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RESEARCH ARTICLE

Cognition As a Natural Kind

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Abstract: In corvids and apes, cognition evolved convergently instead of being inherited by a shared ancestor. In biology, natural kinds are classified according to common ancestry. So, if we were to apply the same strategy to psychology, cognition among corvids and apes would not be the same natural kind. However, Cameron Buckner claims that cognition is a natural kind. I suggest that by using Ladyman and Ross's strategy of taking natural kinds as real patterns, we can support that cognition is a natural kind. Cognition seems to have the properties of predictability and compressibility, which are necessary conditions for real patternhood. Thus, convergent evolution examples of cognition, such as that found in corvids and apes, can be the same natural kind.

Keywords: Natural kinds; cognition; convergent evolution; real patterns.

1. Introduction

Assuming that there are natural kinds allows us to track regularities in science. To speak about natural laws in science, which is a common practice

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among scientists, we refer to natural kinds. Making use of natural kinds lies at the heart of the scientific practice for many theorists and philosophers of science. One reason for this is that natural kinds play an important role in predictions, generalizations, and explanations in science. In some sciences, such as physics and chemistry, appealing to natural kinds does not seem problematic.[1] But, in this paper, I aim to say something about natural kinds in psychology. Natural kinds in psychology are crucial in some aspects. For example, if the same mental states as natural kinds can be realized by different physical states, this can be an example of multiple realization.[2] Here, my focus will be on cognition being a natural kind.

Defining cognition is troublesome. Coarsely, by cognition I mean the mental processes that may give rise to behavioral flexibility. My understanding of cognition in terms of behavioral flexibility is based on Cameron Buckner's approach in "A property cluster theory of cognition."[3] Buckner contends that we can take cognition as a natural kind. Examples of behavioral flexibility, he argues, include the following: context-sensitivity, speed,

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1 For example, there are different token (or particular) molecules of water, but we take H2O as a natural kind, to speak about all water molecules in the universe and track their regularities. Classifications and natural kinds are important for many scientific disciplines, which display probably the most elegant appearance in chemistry. Elements are classified in the periodic table and this classification allows us to track the regularities in the behaviors of the elements which are dispersed throughout the universe. Also, natural kinds can have useful applications in biology, such as the classification of species and their organs. In terms of organs, the classification of kidneys as natural kinds can help us monitor their regularities and differences among different people. However, the issue that I will be discussing in this article is natural kinds in psychology.

2 Multiple realization could support the functionalist theory of mind, which implies the possibility of cognition in artificial intelligence. Simply put, if the same mental state can be realized by different physical states, a silicon computer could possibly realize the same mental state as well. In other words, if cognition can be taken as a natural kind, and if it is multiply realized, then it could be realized in a silicon computer as well. This has crucial implications for philosophical discussions about the ethics of artificial intelligence and the potential risks caused by it.

3 Buckner's approach is not an exception. Many scholars consider behavioral flexibility as an indicator of cognition. Emery and Clayton (2004), Kristin Andrews (2020, 12), and Albert Newen (2015; Newen et al. 2018) are some examples.

class formation, abstract learning, multimodality, inhibition of behavior, monotonic integration, and, expectation generation and monitoring. According to Buckner's homeostatic property cluster theory (HPC)[4], being a natural kind does not require sharing every property listed here. Instead, the presence of a cluster of properties is enough to identify a natural kind. Behavioral flexibility constitutes just such a cluster, a cluster sufficient to consider animal cognition as a natural kind (see Buckner 2015).

From a physicalist point of view, one might think that we should apprehend psychological kinds as we understand biological kinds. When it comes to natural kinds in biology, the common approach is to base classification on the evolutionary tree (Khalidi 2023, 44). Biologists usually make the classification of the natural kinds of species by referring to a common ancestor.[5] I do not object to this in this article. But when it comes to psychology[6], I think using only common ancestry to uncover natural kinds is the wrong strategy. I aim to demonstrate, using Daniel Dennett's *Real Patterns* account, that cognition, which evolves convergently, is a natural kind. Therefore, cognition does not depend on ancestry for being a natural kind.

To the best of my knowledge, no other study claims that cognition is a real pattern. Thus, although the claim that cognition is a natural kind is defended elsewhere, my article is original in terms of its perspective. My approach draws upon the convergent evolution of cognition among birds and mammals.

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4 This view is proposed as an alternative view to relying on necessary and sufficient conditions for identifying natural kinds. Richard Boyd defends this view (see Boyd 1991).

