Unjustified Simplicity: A look at the use of Morgan's Canon in Comparative Cognition

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1. Introduction

The question of mental abilities in non-human animals has long been one occupying the minds of ethologists and philosophers alike. Over time, this question has proven to be a multidisciplinary question, tying in the fields of biology, comparative psychology and philosophy. While the comparative psychologists, ethologists, and biologists observe and collect data on animal behavior, we do not often find it the case that studying behavior leads us to distinct psychological processes that produce that behavior. This means that alongside a behavioral approach, the study of animal cognition needs take a philosophical approach from an epistemological point of view. Conway Lloyd Morgan, often referred to as the father of comparative psychology (Karin-D'Arcy, 2005), posited a principle reminiscent of Ockham's Razor, named Morgan's Canon:

In no case may we interpret an action as the outcome of an exercise of a higher psychical[sic] faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale. (Morgan, 1894)

The ideal of searching for the simplest explanation of animal behavior reappears in slightly different forms in the field of comparative psychology. Another name for Morgan's Canon is the Principle of Cognitive Simplicity (Meketa, 2014), which says that the main hypothesis when looking at animal behavior should postulate that the simplest cognitive ontology (process, mechanism or structure) is responsible. A third similar postulate is from cognitive scientist Daniel Dennett (1983), which states that "behaviorism is the null hypothesis against which cognitive accounts are tested." In all three of these principles, we see that there is the notion that simpler cognitive accounts of animal cognition and cognitive behaviors are to be preferred. Despite many works rejecting the Ockhamist interpretation (Sober, 2005; Fitzpatrick, 2008), Morgan's Canon is referred to the principle of parsimony for comparative psychology (Elsevier's Dictionary of Psychological Theories, 2006). In this paper, I will be using psychological processes and cognitive processes interchangeably, both referencing the underlying processes responsible for animal behavior.

Looking closer at Morgan's Canon, we are faced with two conceptual issues. The first being the establishment of a *psychological scale* in which we can classify cognitive abilities and processes. The second issue lies in the justification that the preferred explanations are the ones referencing lower psychological abilities. The notion of cognition and where cognitive processes would fall into such a psychological scale is currently ambiguous at best. In the following sections, I will discuss different interpretations to establish a psychological scale including causal priority of evolutionary cognitive development, conceptual entailment of cognitive processes, and the

justifications of those interpretations to have explanatory power. After, I will discuss strategies for the future study of animal cognition and behavior through evidence and explanatory power.

2. Scale of Psychological Processes

Intuitively, and in most cases, the differences between lower-level and higher-level psychological processes can be understood as the level of *complexity* (Fitzpatrick 2008; Meketa, 2014). The organization of psychological processes based on complexity runs into some issues. Where are we looking for that complexity? When we speak of a process being more or less complex, are we speaking about the neural organization of the animal? The functional organization? The behavior it produces? Even Morgan himself saw the potential issues and ambiguity in his original principle, leading him to edit it as such:

In no case is an animal activity to be interpreted in terms of higher psychological processes, if it can be fairly interpreted in terms of processes which stand lower in the scale of psychological evolution and development (Morgan, 1903, emphasis added).

We moved from an undefined psychological scale for psychological processes to one based on evolution and development. A connection between increasing complexity and evolutionary development seems intuitive, and the idea of evolution moving towards increasing cognitive complexity seems suited for the notion of a psychological scale from which to judge animal cognition. It is certainly true that complex cognitive phenomena and processes evolved from simpler informational processing systems, it is not always the case that evolution moves from simpler to more complex designs, nor that evolutionary development moves linearly through time.

An example of this is the Baldwin Effect, where an organisms ability to learn new behavior and natural selection bring that behavior under genetic control and makes it inheritable (Weber, Depew, 2003), such as is the case with the North American house finch (Badyaev, 2009). This process, which can contribute to survival strategy in a novel environment, leads to decreased cognitive complexity and a loss in cerebral plasticity (Sterelny, 2012). Morgan himself was aware of the potential for the (to-be-named) Baldwin effect, describing it in 1896.

We can see that a psychological scale based on evolutionary development will not always move in the direction of increasing complexity. Instead, the best interpretation of Morgan's updated view is that possessing higher-level psychological abilities implies having lower-level psychological abilities. Now we will look at how this interpretation is expanded upon.

2.1 Causal Priority

One method of defending Morgan's Canon as he intended, is to do so in line with modern Darwinism. As Shettleworth in 2013 stated:

…explanations in terms of general processes of learning along with species-typical perceptual and response biases should always be sought before invoking complex or specialized cognitive processes.

This line of reasoning places complex or specialized cognitive processes at a higher level on the psychological scale, as compared to more general learning processes. Karin-D'Arcy (2005) also holds a very similar version of this view , arguing that "*complex biological systems evolve by means of adding new systems on top of older systems in a hierarchical yet integrated fashion."* (Meketa, 2014), replacing the idea of higher and lower level with the concepts of *derived* and *ancestral* respectively.

