social animals living in cobreeding social groups where the dominant senior members reproduce and the other closely related members provide parental care [21]; In contrast, in social groups where cooperation is predominantly done with nonkins, especially in humans, the sensitivity and negative reaction to inequity is manifested early in ontogeny [22]. Existing studies of developmental psychology show that early on in their development, children are surprised by unequal reward distribution and later protest and reject disadvantageous unequal treatment [22]. After the acquisition of sufficient sensory-motor skills, they then start punishing those who provide them an unfair reward assignment (second-party punishment), refusing to be favorably but unfairly rewarded (advantageous inequity aversion), and finally inducing a cost to punish those who are unfair not to themselves but to others (third-party punishment) [21, 22].

In short, inequity aversion and punishment are, in essence, evolutionary solutions to synchronize the contribution and reward assignment among cooperators. In nonhuman primates, disadvantageous inequity aversion and second-party punishment are at least natural reactions to norm violations, allowing small-scale and context-limited cooperation involving predominantly parallel roles [9-11]. After the emergence of advanced intentionality, inequity aversion and punishment are not restricted to specific participants of cooperation but to anyone in the social group, who may fill the role of a cooperator [9-11].

3.2 Intentionality

Behavioral synchronization is not enough for complex cooperation because sophisticated cooperation in humans requires cooperators not only do what others do but also know what others

know [10]. To cooperate successfully, the motivation and the ability to read others' intentions allow social animals to know what others want, thereby responding appropriately. Because this ability is, in essence, the use of causal inference in social contexts [10], it follows that the social animals that are capable of intention reading make *ought* and *would* inferences from the behavioral cues of the signalers [7], which are the basis of moral and normative reasoning in humans.

3.2.1 Intention-reading

Primates are interested in what others see, hear, and know. Without habituation, vervet monkeys (*Chlorocebus pygerythrus*) attend and respond to the vocalizations given by other ingroups, such as food call and alarm call [12]. In great apes, chimpanzees are experts at following others' gaze and head orientation to learn what others see and know, and they make predictions accordingly regarding the perceptual, intentional, and goal state of others. For instance, in scramble food competitions, they preferentially approach the food that is hidden from the perception of their competitors [25]; In cooperative contexts, they use attention-getters, with a combination of bodily movements and vocalizations, to attract the attention of potential helpers and engage them in cooperative tasks that cannot be achieved by themselves alone [26].

Although the ability and motivation to read and manipulate intentions are shared by humans and nonhuman great apes, indicating their evolutionary origin [10,11], its specialization and maturation are not possible without proper scaffolding: Human-raised and -trained chimpanzees excel their wild conspecifics in reading and responding to cooperative intention signaled by humans [27]; Likewise, infants' engagement in and practice of gaze-following, pointing, and executing collective goal are coupled with a better understanding of the intentions involved in the above tasks [28, 29].

In essence, the understanding of intention may itself be a form of normative inference, and the violation of habituated norms results in surprise, frustration, and protest. The infants older than one year of age are reliably surprised by looking significantly longer at an action that violates their expectation after they were habituated with a goal and intentional state of the actor [28]. After the possession of sufficient locomotive skills, when engaging in cooperative tasks with adults, children around two years of age are frustrated by and even protest against their cooperators' sudden withdrawal if it was made without proper excuses [30]. Likewise, when the adult cooperators are unwilling to continue cooperating, older children (around the age of 3 years) would make protests and try to reengage them, while they seldomly do so when the cooperators quit because they are unable to continue playing their role [31].

3.2.2 Shared intentionality

Between the age of 9 to 12 months, children enter the socio-cognitive revolution, in which shared intentionality develops, transforming the original second-person normative reasoning into the third-person normative reasoning [32, 33]. As a result, children begin to reason in a we-ness manner, employing joint attention and a shared goal when cooperating, thereby understanding the social roles played by their cooperators with the bird's eyes view. When cooperating, instead of just expecting what a specific partner should or ought to do, children expect any participant who joins in cooperation to be committed to a joint goal, execute the assigned roles, and even assist other cooperators in playing their own roles [27, 30, 31].