5 Taking biological species as a natural kind by applying to common ancestry is a plausible way to talk about them (Khalidi 2023, 41-42; see LaPorte 2009). However, I do not disregard that whether biological species are examples of natural kind is contentious. For example, Michael Ghiselin and David Hull think that species are not natural kinds but individuals (see Ghiselin 1974; Hull 1976). Still, even if species are individuals and not natural kinds, this would not harm my central thesis, which is the claim that cognition is a natural kind. I mention biological species just as an example of opposition to Cameron Buckner's claim. Without this example, I can still defend my thesis, which is that cognition is a real pattern and, therefore, is a natural kind.

6 Although I do think that my strategy here can be extended to biology, my focus here will be the natural kinds in psychology.

2. Convergent Evolution

All living beings on Earth have a common ancestor (Akanuma 2019). Throughout evolution, living beings diversified and different functions and organs evolved. Many independent branches of the evolutionary tree produced dissimilar traits. And similar traits are usually homologous (Butler 2009). Yet there are many examples of convergent evolution. Convergent evolution refers to the evolution of similar characteristics in different branches of the evolutionary tree. Some traits evolve repeatedly in independent branches of the evolutionary tree, despite being absent in their last shared common ancestor. The reason for this is the power of natural selection. Non-functional and developmentally unsustainable traits cannot survive and because of the restricted number of functionally possible characters, we see that similar functions occur repeatedly. For example, wings of bats and birds are convergent, wings were not observable in the last common ancestor they shared (Seed et. al. 2009). Likewise, legs evolved in arthropods and vertebrates through convergent evolution (Ritzmann et. al. 2004). Also, the camera-eye evolved convergently in mammals and octopi, although their last common ancestor lacked a camera eye (Clayton and Emery 2008, 130).

In this article, I will focus on the convergent evolution of cognition among birds and mammals. Birds have very high-level cognitive capacities. I should note that the ideal comparison would involve two single species but, to the best of my knowledge, there is no scientific comparison of two species from the aspects that I am interested in. So, to narrow down the compared examples, I will compare corvids and apes. I will argue that corvids and apes share the same natural kind of cognition.

To begin, we will start by exemplifying some impressive abilities of corvids and apes. The manufacture and use of tools, which require the integration of visual and haptic information, are seen as a cognitive capacity (Buckner 2015, 320). Among apes, chimpanzees display behaviors of tool usage such as ant-dipping and termite fishing (McGrew 1992). Likewise, New Caledonian crows among corvids, excel at tool usage and manufacturing (Hunt 1996). Crows and ravens can also delay gratification for a quality of reward (Hillemann et al. 2014), which indicates impulse control through inhibitory behavior. Similarly, chimpanzees can delay gratification for several minutes for a quantity of reward (Dufour et. al. 2007). Moreover, both corvids and chimpanzees display transitive inference (see Paz-y-Mino C et al. 2004; Gillan 1981). These behaviors are thought of as cognitive, as psychologists take these as indicators of behavioral flexibility (Buckner 2015). Studies on corvids suggest that they have beyond instinctive behaviors, with very high cognitive capacities. For example, scrub-jays seem to have the theory of mind, an efficient memory, can mentally travel in time, and plan for the future (Baciadonna et. al. 2021). The cognitive capacities of corvids are comparable to that of apes (Güntürkün 2012).

It is easier to conceive of apes as cognitive beings because they separated from us relatively recently, from 9 million to 5 million years ago (Andrews 2019). However, the last common ancestor of birds and mammals lived around 300 million years ago, and that ancestor is not considered cognitive (Emery 2016, 38). Thus, cognition evolved separately in different branches of the evolutionary tree. Here, we have a case of convergent evolution (Van Horik et al. 2012).

At this point, consider a possible objection: one could claim that since cognition evolved slowly, some degree of cognition was already present in the common ancestor of corvids and apes; and, any claim about the common ancestor's lack of cognition is troublesome. At first sight, this would seem to hinder my claim that the natural kind of cognition evolved convergently in corvids and apes. However, because of the definition of cognition I adopted here, I think the slow evolution of cognition does not harm my thesis. Following Buckner (2015), I define cognition as a cluster of properties. As long as any cluster of properties among the examples of behavioral flexibility is satisfied, we have cognition. Although some degree of behavioral flexibility may be present in the common ancestor of corvids and apes, if the properties of behavioral flexibility do not occur as a cluster, we can say that there is no cognition. Buckner's property cluster theory of cognition provides a threshold for the presence of cognition[7], and it is

[7] This is similar to autism, which appears as a degree, being a natural kind (see Khalidi 2023, 60).

unlikely that the common ancestor of corvids and apes had the cluster of properties for complex cognition (see Emery and Clayton 2004)[8].