The critical difference between this view and Morgan's own, is that it is based off of causal priority of cognitive abilities, rather than a phylogenetic or evolutionarily-later priority of cognitive abilities. A cognitive process Y is higher on the psychological scale if process X is causally prior, or required for process Y to evolve. This view doesn't imply that evolution moves from simpler to more complex cognitive processes, only that there must be some simpler cognitive processes which evolved first and are necessary for more complex processes to evolve later. However, the causal priority view is not without its issues. This view doesn't necessarily associate higher-level processes with more complex ones. This allows for the possibility that an ancestral process is more complex than an evolutionary later derived process, and thus Morgan's Canon through this interpretation would prefer the more complex ancestral process for explanation. To validate this view, we would need a necessary correlation between lower-level processes and a lower level of complexity.

2.2 Conceptual Entailment

Another potential method to setting up a psychological scale is to do so independent of development and evolution. This method develops the psychological scale on the basis of conceptual entailment relations. Using this perspective, we are less interested in the processes that underlie animal behavior, rather we are interested in whether those processes are similar or the same as those underlying human behavior. Through the lens of conceptual entailment, we shift away from empirical investigation, and move towards *a priori* reasoning and introspection. We can say that ability Y is higher in the psychological scale if having ability Y conceptually entails having ability X. It is the belief that this method will end up selecting the explanations that Morgan's Canon initially sought to select, as if having Y entails having X, ability X must evolve before Y. Conceptual entailment however, prohibits the possibility that an organism can lose a lower-level psychological process while still keeping the higher-level process.

There are a few benefits to the conceptual entailment view as compared to the causal priority view. Primarily, due to the classification of psychological processes conceptually, we can directly compare distinct species, distantly related in the evolutionary tree. However, there are a few problems that arise with adoption of this perspective. First, there is no guarantee that certain cognitive processes stand in conceptual entailment with each other. When looking at the debate of consciousness, theory of mind, beliefs in animal cognition, this poses an issue. The second issue is that with conceptual entailment, we presuppose to know everything *a priori* about the mental categories studied in humans, and thus would only be interested in how they appear in non-human animals. Due to its lack of empirical justification, we are in no position to use the conceptual entailment view to compare human mental capabilities with those of animals. Lastly, there is concern that comparing cognitive abilities using humans as a benchmark is *setting the comparative bar unreasonably high* (Starzak, 2017).

Summary
In both the causal priority or conceptual entailment cases, the idea of establishing a psychological scale to which you can analyze cognitive processes are defended, but ultimately fail to identify more complex processes as higher-level processes, or are not a *scale of psychological evolution and development*, as presented by Morgan (1903). We now move onto the challenge of justifying the preference for a lower-level psychological process explanation.

3. Explanatory Justification

Is the preference in Morgan's Canon for lower-level process explanations justified? To answer this, we must first look at what we want from an explanation. We want explanations that are *explanatory* and explanations that are *true*. Explanatory power can be thought of as the probability that the explanatory hypothesis is true, or in other words, better explanatory power suggests a larger probability of being true. There is another way of thinking about explanatory power, given by Ylikoski & Kuorikoski (2010); *explanatory virtues are (…) about how good an explanation is, if it is true*. So we are presented with two ways of looking at explanations in regards to Morgan's Canon; we should prefer lower-level process explanations because they are more explanatory, or we should prefer lower-level process explanations because they are more likely to be true. In either view, we first need to show that lower-level processes are more explanatory, and second that by nature of being more explanatory, it is a justification for use of Morgan's Canon.

3.1 Explanatory Power

Ylikoski and Kuorikoski (2010) explore a few parameters to measure explanatory power. The first of which is *cognitive salience*. The argument for this is that an explanation should be measured against the amount of understanding that explanation provides. Yet, it is unclear why explanations referencing lower-level processes should provide an easier understanding than those referencing higher-level cognitive processes. Even Morgan (1894) was aware of this in his initial formulation of his Canon, going so far as to mention that explanations referencing lower-level psychological processes can be more difficult to understand than those referencing higher-level processes. This is not to say that Morgan is backtracking on his Canon position, but rather that cognitive salience is not a useful parameter to justify lower-level process explanations.

Other parameters explored are *degree of integration* within existing larger theoretical frameworks, and *factual accuracy*, the number of idealizations used in an explanation. For example, it is the position of McClelland et al. (2010) that we should explain *human thought, language and behavior in terms of emergent consequences of a larger number of simple non-cognitive processes* and that the mental vocabulary we use serves as a description rather than an explanation. They believe that such descriptions have no basis in explaining the underlying processes. For *degree of integration*, a similar point can be made. If it is the case that higher-level explanations are just abstractions, and lower-level explanations reference the neural mechanisms involved, then lower-level process explanations are going to always integrate into the existing cognitive neuroscientific framework. However, as Starzak (2017) mentions, the arguments for *factual accuracy* claim that lower-level descriptions, not processes, are more explanatory. Lower-level descriptions can be given for higher-level processes, and therefore there shouldn't be any difference in *factual accuracy* between higher and lower-level explanations. The same argument can be made against *degree of integration*

as a parameter, as lower-level descriptions, not explanations, are better integrated into the current cognitive neuroscientific framework. There is a potential to interpret Morgan's Canon in the way that higher and lower-level are not referring to processes, but to the level of description of the same processes. However, the Canon is usually interpreted to suggest which processes are used, rather than how to describe them.