On the other hand, shared intentionality also scaffolds norm understanding and internalizing by facilitating communication [34]. When jointly attending to the same thing or goal, with shared intentionality, cooperators can easily understand the informative gestures made by the others, like pointing and pantomiming, thereby explicating the goal, plan, and complementary roles that are needed, even in the absence of explicit verbal communication in conventional language. After repeated cooperation aiming at the same or similar goals, the informative gestures and the roles involved in the tasks would become conventionalized or standardized, facilitating the efficiency of future cooperation [34].

Although previous studies seldomly focused on the process of conventionalization or the formation of morals, this process may bear resemblance with the cultural evolution of conventional

language. Linguistic anthropologists have done amazing work identifying the origin of conventional language. For instance, within 25 years, well-structured Nicaragua sign language (hereafter NSL) evolved from the original crude home sign; The sophistication and specialization of word use and grammatical structure were the results of the accumulative edition contributed by new generations of deaf signers who were initially foreign to it [35]. Hence, it is likely that the conventionalization of morals follows a similar path to the evolution of NSL, in which new and more specific social rules and expectations like new words and grammar accumulate across time, resulting in morals that are increasingly more conventionalized and suitable for systematic pedagogy.

In addition, in parallel with the role of conventionalization of language played in facilitating communication between strangers who share the same language, the conventionalization of moral norms may facilitate the cooperation of the strangers of the same culture by explicating the responsibility and the consequence of cheating like free-riding [23, 24].

3.3 Norm-understanding

Once children possess shared intentionality, they start to acquire and internalize the established moral norms in their immediate cultural environment, a process that cannot be explained by conditioning (e.g., domestic dogs) and the queuing in the dominance hierarchy [36, 37]. To explain this singularity, the author summarizes four following ways that humans excel their primate relatives in understanding and maintaining norms.

First, only humans were found engaging in third-party punishment: before the beginning of formal education, children already recognize fairness as a norm and punish both those who are unfair to themselves and those who are unfair to others (third-party punishment) [21, 22, 27]; however, adult chimpanzees are found only engaging in second-party punishment but not third-party punishment [7, 21]. Second, norm understanding regulates children's prosociality but not chimpanzees': children's acquisition of local social norms helps cope with the free-rider problem by selectively offering their help to those who are obeying the cultural norms [27]; while chimpanzees do not use social norms to regulate their prosociality but use their past experience [38, 39], which limits their choice of cooperator and the contexts of cooperation [30]. Third, in humans, the reactions to norm violations, taking the form of inequity aversion and punishment, are associated with brain activation and negative emotion [23, 24]: although this association has not been investigated in nonhuman primates, norm obeying corresponds with the activation of the specific brain regions involved in behavioral control; and experiencing norm violation as either a victim or onlooker (e.g., fairness) is found to be associated with the expression of negative emotions [17, 22]. Finally, humans, not chimpanzees, are concerned with reputation and use language to punish norm violators: although chimpanzees reciprocate upon contingency and select helpful cooperators [38, 39], only humans concerning reputations and use language to create affairs for either enhancing or undermining the reputation of their own or others [21, 40].

In short, the adaptations for moral norms expand the repertoire of human cooperation by recruiting all those norm-following strangers, even though they had no experience of working successfully together.

4. Implications

A review of the natural history and ontogenetic milestones reveals that human morality is indeed a collection of biological and cultural adaptations facilitating cooperation and solving problems encountered when cooperating. As presented above, the full-fledged human morality includes (but is not limited to) three key components: synchronizing, intention-reading, and norm-understanding; and the human-unique norm understanding and internalizing are built upon basic cognitive infrastructures that are shared phylogenetically with other social animals, especially nonhuman primates. With proper scaffolding of the cultural environment, the innate ability allows rapid internalization of the

existing moral norms early in human ontogeny, facilitating the maturation of appropriate moral sentiment and reasoning and the innovation of the existing moral norms (see Figure. 1).

On the basis of those infrastructures, humans engage in complex cooperation involving multiple complementary roles to create benefits that are almost impossible to be achieved individually or by smaller and simpler cooperation [1, 11, 15, 16]. The booty of cooperation is distributed in accordance with jointly agreed social norms, while the violators and free-riders are excluded from future cooperation or even punished [23, 24].