Scientists believe that cognition among birds evolved convergently primarily because cognitive capacities in mammals occur in the prefrontal cortex, yet birds do not have a prefrontal cortex. Instead of the prefrontal cortex, birds evolved another region (nidopallium caudolaterale) for cognitive functions. It is believed that this region evolved separately from the mammalian prefrontal cortex as it has a structure different from the prefrontal cortex (Clayton and Emery 2008, 131-132; Güntürkün et al. 2024; Güntürkün 2012). Moreover, some corvids have more complex cognitive capacities than some mammals (Clayton and Emery 2008, 130), and this, too, implies convergent evolution.

The similarity of cognitive capacities between corvids and apes seems to suggest multiple realization. Yet differences may imply cognition is not a natural kind. As mentioned before, Cameron Buckner (2015) claims that cognition displays a cluster of properties (some of which are exemplified above), which suggest that cognition in corvids and apes is a natural kind. However, because they result from different evolutionay paths, one might object to cognition in corvids and apes being the same natural kind. Since biologists classified natural kinds according to common ancestry, it is not unreasonable to expect the application of the same strategy to psychology as well. Buckner's claim is not applicable to convergently evolved cognition if natural kinds are identified by common ancestry. Indeed, some have proposed that pain in dogs and pain in humans are of different natural kinds because they are in different species (see Kim 1972, 190; Lewis 1969). As such, cognition in birds and in apes must be different.

Now, I will employ Dennett's *Real Patterns* account to support the claim that although these two sorts of cognitions follow different evolutionary paths through convergent evolution, they are, nonetheless, of the same natural kind.

[8] Here, I think what is cognitive in Emery and Clayton's article is also cognitive in Buckner's theory. The criteria in these two articles are compatible. They both emphasize behavioral flexibility in their understanding of cognition.

3. Cognition as a Real Pattern?

In 1991, Daniel Dennett wrote “Real Patterns”, which states that compressible patterns that allow prediction are real. Dennett considers whether beliefs are real and because belief attribution can help us to explain complex behavioral patterns in a compressed way, he thinks they are. Being compressible means that instead of counting one by one, we can express the data in a shorter description. A pattern that is nonrandom and allows for prediction is real. Since beliefs allow the prediction of behaviors, they are real.

I will now argue that cognition is real in the same way. Although Dennett’s article has been criticized because it does not offer sufficient conditions for being a real pattern (Ladyman and Ross 2007, 205), I will endorse his predictability and compressibility approach to claim the initial plausibility that cognition is a real pattern. My aim is to propose that cognition is a real pattern, and to underline the plausibility that convergent evolution can produce real patterns that may have implications for natural kinds.

Ladyman and Ross (2007), with more detailed descriptions of patternhood,[9] claim that natural kinds are real patterns: “We contend that everything a naturalist could legitimately want from the concept of a natural kind can be had simply by real patterns” (Ladyman and Ross 2007, 294). They define natural kinds as “real patterns with a high indexical redundancy” (Ladyman and Ross 2007, 295). A pattern has low indexical redundancy if it can be observed at just one point in space and time (Cretu 2020, 4). In that case, convergence of cognition seems to increase its indexical redundancy because repetition increases the number of measurements. Cretu’s definition of real patternhood gives us a clear view: “Real patterns are robust relations amongst entities exhibited by any two given entities with sufficient regularity at any given scale” (Cretu 2020, 21). The main question is whether cognition is a real pattern. Although not conclusive, I offer reasons to think it is.

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9 They take projectability as a condition for being a real pattern. Projectability refers to the possibility of calculating an outcome from something else. As I understand it, it could be used interchangeably with predictability here. For example, the instances of clustered properties are calculatable from the reality of cognition. Still, I am not claiming that my approach here satisfies their requirement for being a real pattern.

Does cognition have predictive power? According to Buckner's property cluster theory of cognition, cognition as a natural kind displays some behavioral characteristics that cluster. Although not all of them need to be displayed in every cognitive animal, a cluster of the properties should be displayed. As I mentioned above, corvids and apes seem to display some of the properties. Buckner signifies; context-sensitive behaviors, rapidity of learning, categorization capacity, abstract learning, multimodality, inhibition of behavior, monotonic integration (such as transitive inference) and, expectation generation and monitoring, as clustered properties of cognition. A cognitive animal must have some but not all of these properties (Buckner 2015).