Since no single parameter can justify the preference for lower-level processes, perhaps we must consider multiple. Should we do so, the more parameters we have to include, the less powerful a parameter becomes in justifying the preference. Even if one parameter consistently suggested a preference for lower-level explanations, it would have to outweigh the effects of all the other parameters. Because explanatory values are not always on the side of lower-level explanations, explanatory power is not a justification for the lower-level explanation preference of the Canon. Alongside that, the preference would only be justified if explanatory power was more powerful than the probability of explanation truth. In other words, we shouldn't choose an explanation that is more explanatory, but less likely to be true. Explanatory power then only comes into use as a parameter when the same probability of truth is found multiple competing explanations, but whether different psychological and neural mechanisms are equally likely is unlikely.

3.2 Are lower-level process explanations more likely to be *true*?

We have shown that explanatory power doesn't provide the necessary justification for a lower-level process preference, and now we move onto whether likelihood (probability) of truth is able to provide such a justification. Morgan's Canon, being called the principle of parsimony for comparative psychology, runs into a few issues on the parsimony front. The main point which I will try and demonstrate is that on the basis of parsimony or simplicity, there is no still no justification for the lower-level preference.

Morgan (1890) himself did not necessarily agree with the comparison of his Canon to that of the law of parsimony. He states that *we do not know enough about the causes of variation in cognition to be rigidly bound by the law of parsimony*. However, it is also the case that the preference is for an explanation with the fewest processes, which would include higher-level process explanations to be preferred if explained by a lower number of constituent processes (Sober, 2005). If we take the view of *causal priority* as described in section 2.1, newly-evolved (cognitive) systems (B) are integrated into older systems (A). The parsimonious explanation in any case taking this view is explaining behavior on the single ability A, rather than the multiple abilities of A&B. This is also the case if you take the views of *conceptual entailment* as described in section 2.2. We run into the question of whether parsimony is only relevant for explanatory power (which is insufficient for justification of preference), or is indeed it increases the probability for an explanation to be true.

Tomasello and Call (2006) present the argument that it would be more parsimonious to explain a set of animal behaviors as a result of a single higher-level cognitive process, rather than explaining the same set as a combination of lower-level cognitive processes. In these cases, by virtue of simplicity, the law of parsimony is going to prefer these higher-level process explanations. Due to this, one could shift the notion of simplicity and parsimony to the realm of explanatory power, rather than the realm of probability of truth. Thus, parsimony doesn't justify the preference for

lower-level process explanations as advised by Morgan's Canon, nor can competing hypotheses be judged *a priori* on the basis of simplicity or parsimony.

In the case that likelihood cannot be judged *a priori*, we must analyze how useful a principle Morgan's Canon is *a posteriori*, against empirical knowledge and evidential support. We'd like to be able to make empirically informed probability assessments (Starzak, 2017). Povinelli & Vonk (2006) posit that we should analyze explanations against the demands they make on the evolutionary process, and prefer explanations that are easier for evolution to explain. A claim would take the form that evidence supports the probability of having lower process *A*, without having higher process *B*, is higher than having both *A* and *B*. Causal priority and conceptual entailment are supported by this argument.

However, while our empirical evidence may support a lower process explanation in some cases, it depends on the animals studied. The probabilities of possessing *A* without *B* or possessing *A* and *B* will change based on both the process and target group studied. Expanding or limiting the group of animals compared and studied will change the probabilities. Take the example of Theory of Mind . We know that humans have Theory of Mind, but not sure whether other species do, so statistical probabilities are not useful despite the group size of comparison.

An example from taking biological considerations into account; higher-process explanations can be more parsimonious regarding memory resources required for learning. In order to learn the same thing, a more sophisticated higher-level learning process is more efficient than simpler associative learning processes (Fitzpatrick, 2008).

Simplicity and parsimony can be understood in many ways. In none of the interpretations do they unilaterally increase the probability of an explanation being true, and therefore do not justify the preference for lower-level process explanations as advocated by Morgan's Canon.

4. Conclusion

All interpretations of Morgan's Canon fail to systematically select explanations that satisfy the following: for there to be a justification for lower process explanations, the explanations must be more likely to be true, or if equally likely, must be more explanatory. The interpretations failed to provide such justifications as explanatory power and evidential support are multi-faceted notions sensitive to many parameters. Morgan's Canon may be an attractive reductive notion, it is most likely that any interpretation of it cannot be successful. It seems conceptually impossible that any sort of psychological scale could be sensitive to the numerous relevant parameters, and adequate account for them in explanations. Instead, the best use of Morgan's Canon is to provide hypotheses and explanations against which we can test present and future empirical evidence.

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