Although larger and more sophisticated cooperation may unavoidably conceal subtle free-riding and cheating, cultural evolution accumulates the editions that explicate and conventionalize moral norms, which facilitates cooperation by deterring cheating and free-ridings and by making the acquisition of moral norms the subject of pedagogy. Newborns of modern society adopt the heritage of cultural evolution. As they grow older, they make contributions to the cultural heritage by proposing editions to the existing moral norms, which not only provide new solutions to the problems of cooperation but also allow more complex and novel forms of cooperation.

Future studies can gain a fruitful understanding of human morality by studying its cultural evolution and development. The author encourages the use of both an ontogenetic approach and longitudinal design to understand: (1) The developmental association between the activation of specific brain regions with moral reasoning and sentiments; (2) the standardization and conventionalization of moral norms across time. On the other hand, considering the paucity of comparative studies on bonobos (*Pan paniscus*), a species of nonhuman great ape that is equally related to us as we are to chimpanzees, a study on the prosociality, intentionality, and norm understanding in this species may provide a deeper insight in the origin of morality.

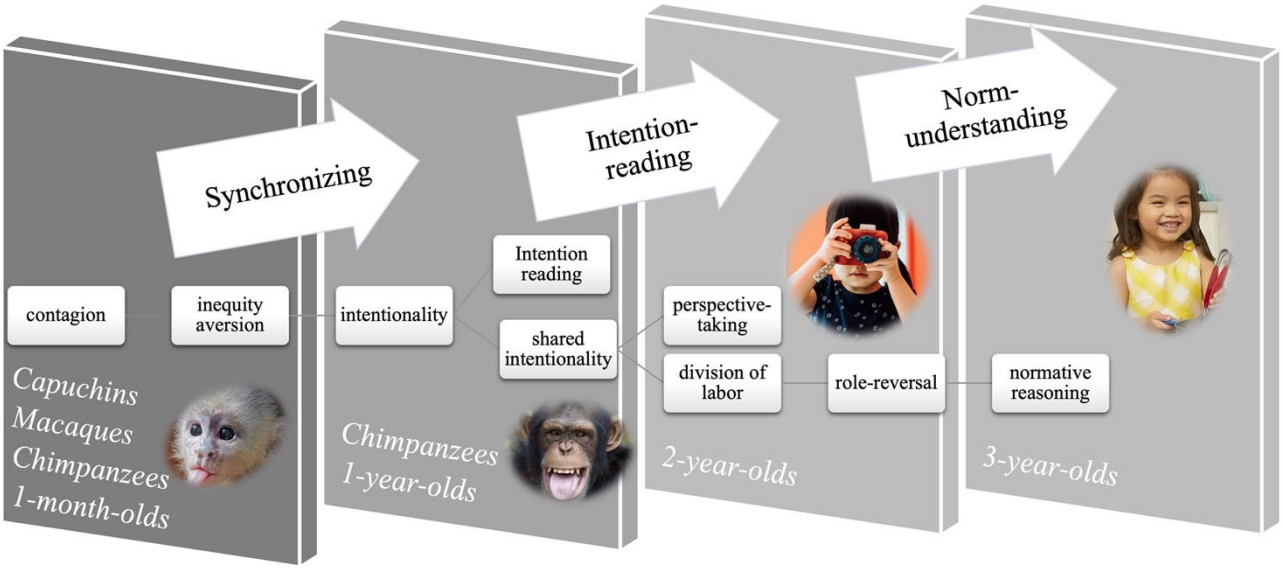

Figure. 1 the evolution of moral infrastructure

5. Conclusion

In sum, human morality has its origin in both cultural and biological adaptations. Although basic infrastructures of morality are shown in nonhuman social animals and young children, a proper scaffolding of the acquisition and internalization of moral norms is essential to the development of full-fledged human morality, given the complexity and arbitrary nature of moral norms resulting from the accumulative process of cultural evolution. After a thorough review of the previous studies using the comparative approach, the author finds support for MAC hypothesis that human morality is a collection of both biological and cultural adaptations that facilitate cooperation and solve problems encountered in cooperation. However, to draw a comprehensive picture of the origin of morality, more comparative studies on infants and other nonhuman primates must be done in the future, and the cultural evolution of moral norms has to be thoroughly investigated.

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