International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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A 6-year follow-up of Dr. Richard Wrangham's masterpiece, The Goodness Paradox: mobile hunter-gatherer bands and the evolution of our psychological abilities

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International Journal of Science and Research Archive, 2025, 15(01), 215-221

Publication history: Received on 24 February 2025; revised on 01 April 2025; accepted on 03 April 2025

Article DOI: https://doi.org/10.30574/ijsra.2025.15.1.0958

Abstract

Dr Richard Wrangham argues in 'The Goodness Paradox . . . that our psychology primarily evolved in African, mobile, hunter-gatherer bands before the end of the last ice age. This conclusion is supported by the exquisite cave paintings and tool artifacts from that ancient period. Further evidence also comes from anthropological studies of current hunter-gatherers that represent the earlier time. These studies have also identified the natural selection processes that produced our psychology. The processes consisted of four behaviors: 1) egalitarianism, 2) problems for egalitarianism, 3) Egalitarianism enforcement and effects on our psychology, 4) Avoiding being targeted and expansion of selection effects. The psychological traits arising from these four behaviors and highlighted by Dr. Wrangham are emotions, intelligence, conscience, and personality. Based on his evidence, we also argue for traits of theory of mind, language, aesthetics, and free will. Further support for the importance of the four behaviors is also discussed, including the domestication syndrome, natural selection pressure, feedback models, identical twin studies, and our personal experiences of consciousness, agency and free will. We conclude by discussing why Dr. Wrangham's masterpiece and his perspectives have not gained more acceptance.

Keywords: Evolution; Hunter-gatherers; Natural selection; Execution hypothesis; Psychology; Sociology; Anthropology

1. Introduction

1.1. Hunter-gatherer bands before the end of the last ice age

Paleoanthropologists generally agree that our unique psychological abilities started developing after our common ancestor with the chimpanzee seven million years ago [1,2]. Development is also indicated at 300,000 years ago, the time of our first identified fossils. A rapid advancement in our psychological abilities is demonstrated after 100,000, by a large increase in artifacts such as cave art and sophisticated stone tools. Further archaeological evidence implies that all of our psychological abilities had developed by 12,000 years ago, the end of the last glacial period, and that our nature has remained relatively unchanged during the more recent farming and modern ages [1,2]. Dr. Wrangham presented the evidence for these conclusions in *The Goodness Paradox: The Strange Relationship Between Virtue and Violence in Human Evolution, 2019,* and his YouTube lectures [1,2]. We have reviewed his work in three prior publications [3-5],; however, additional aspects of his work are currently being discussed. Further evidence supporting Dr. Wrangham's arguments comes from current mobile hunter-gatherer bands that represent the ancient cultures between 300,000 and 12,000 years ago. This representation is based on the current bands living in isolation from modern cultures and making the same artifacts as the earlier period. The bands are primarily in Africa (Botswana and Tanzania), Australia, and the

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Americas. Dr Wrangham discussed the studies of these bands by anthropologists, such as Dr. Boehm who investigated 20 different bands, and other researchers including Drs. Knauft, Lee, and Woodburn [1,2,6]. High-quality anthropological research methods were used in these studies, including 10 to 20 years of data collection and close observation of band life, causes of death, and progenies. The conclusions from these studies include that the ancient bands had modern language and cognitive abilities and that they had subsistence living. The bands consisted of 30 to 40 individuals, and some of the mobile bands became sedentary if sufficient food resources were available. They had no formal institutions such as governments, police, or schools; their disputes were resolved within the band. They shared resources, and they had little concept of individual property. Each family made a thatched hut, which was primarily used for sleeping. They had very active social lives with group singing and storytelling. An important organizing principle for the bands was egalitarianism. Men conducted hunts, made stone tools, and had coalitions, whereas women foraged for plant foods, childcare, and domestic chores. The evening meal was an important part of band life, and it was cooked by the women. They had arranged marriages, either monogamous or polygamous. Shamans and animist thinking were used to explain much of nature and to justify their egalitarian values. A coalition of married men determined the bands' ~~social~~ egalitarian norms, and the married women supported the norms. Some of the norms, such as polygamy, primarily benefited the men. Warfare, disease, and famine were constant threats [1,2,6].