If, because clustered, we take cognition as a natural kind, we can predict behaviors (just as we predict behaviors based on beliefs). For example, if we have reasons to think that an animal has cognition, we would expect it to display some instances of behavioral flexibility.[10] For example, we can expect a cognitive animal to develop a strategy to hinder pilfering of its food. If beliefs are real as Dennett stated, then, I claim, cognition can be real as well. If so, cognition is a natural kind. We should be able to take convergently evolved examples of cognition as the same natural kind because they display real patternhood.

4. Some Other Words About Prediction

Dennett offers *The Game of Life* as an example of a pattern generation process. *The Game of Life* is a computer simulation that proceeds with a simple rule through which patterns are generated, and new shapes emerge: "There are computer simulations of the Life world in which one can set up configurations on the screen and then watch them evolve according to the single rule" (Dennett 1991, 38). The Game of Life, which is intended to

[10] Of course, we infer that an animal has cognition *because* it displays behavioral flexibility. So, expecting behavioral flexibility because an animal is cognitive does not seem a novel prediction. However, what I mean here is that if we infer that an animal has behavioral flexibility, we can predict how it will behave in the contexts that we have never tested before. So, this is a novel prediction.

represent evolution, gives predictions for the upcoming figure, thanks to the rule it applies. In evolution, the primary pattern generation process is natural selection. The convergent evolution of many organs and cognition likewise shows us the power of natural selection. The many examples of convergent evolution can even be used to predict the evolution of possible extraterrestrials.[11] With sufficient information about their environments, it could be possible to predict the body shapes of extraterrestrial beings and even their cognition. If natural selection produces similar outcomes repeatedly on Earth, the same rule would produce similar outcomes on an extraterrestrial planet as well, if the environment is similar (see Morris 2003; Kershenbaum 2021).

The multiplicity of examples of convergent evolution in the biological realm gives rise to ideas about the predictability of evolution. Natural kinds can help us with predictability. For example, the periodic table of elements in chemistry allows us to make predictions. Likewise, convergent evolution allows biologists to make a "periodic table" of life (see McGhee 2008; McGhee 2011, 261). As the periodic table of elements can be used to predict the behavior of elements, a periodic table of life can be used to predict the direction of evolution (McGhee 2011, 276).[12] In the case of cognition, by acknowledging cognition as a natural kind, we can track the regularity of its presence in the evolutionary process. For example, as mentioned above, we can predict the appearance of cognition on an extraterrestrial planet (see Morris 2003; Kershenbaum 2021; Schulze-Makuch and Bains 2017; Powell 2020).

Another question about the real patternhood of cognition is compressibility (Dennett 1991). I will not delve into the issue of compressibility in detail, but I will say a few words about its initial plausibility in cognition. Compressibility is possible if the data are not random. It means that to be real, the pattern has to have low entropy. Entropy can be considered a measure of disorder. And order can be described as "a constant relation

[11] This is a contentious claim, but I do not think it is wrong to exemplify this as I do not claim a conclusive position in this article.

[12] This will not give us %100 predictions. But Daniel Dennett's account allows real patterns with less than %100 predictions.

between neighboring constituent elements of a system" (Grandpierre 2005). If there is no constant relation, a system is random.

Is there a relation among the cognitive behaviors that are clustered? Because of the claim that they are clustered (see Buckner 2015), a cognitive system has low entropy. If we compare the behaviors caused by cognition in corvids and apes with the behaviors caused by non-cognitive processes, such as the behaviors of bacteria, we can see that there is a non-random relation in the behaviors caused by cognition. They occur together. I will not offer any quantitative calculations, as just exemplifying the common qualities displayed by cognitive capacities seems enough to support the compressibility of cognition. Still, I do not claim a conclusive position, as my aim here is to show the initial plausibility of cognition being a real pattern, and if a real pattern, a natural kind.

5. Conclusion

I have proposed a way, following Buckner's property cluster theory of cognition, to take convergently evolved examples of cognition as a natural kind. However, in biology, natural kinds are usually classified according to common ancestry. Therefore, whether convergently evolved examples of cognition are of the same natural kind is debatable. I proposed that Ladyman and Ross's method of taking natural kinds as real patterns could ease taking cognition as a natural kind. To this end, in the first section, I introduced the importance of natural kinds. In the second section, I explained what convergent evolution is, and gave an example case, corvids and apes, to demonstrate that thanks to convergent evolution similar cognitive capacities evolved. Then, I mentioned the idea that cognition should be taken as a natural kind. In the last two sections, I proposed the idea that cognition could be an example of a real pattern. My discussion about the real patternhood of cognition is far from conclusive and should be understood more as a proposal than a conclusion. If further studies support the idea that cognition is a real pattern, this would support the view that it is a natural kind, the same natural kind in corvids and apes, although it evolved convergently in separate branches of evolution.

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