**The Potential Role of Animal Consciousness Regarding Reductionist Approach in The Study of Animals’ Cognition**

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# Introduction

The philosophical scholar known as “Reductionism” is a research method that argues to investigate complex phenomena by deconstructing the it into smaller parts which, ultimately, will provide a solution (Doniger, 1999). Likewise, in psychology the reductionist seeks to explore psychological matters by utilizing brain analysis tools such as fMRI, PET and so on. Despite its massive contribution to understanding the underlying causes of psychological operations, reductionist measurements are far from being the sole and pure attribution to human and animal behavior. Regarding animal research, the operation of studying the human mind through psychologically “simpler” creatures, animals, is a reductionist action for itself. That is, researchers concluded that by studying the cognition of animals, which is believed to be less complex than of humans, we can provide psychology with insights into the human mind. A further established conclusion is the irrelevance of consciousness to the study of animals’ cognition. Often while studying animals in the course of psychology, terms such as memory, emotions, motor orientation and more are used. If carefully fitting a framework for the mentioned terms that are studied and introduced in psychological animal research- consciousness might be the rightful framework. Ultimately, it is to say that the findings found and concluded from animals’ studies regarding consciousness apply to humans. In fact, much of the fundamental basis of modern psychology is based on animal studies involving animals such as rats, pigeons, monkeys and more with behaviorism being the prime example (Krebs, 1983). However, the extent to which findings emerging from an animal study, exploring that specific animal’s consciousness, can be generalized to humans- is questionable. Similarly, to what extent does consciousness impacts cognitive research?

While reductionist conclusions are all helpful in the practical sense, one must critically asses the ramifications following the route of reductionism- for both scientific logic and reasoning as well as the ethical implications in relation to animal welfare. Hence, this paper will asses the role of consciousness in animal research as well as the construct of consciousness in general.

# Validity

In order to study a construct, we must first define it in a clear and scientific manner- construct validity. Additionally, a clear definition of consciousness is yet discussed in today’s psychology. However, what we do assume, and quite confidently, is that humans, apes, rats and all different animals possess different forms of consciousness. Moreover, we dare to say that it is our human consciousness that has enabled us to rule the world by cognitive means. Following this introduction there are three premises that we shall carefully suspect (Gutfreund, 2017):

1. The brain of species X produces consciousness.
2. We understand how the brain of species X works.
3. We do not understand how any brain produces consciousness.

These three premises crate a paradox. Meaning, we cannot know and understand how the brain works without understanding the consciousness arising from it. As Gutfreund (2017) sees it, the third and first assumptions are the correct ones. That is to say, we believe consciousness is found somewhere in the brain and secondly, we do not understand how the brains produce the state of consciousness. Nonetheless, I question two assumptions and my interest and motivation for studying animal cognition stamps from these.

To begin with, I disagree to an extreme reduction of consciousness to the brain alone. Firstly, and simply, because localizing a metal quality that is poorly defined is irrelevant and reckless. To illustrate, if an ill person comes to the general practitioner with a problem, the doctor will naturally first try to grasp a clear description and definition of the complaint before he would check the person’s reflexes or other qualities. Thus, we must first define the concept and only then try to localize it in the brain as the opposite manner would make no sense. Secondly, even if we are to succeed and localize a mental state of consciousness in the brain, using a causal term as “produce” is somewhat wrong. Mental sates are a result of interactions between genes and different levels of the environment over the lifespan of an individual, and it is well established in psychology by the “PsychoBioSocio” framework. Hence, finding neural correlates of consciousness covers part of the entire story. For example, if one day we find the entire neural system of depression in the brain (assuming that such a system exists) of a patient that is being abused when he comes back home and recover it biologically, if this individual is still under severe stress, the development of depression is likely to reoccur. In fact, the biological component is useless if ignoring the social or psychological, as many cases in clinical psychology can point out. Regarding external validity, if we are to accept the former first and third premises, as I believe most science indeed does- we cannot study consciousness in animals in an effort to understand our consciousness. Let us lay it out in standard form once more:

P1) The brain of species X produces consciousness.