The current hunter-gatherer studies have also found evidence for the natural selection processes that produced our psychology. Four behaviors (4-behav, previously named the Execution Hypothesis and the Wrangham-Boehm Model) were found to be responsible for our psychology. As explained below, one of the four behaviors included three coalitional actions (3-coalition-actions) [1,2,6].

2. The 4-behav and 3-coalition-actions identified in mobile hunter-gatherer band research

The first of the 4-behav reported by anthropologists in the current hunter-gatherer band studies was **egalitarianism (Figure 1.1)**. Egalitarianism was associated with the onset of language abilities, and this value was an important part of the social norms [1,2]. A coalition of married men produced the norms of the band, and the married women supported these norms. Egalitarianism was not directed at marital relationships but represented attitudes toward everyone in the band. This value encompassed friendliness, tolerance of others, and cooperation. For example, during hunting, everyone was given an equal voice in planning the hunt and interpreting animal signs. Egalitarianism, however, was hard to maintain, as explained in behavior two.

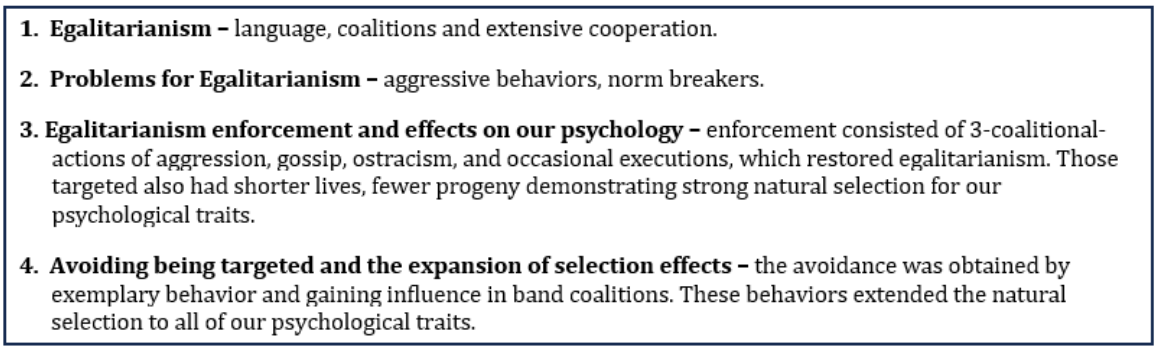

Figure 1 The 4-behav and 3-coalition-actions were identified in the mobile hunter-gatherer band studies, produced the natural selection pressure for our psychological traits. 1 to 4 as shown. See text

For the second behavior (1.2), problems for egalitarianism were observed. individuals in the bands were seen breaking the egalitarian norms. The paleoanthropologists found that some individuals tried to increase their control, become chiefs, or conduct other self-serving acts. They might also commit impulsive acts of anger aggression, which went as far as wife stealing and murder. For another example, when a hunter returned to the band with game, he was required to distribute it to all the families. This distribution was difficult~~,~~ because of egalitarian requirements, meaning the hunters had to be very humble or else they would be accused of boasting and breaking egalitarian norms [1,2,6]. The problem of norm-breakers was managed is in the bands as explained in the third behavior.

The third behavior (1.3), egalitarianism enforcement and effects on our psychology; this was targeting the anger-aggressive behaviors (Second Behavior) with 3-coalition-actions of gossip, ostracism, and executions, which punished bullies and rule breakers, thereby maintaining the band's egalitarian structure. This targeting depended on coalitions and consensus building within the band. Importantly, the 3-coalition-actions also produced strong natural selection

pressure for decreased anger-aggression over many generations. Selection was demonstrated for those being targeted because they lived shorter lives and had fewer children. For example, the rate of executions in the band varied widely over time, but they are estimated to have occurred once every three to four years. This rate alone, according to Dr. Wrangham, was sufficient to produce the low levels of anger aggression that we have today [1,2]. Selection for other psychological traits also followed from the 3-coalition-actions. Further extension of the natural selection from the 4-behav and 3-coalition-actions to all of our psychology is described in the fourth behavior.

