

stating it explicitly. So, in looking at the broad suite of traits that Jordania is labeling as „Intimidating Audio-Visual Display“, it is critical to distinguish those features that seem to be operating competitively at the individual level – and could reasonably be said to be due to natural selection – versus those that seem to be operating cooperatively at the group level, and should be attributed to a group-level selection process.

That said, the group-level mechanisms that Jordania attributes to predator defense operate equally well for inter-group conflict as well as in the very opposite of predation avoidance, namely hunting. For example, the Pygmies of the central African rainforest are the most skilled elephant hunters in the world. But this hunting is nothing less than a highly coordinated group activity, and it is accompanied by rituals and musical forms specific to it. So, while loud music, dancing, rhythm, body painting, and collective identity can certainly be used as predator avoidance mechanisms, they have a multitude of other essential functions unrelated to predator avoidance, including animal hunting and inter-group competition. But even if we focus on the predator-defense aspect, it is the *collective*, rather than individual, aspects of these behaviors that make them effective for predator defense. Human dance would certainly be a very different thing than we know it to be if it was only ever done by individuals. We need an evolutionary account for why we dance in groups and why we sing in choruses and why we do so many other group-level ritualized behaviors. Natural selection still seems like the wrong mechanism to explain these kinds of arts behaviors in humans. So, I do have to agree with Darwin here that, if individual-level selection is the only mechanism available to us, then music, dancing, rhythm, body painting, and collective identity are indeed mysterious processes.

Joseph Jordania

Response to Steven Brown's comments

The reviewer's central point of criticism is that I rely on the mechanisms of group selection model without explicitly admitting this. I am happy to accept his criticism and state that the strength of group selection model is clearly visible in such traits as universal human predilection towards group forms of singing and group rhythmically united dancing. I tried to avoid discussion of the two conflicting approaches to natural selection in social animals: individual and group selection models. But I am ready to state my view on this subject.

Distinction between „individual“ and „group“ models of selection is not always clear. Quire confusingly, scholars are still arguing what kind of altruistic

behaviors can be qualified as the examples of „individual“ or „group“ levels of selection. The same behavior is sometimes qualified as the result of the „group selection model“ and sometimes as the result of the „individual selection model“. With the appearance of the relatively new notions of the „inclusive fitness“, „kin selection“ (1964, W.D. Hamilton), and „reciprocal altruism“ (R.L. Trivers, 1971), the borders between the group and individual models became blurred. Scholars disagree, for example, how to qualify the evolutionary forces that makes an animal (or a human) to sacrifice his/her own life for the good of his/her offspring, relatives, or group members. Should the name „selfish“ be applied to those who are concerned of their own well-being only? Or the title „selfish“ equally applies to those who sacrifice their well-being and life for offspring, relatives or group members?

The emerging notion of the „multi-level model of evolution“ possibly reflects the complex reality of the evolutionary forces that apply pressure on live organisms much better than the straight antagonism between the „individual/selfish“ and the „group/altruistic“ selection models. Levels of evolutionary forces is a separate topic, and it was impossible to discuss it sufficiently in my article of this answer, but I would like to suggest here that some of the widely accepted theoretical assumptions about the evolutionary origins of cooperation might be misleading.

Why, for example, scholars are only talking about the „origins of cooperation“, taking for granted that cooperation is a later phenomenon? Why should not we allow the idea, that cooperation might be the initial state of most primitive organisms, or even the basic rule of the emerging life? We must be aware, that a straight and ostensibly „logical“ thinking pushes us to fall a prey of „simple logic“ – „one‘ is simpler and earlier, ‘many‘ is more complex and later“. But such a simple logic sometimes can be misleading. I want to remind the readers that the same way, it was believed among music historians that polyphonic choral singing was a late invention, a cultural trait that humans developed after they „outgrow“ the initial stage of monophonic singing. However, a deeper look at the subject revealed that the process of the origins of choral must be viewed the other way round, and that group choral singing most likely was the initial form of human musical behavior. There are many facts confirming this view: from the array of examples from all over the world, where polyphonic traditions are gradually disappearing, to the examples of amazingly rich traditions of choral polyphony, present among some of the most non-industrialized peoples from the most remote parts of the world. So we should not follow blindly the simple logic assumptions (Jordania, 2006, 2011).

Interests of individual and group selection are sometimes in direct conflict with each other, and a closer look reveals that individual selection is not always favored by natural selection in this conflict. For example, longer lifespan can be thought to be beneficial for the individual animals for many reasons, but shorter lifespan is preferred by the evolutionary forces operating on the level of groups and species, because the ever changing environment gives advantages to the animal species with shorter lifespan, who can quickly accumulate mutations and change their genotype (and phenotype) according to the new demands of the environment. Great number of species and the variety of insects and other simple animal forms with extremely short lifespan, vastly outnumbering larger animals with longer lifespan, suggests that the evolutionary forces operating on a group level are extremely powerful. Another powerful indication of the ancient roots of cooperative behavior is that some of the best examples of „group selection model“ and cooperation come in the form of eusociality from the simplest life forms (from viruses to insects). So we should not exclude the possibility that cooperation was the initial state of the existence of live organisms on our planet, and that the selfish nature of genes were gradually developed by the forces of natural selection, together with the emergence of increasingly complex organisms.

So I must clearly state, that human singing and dance, mostly done in groups, with closely connected phenomenon of the „collective identity“ (specially discussed in my article) demonstrate the strength of the natural selection operating on a higher (group) level of the multi-level selection model. Cooperation between the individuals (and competition between the groups and species) was behind the emergence of the several basic forms of human culture: choral singing, group rhythmic dancing, body painting. All of them were (and often still are) serving as the means of reaching of „collective identity“, core element of the hominid strategy of physical survival.

I can not fully agree with the reviewer on two points, that (1) Charles Darwin could not find the individual benefits of singing, and that (2) natural selection only works on individual level. Darwin's suggestion of singing (and dancing) being tools of sexual selection via female choice does imply that singing and dancing can be tools of competition between the individuals. The same way, many supporters of group selection model proposed that natural selection acts not only on an individual level, but on group level as well, in competition between groups and between species.

I agree with the reviewer, that „while loud music, dancing, rhythm, body painting, and collective identity can certainly be used as predator avoidance

mechanisms, they have a multitude of other essential functions unrelated to predator avoidance, including animal hunting and inter-group competition.“ It is difficult not to agree with these words. In this article I tried to show that these elements (loud music, dancing, rhythm, body painting, collective identity) were initially designed by the forces of natural selection for the defense from predators. It is clear that these faculties had the important role of inter-group competition as well, as they still play an important role in human conflicts, from inter-tribal fights to contemporary wars. Hunting, on the other hand, must have been secondary, as these faculties, based on intimidation, are obviously better suited for scavenging confrontations than hunting.