P2) All species have different brains

C) Each specie has a different form of consciousness

As it follows from this conclusion, we simply cannot study other animals in order to understand humans’ consciousness. However, science did not lose hope and in an implicit way has resolved this paradox by assuming that cognition is separated from consciousness- a notion that can and must be further questioned and supported. In fact, we have gone so far as to say that the cognition of animals is representative of human cognition, but “simpler”. In that way, for instance, vision can be easily studied in monkeys. Following this step, we can happily study animals, to a limit of “simple cognition” and to generalize it to humans.

Then again, can we really assume that these simple cognitions are indeed similar between humans and rats for example? Or rats and monkeys? Or is consciousness really unnecessary for cognition? After all, the true reductionist that a few paragraphs ago argued that “consciousness is in the brain” must also agree that vision rests and found in the eyes, however as far as I know humans’ and monkey’s eyes are not exactly the same.

# Consciousness

Consciousness is a matter of utmost interest in both humans and animals. The concept is being attended by myriad disciplines in the everlasting quest to grasp the elements of the tricky phenomenon. Within the framework of the study of consciousness and in regard to animal studies we can make a rough division into two schools of thoughts: non/representationalism and neurological research, each embeds different premises and conclusions. Moreover, representationalist theories can be further divided into sub- categories - first and second order of consciousness. To establish a proper grasp of the said above I have created a visual scheme:

Consciousness

Second order

First order

representationalism

Neurological research

Non-representationalism

Let us begin with the neurological research. First, the research in neurology that regards animals rests heavily upon analogy. For the neurologist the task is simple- learn the cognitive processes that are identical to humans (memory, decision making, problem solving and more) and find the corresponding structure in the brain that is assumed to be similar to the humanlike structure. Secondly, as follows from such an approach, the way it feels to remember or think as animal X is not important to study cognitive processes- meaning the qualia of experience is irrelevant for the research. However, and quite clear, the approach runs into several problems when considering the given premises as I also attended in my pervious text. Questionably, is it really the case that animals engage in similar cognitive processes as us and can we expect those processes to have an identical corresponding brain structure? This notion makes little sense to my personal view- if the initial hypothesis is that brain structures lead to cognitive processes, can we expect different brains to have different cognitive processes? So, an animal that does not have hippocampus is not able to generate new memories? This is clearly not case as we know from existing animal research- different structures of sensations are a result of adaptation to natural environments and thus it is clear that variation in structures allowing cognitive processes will be found. Moreover, can we expect animals that have similar structures, say rats, to have the same cognitive processes? Donald Griffin (1992) brought back the essence of such a question by suggesting that the way the animal is experiencing cognition is relevant for cognition itself- a notion I agree with. According to Griffin, behavioral flexibility is some evidence for the ability of animals to draw mental representations that are necessary for consciousness. This leads us to the two remaining approaches in animal consciousness: representationalist and non- representationalist theories. The first holds that the aspect of mind shared by all conscious beings is the ability to draw mental representations while the later argues for disassociation between mental representations and conscious experiences and therefore holds the belief that consciousness is found in neural correlates within the brain. Additionally, representationalist theories has come up with a distinction in conscious abilities: first order which is the ability to have mental properties that allow consciousness as having a belief and second order of consciousness which is the ability to reflect upon the mental capacities, thus metacognition. The conclusion from such a division is that animals are able to have first order consciousness whereas humans are the only animal able to engage in second order of consciousness. This sums into the following:

P1) Animals do not have thoughts about thoughts.

P2) Without having thoughts about thoughts, one cannot be conscious.

**C)Therefore, animals are not conscious.**

Nonetheless, some critique about this matter emerges from blindsight and implicit learning. These processes do not require consciousness in order to evolve and function. We know how to use grammar rules without knowing, often, why we use the language the way we do. Likewise, Blindsight clients can report a “feeling” of objects and even avoid them is some cases. This sums into:

P1) Animals do not have thoughts about thoughts.