For the fourth behavior (1.4), avoiding being targeted and the expansion of selection effects; the hunter-gatherers were aware of and conducted themselves to avoid being targeted or suffering the after-effects of being targeted. These avoidance behaviors extended the natural selection process to all of our psychological traits. One way to reduce the risk was by conducting exemplary behaviors such as effective hunting, quality arrowheads, and good storytelling. These activities increased one's influence in the band. Another way to reduce being targeted was by individuals adhering to the band's egalitarian norms. They needed self-control to refrain from transgressions and the capacity to recognize what actions would warrant targeting. A third way was gaining further influence in the band's coalitions, particularly the coalition of married men. Shamans and animist thinking were important in this group. A shaman could label individuals as sorcerers, which led to targeting. In another strategy, band members tried to avoid the adverse effects of being targeted after they had been targeted. The behaviors noted above also applied to this avoidance. These extensive behaviors to avoid being targeted and the after effects of targeting expanded the natural selection to all of our psychological traits [1,2]. Thus, our traits increased in the bands over many generations.

Dr. Wrangham concludes that the 4-behav and the 3-coalition-actions produced the natural selection pressure for the evolution of our psychology before the end of the last ice age. The importance of this conclusion is further clarified by discussing our psychological traits and our ancient ancestors. Dr. Wrangham only rated a few of our traits, however, we are extending his evidence to seven abilities (Figure 2) [1,2,6]. The first species to be rated is our common ancestor with the chimpanzees from 7 million years ago. It is important to use common ancestors in this historical analysis because it allows for adaptations to be assigned to ancestral lines. Today's chimpanzees can represent our common ancestor because they both lived or are living in the same tropical rain forest with very similar adaptations. The next species discussed is our species, *Homo sapiens,* and we are rated at four different times. First, at 300,000 years ago, this is the time of our first identified fossils and this is the time of our transition from H. *heidelbergensis.* During the period between our common ancestor with the chimpanzee and the first *H. sapiens* fossils there are several hominin species. The natural selection pressure from the 4-behav would have been limited during this time because egalitarianism, language, and strong coalitions were still quite limited. The second time point for us is 100,000 years ago. Leading up to this time, the 4-behav and our psychological abilities would have been developing. The third time point is 12,000 years ago, the end of the last ice age. Between 100,000 to 12,000 years ago our language and psychological traits would have become fully developed. These abilities are demonstrated by increasingly sophisticated artifacts such as arrows with exquisite stone tips, spears with wooden shafts, symbolic and cave art, and migrations out of Africa. The fourth and last time point for us is today, which is characterized by the farming and modern ages that followed the end of the last ice age. Dr. Wrangham argues that the 4-behav and their mortal dangers did not play a significant role during this recent period because hierarchical values were adopted during this period. Thus, for the end of the ice age, today, and the period in between, our psychological abilities are rated the same. At exhibited below, the seven psychological traits are rated for the different species at the five time points, and a 5-point rating scale is used: 'very low', 'low', 'moderate', 'high, and 'very high'.

3. Comparing psychological traits between our ancestors and us

The first trait rated is aggression; this behavior includes both anger and planned aggression (**Figure 2.1)**. Dr Wrangham explained that these two types of aggression occur through different genes and brain pathways [1,2]. He compared anger aggression in chimpanzee troops and our cultures based on hitting rates. Measurements for adult chimpanzees demonstrated that they were hitting each other approximately 500 times more often than we were. This high level of anger-aggression in the chimpanzee is also associated with a lack of tolerance for each other. These two behaviors are attributed to parental investment processes. For example, the alpha chimpanzee conducts extensive hitting and does most of the mating. More cooperative behaviors are seen for the chimpanzee during daily grooming, foraging, and group patrols of the territory. The patrols, however, would kill encountered chimpanzees that were not from their troop. These different behaviors are also considered, and a general level of anger aggression is rated. We contrast from the chimpanzee markedly in this area. We have hitting rates that are 500 time lower than the chimpanzee, showing that we are also much more tolerant of others. In contrast to the chimpanzee, we are a very cooperative species. Based on these perspectives, general anger aggression for our common ancestor with the chimpanzee is rated 'as very high' and we are rated as 'very low'. The rating for us today also applies to the end of the last ice age, as explained above.

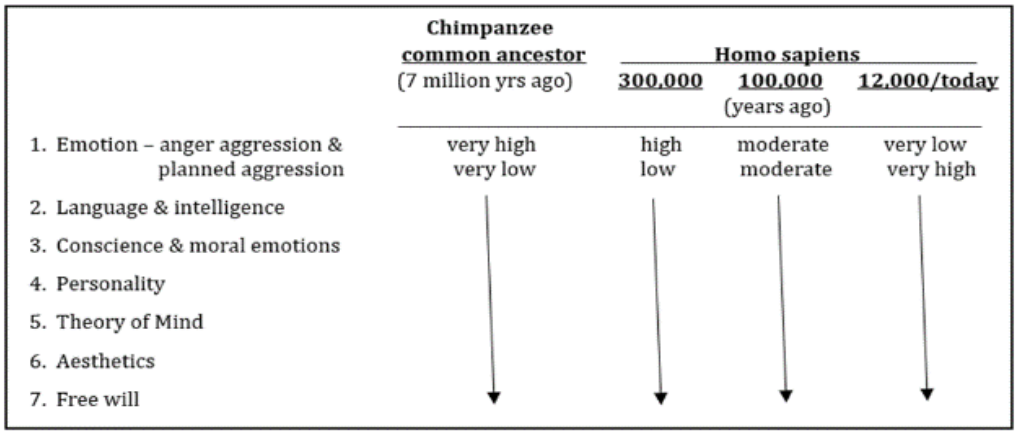

Figure 2 Rating of seven psychological traits for our ancestors and us today using a 5-point Likert scale. The arrows indicate that the ratings are the same as for the text above them. See text

To rate general anger aggression at 300,000 years ago, the four hominin species need to be considered [1,2] **(Figure** 2.1). These species are Lucy (Australopithecus afarensis), Homo habilis, H. erectus, and H. heidelbergensis. Lucy is also used here to represent earlier hominins because of her nearly complete upright walking, opposable thumb, and decreased size of canine teeth. These four species are associated with a tripling of brain size, and advancements in stone tools such as choppers and hand axes. Their artifacts indicate butchering and cooking at a common location (H. erectus), which demonstrates increased cooperation. Further, the fossils from this period show that females increased in stature to become 80% the height of males. This sexual dimorphic change is typical of the domestication syndrome, which is associated with decreased anger aggression. These behavioral and anatomical changes in the four hominin species argue for a large decrease in general anger aggression by 300,000 years ago. However, the 4-behav would have been in very limited form during this period, which would limit the decreases. Based on this evidence, we estimated that at the time of our transition from H. heidelbergnesis to H. sapiens, there would have been a decrease in anger aggression to the rating of 'high'. The next rating is 100,000 years ago when there would have been increases in the 4-behav and language abilities. Our rating for general anger aggression for this time is 'moderate'. The next rating time is 12,000 years ago and for us today, as explained above, the 4-behav and language would have been fully active by this time. Thus, the strong natural selection effects from the 4-behav would have resulted in our 'very low' levels of general anger aggression.

We recognize two different types of aggression, anger and planned, in our modern life. This is seen in our judicial rulings about murder. In the United States, approximately half of the murders are committed with planned aggression, which is 1st-degree murder, and the other half with anger aggression, or 2nd-degree murder. Dr Wrangham writes that expanded planned aggression abilities arose along with our evolution of language abilities by 12,000 years ago [1,2]. Planned aggression was practiced by coalitions in the migratory hunter-gatherer bands and is highlighted by the 3-coalition-actions described above. In addition, planned aggression produced the natural selection pressure for our 'very low' level of reactive aggression that we demonstrate today. This second type of aggression is rated at the different time points. Planned aggression is demonstrated in a very rudimentary form in chimpanzees when they group to patrol their territory. With these perspectives in mind, we rate the chimpanzee as having a 'very low' level of planned aggression, and our transition species 300,000 years ago as 'low'. At 100,000 years ago, our species is rated 'moderate', and our abilities in this area at the end of the last ice age and today are rated as 'very high'. This pattern of rating increases at more recent time points is also used for the remaining six traits, as shown by the arrows in Figure 2.

Other emotional traits include fear, disgust, sadness, trust, attachments, friendship, and surprise. Chimpanzees are seen exhibiting these behaviors. The chimpanzee attachments between the mother and baby are strong; the mother carries the infant on her back for three years. They also conduct grooming, which is a friendly behavior. In comparisons between us and the chimpanzee, we appear to experience these emotions in more complex ways. There is little comparative research for these emotions, and they are not rated here.

The next psychological trait shown in Figure 2 is language and intelligence. These two abilities have a close association. Our language and intelligence abilities are integral for the 4-behav and the anger and planned aggression that were rated above [1,2]. These abilities are also associated with conceptual thinking related to words, symbols, and sentences. Chimpanzees, in contrast, demonstrate limited conceptual thinking, and they have limited cultural learning. For example, a chimpanzee mother has no concept about death when she carries a dead baby around on her back for weeks

because of her emotional attachments. In another area, chimpanzees can be trained in the laboratory to respond to words to identify objects; however, they do not follow caregivers pointing to where food might be hidden; thus, they have limited intentional cognition. They cannot solve some simple puzzles, such as removing blocks to get at food. Ratings in this area-have a history for chimpanzees. Three naturalists were awarded the Nobel Prize for explaining non-human animal behaviors in terms of simple and complex reflexes or instinctual behaviors. The simple reflexes are reactions to fear, anger, etc. Complex reflexes (fixed action pattern behaviors with signals) are more extensive behaviors. Although the Nobel Prize winners did not study chimpanzees, their conclusions about mammalian behavior generally applies to this species. For example, chimpanzees respond to the early morning signal of light from the sun to start foraging, which they continue throughout the day. Foraging is a highly stereotyped behavior that is primarily instinctual in origin. Further, the primary source of selection pressure for our advanced language and intelligence abilities is the 4-behav, which are not present in the chimpanzee troops. From the above evidence for language and cognitive abilities, the ratings are shown in the figure.

The third trait is conscience & moral emotions (2.3). These adaptations include emotions and behaviors related to embarrassment, shame, guilt, and fear of exclusion. Dr. Wrangham argues that these traits evolved in our ancestral line because of the 4-behav and their mortal dangers [1,2]. These abilities provide considerable self-regulation, such as preventing us from acting immediately on the impulsive urges associated with anger. In contrast, the chimpanzee is described as psychopathic because of their 'very high' level of anger aggression. They show no indication of acting according to a sense of right and wrong. Thus, the same ratings are used here.

The fourth trait is personality, which we express in five areas: conscientiousness, agreeableness, extroversion, openness to experience, and neuroticism (2.4). Natural selection in these areas would have also occurred in the mobile hunter-gatherer bands to avoid the mortal dangers of contrarian behavior [1,2]. For example, conscientiousness would be helpful for high-quality behaviors in areas such as tool-making and storytelling. Neuroticism means that one will worry about one's behaviors. In comparison, the highly stereotyped behaviors of chimpanzees mean they have limited personality abilities. Thus, the above rating pattern is used again.

The last three traits, theory of mind, aesthetics, and free will, are characterized as complex traits that also have extensive interactions with other traits. These three traits are particularly limited in chimpanzees. The same ratings continue to be used.

Theory of mind includes social awareness and the capacity to understand what others are thinking about us (2.5). This trait would have been selected in the hunter-gatherer band because it would aid in recognizing the risks of being targeted as explained with the 4-behav [1,2]. We are rated high in this area because we can consider up to five levels of back-and-forth thoughts about what others are thinking, in particular what others may think about what we are thinking. Our transition time at 300,000 and further development between 100,000 and 12,000 years ago are associated with advances in theory of mind. Chimpanzees have limited theory of mind abilities. They are observed in the laboratory to avoid taking food if the alpha male is watching. They also pass the mirror test as they groom themselves in a mirror. The corresponding ratings are as shown in the figure.

Aesthetics is trait six (2.6). We have extensive abilities in this area. The mobile hunter-gatherer bands before the end of the last ice age demonstrated this ability through their cave art, some of which Picasso described as the greatest art ever created! Their exquisite arrow-head stone tools, singing, and storytelling also show advanced aesthetic abilities. Dr. Wrangham argues that the strongest natural selection pressure for our aesthetic abilities would have been between 100,000 and 12,000 years ago [1,2]. He also argues that our aesthetic abilities evolved because they enhanced a person's ability to be part of the band's coalitions. In contrast, chimpanzees exhibit little or no abilities in this area. The ratings are again shown in the figure.

The last trait is free will, which is the capacity to recognize/generate multiple choices, analyze the consequences, and then elect to pursue a choice (2.7). We demonstrate a high level of free will. These abilities were essential to avoid the mortal dangers of the 4-behav. A potential limit to our free will is our biases. Dr. Wrangham, however, explains that our biases are very weak in influencing our thoughts and behaviors compared to the strong instinctual behaviors that compel chimpanzee behaviors [1,2]. Thus, our biases do not rise to the level of an exception to our free will abilities. Moral responsibility is an important part of our free will and we demonstrate extensive moral emotions, thoughts, and behaviors. At our transition time of 300,000 years ago, instinctual behaviors probably continued to have a major influence on our behaviors, and free will would have been limited. The period between 100,000 and 12,000 years ago with the dominant role of the 4-behav in our psychological evolution, our free will would have primarily evolved. Chimpanzee behavior, in contrast, is compulsive, stereotyped, and without moral emotions. Dr. Wrangham writes that

in comparison to us, they are psychopathic because they show no indication of acting according to a sense of right and wrong. Their behaviors are primarily driven by instincts. Thus, the ratings are as shown in the figure.

4. Further discussion of the 4-behaviors and the 3-coalition-actions

To better understand why the above species, have such vastly different ratings, natural selection pressure provides some insight [5]. This measure is defined as the amount of trait change per million years. In the above discussion, high natural selection pressure from the 4-behav and 3-coalition-actions are driving the evolution of our psychological abilities. In contrast, the natural selection pressure for other mammalian adaptations is much lower. As examples, the long giraffe's neck or the elephant's trunk is produced by a lower pressure because the change is smaller and it occurred over a much longer period. Thus, our natural selection pressure from the 4-behav and 3-coalition-actions are estimated to be more than a hundred times greater than the pressures for other typical mammalian adaptations. Further, our high selection pressures from the 4-behav indicates that there was a limited role for other natural selection processes such as predator-prey and reproduction. The hunter-gatherer band studies were designed to assess these alternative selection-pressures, and they were found to not be significant. In summary, the high natural selection pressure from the 4-behav is now being used to explain our vast psychological differences from the chimpanzee and our other ancient relatives.

A mathematical feedback model can also clarify the importance of the 4-behav in our psychological evolution [5]. In this model, proto-4-behav is assigned to the approximately 7 million years leading up to our first identified fossils of 300,000 years ago. Between 100,000 and 12,000 years ago, the full natural selection effects of the 4-behav are predicted. The feedback model includes both positive and negative processes. The fundamental dynamic of feedback is that the rate of change increases over time. For positive feedback, enhancement of planned aggression trait increased the selective pressure that enhanced other traits, which further enhanced planned aggression. In contrast, negative feedback amplifies the rate at which decreases occur and explains our low level of anger aggression today. These positive and negative feedback processes mean that enhanced psychological abilities lead to more effective implementation of the 4-behav.

Further insight into the 4-behav also comes from identical twin studies [5,7]. This research has shown that only half of our thoughts, motivations, moral emotions, and behaviors, i.e., our character, come from the above discussions of our genetic inheritance, i.e., our nature. The other half comes from our environment, which includes our childhood development, home life, learning, and culture, i.e., our nurture. It is widely agreed that these dual processes, nature and nurture, produce our character. According to Dr. Wrangham 50% of our character coming from our nurturing can be expected. Nurture traits in the hunter-gatherer bands would have been strongly selected for by the 4-behav. Individuals in the bands needed to respond to their cultural norms in effective ways, which included a high percentage of nurture traits in our psychological abilities.

Another psychological area that can be understood from the perspective of the 4-behav is our experience of agency and consciousness. We experience life with agency, meaning that we feel that we control our actions and that we can control events in the world. This is in line with the seventh trait discussed above, free will. In the area of consciousness, we are primarily aware of the seven traits (Figure 2). Our ability to experience agency, free will, consciousness and other traits would have been selected for by the 4-behav and their mortal dangers.

Domestication syndrome also helps to explain many of the biological changes that occurred in our evolution [1,2]. This syndrome is associated with decreased anger aggression, and increased, tolerance, cooperativity, and intelligence, primary traits selected by the 4-behav. The syndrome was characterized by Dr. Belyaev, a Russian geneticist, based on his breeding of captured wild foxes. Young foxes were mated as adults based on their friendliness toward human caregivers as pups. Within a few generations, all the pups were much friendlier toward their litter-mates and care-givers meaning that they had become domesticated. Other changes also occurred in the foxes including smaller size, floppy ears, changes in coloration of their fur coats, greater cognitive abilities, and an extended estrous cycle. Hormonal changes occurred that were associated with this greater friendliness. Neural crest cells, which control many aspects of development, were delayed in the domesticated foxes, which caused many of their physical changes. For the fox studies, the selection for decreased aggression was conducted by breeding, whereas our decreased aggression is now associated with the 4-behav, which means we had self-domestication. Further supporting evidence for the importance of this syndrome in our evolution comes from the fossil records, which demonstrate that we have a smaller brain size and lighter skeletal structure than *H. heidelbergensis,* changes associated with the syndrome.

Criticism of Dr. Wrangham's thesis has included possible concerns in several areas [1,2]. One critique is that stationary hunter-gatherer bands and hierarchical values occurred earlier than 12,000 years ago. Dr. Wrangham agrees that this

probably happened in a few locations, where there were abundant natural resources, such as along the Columbia River in the northwestern American continent. This is only a limited concern, however, because the few stationary bands do not negate the importance of the far more prevalent migratory bands, which the 4-behav are based on. Another concern is that the migratory bands that were part of the recent hunter-gatherer research were not entirely isolated. Dr. Wrangham, however, provides considerable evidence for their isolation, and his arguments are now widely accepted. A third concern is that there was a more fluid sexual division of labor, for example, both women and men taking part in hunting. Dr Wrangham countered that this alternative was not observed in the current band studies. He also points out that there is a greater variety of roles for women in the cultures after the end of the last ice age. A fourth area of concern is that the 4-behav could be compatible with adverse social programs such as eugenics. However, Dr Wrangham argues against this. He explained that there is no support for imposing social selection in modern politics. The arguments he presents are only for a better understanding of our evolutionary psychology.

Another area of concern is possible alternative explanations for the origin of our psychology [1,2]. These explanations typically use a different natural selection process for each of our psychological traits. Dr Wrangham points out, however, that there are many problems with these alternative explanations. In particular, there is no supporting evidence for them in the recent hunter-gatherer research. In contrast, the 4-behav provides an explanation for the evolution of our psychology that has strong support.

5. Conclusions

Evolutionary psychology is the field where the insights from the mobile hunter-gatherer band studies and the 4-behav and the 3-coalition-actions are having their greatest impact [1,2]. This new perspective provides an important natural history explanation of our psychological abilities. The perspective can explain why psychological traits are so poorly developed in our ancient ancestors; whereas, they are more dramatically developed in our recent history. Psychological conditions can also be understood from the Wrangham model. For example, we are known as an anxious species and this characteristic can be seen as a natural outcome of the 4-behav and their mortal dangers. Other psychological conditions including depression and schizophrenia, might also be better considered from the new understanding produced by the 4-behav. Our character traits, such as the desire to conform, friendliness, and differing personalities, all appear to have their origin in the psychosocial processes being discussed. Dr. Wrangham's book is a masterpiece, and his insights have become essential for understanding our evolutionary psychology.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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