P2) Without having thoughts about thoughts, one cannot be conscious.

P3) humans can engage in cognitive functions as learning in an unconscious manner.

P4) research is only interested in cognitive functions

**C) we can research cognition in animals, as consciousness is irrelevant for the research.**

I oppose to this later conclusion and will use Carruthers (1989) to support my stand- experience and consciousness are separated in this view, the existence of Blindsight, priming, implicit learning and so on are all evidence for functional sense organs that do not require consciousness. These organs are vital for information gain, but they do not reward us with consciousness- this, according to Carruthers, is conditioned by the term of possessing metacognitive abilities. I would like to further add that in my view, the notion of concluding that consciousness is not required for cognition because evidence as blindsight and so on is inaccurate. The mentioned phenomena are all example of passive operations, in order to be primed, walk a room full of objects or engage in a very trained behavior as language- we need not to actively engage with the incoming information and operates in it. Meaning, working memory is not necessary for such takes. Therefore, I believe that those phenomena are representative of minimal consciousness but are tremendously far from constituting a whole representation of consciousness and allowing to conclude that consciousness is not required for cognition- as neurology is often striving to conclude.

Tye (1997) offers an overview of his theory that, he believes, can deem the consciousness of animals by four elements:

1. Poised- available to belief-forming cognitive processes
2. Abstract- no need for an object resulting in dreams and hallucinations for example.
3. Nonconceptual- no concept is required for the mental state/sensation, example is seeing shades of red.
4. IntentionalContent- the content of a mental state.

Animal learning provides the best evidence for has intentional representational content and Tye illustrates this point by using Fish as an example. Gray snapper usually enjoys eating silverside fish, however when researchers marked fish and injected them with bad taste, the Gray snapper has learned to avoid those fish- meaning, according to Tye, that it has formed a belief about the food being eaten and thus is conscious.

Thus, I believe further research must first clarify and define the relationship between consciousness and cognition before omitting these notions and drawing very questionable conclusions as facts. For example, researching active working memory tasks such as simple math or other information manipulations in humans, blind sighted or healthy, then compare it to apes’ performance in the task.

# Evaluation of Theories of Consciousness

After a carful and neat evaluation of the theoretical principles beyond the study of animals in regard to human and animal cognition, I would like to illustrate the notion of consciousness by evaluating a case study- fish’s pain. In doing so, I will touch upon the theories described in the couple of previous assignments and will challenge the common and vast view in animal cognition research according to which consciousness is irrelevant to the study of animals and their cognitive abilities.

Braithwaite et al (2010), were interested in the question whether fish can consciously feel pain and its effect of their cognition. In order to study this issue, Braithwaite has designed three experiments. All subject were trout fish. In the first experiment, the fish were divided into three groups. Control group, receiving and injection of a saline solution, a manipulation group receiving an injection of bee venom and finally the second manipulation involved injection of vinegar. All injections were injected to the mouth area if the fish and in order to stimulate the nociceptors that has been found to correspond to pain sensation. The measurement of pain, namely the dependent variables, were heart and breath rate and consumption of food. These measures were selected since many animals, including humans, show a faster breath and heart rate when in pain as well as lack of hanger. Results were confirmed and fish in the two manipulated groups showed increased heart and breath rate as well as decreased food consumption. The conclusion given by Braithwaite et al (2010) is that fish can modify their behavior in relation to painful stimuli.

That is however not evidence to consciousness in fish. It is equally possibly that fish simply suppress hunger unconsciously, in an automatic reaction to activation in the nociceptors. Therefore, Braithwaite et al (2010) have designed a further research which involves a more complex cognitive task in relation to pain.

Braithwaite et al (2010) explored the degree to which fish are conscious of their pain. In order to do so, the team has used the same subjects as past research- trout fish and with the same variables- effect of pain on cognition and behavior. The research included two experiments. Firstly, fish were divided into two groups- pain group and a control group. Manipulation was done by injecting vinegar into the mouth area of the fish- same as former research and control group was merely injected with a saline. Then both groups were exposed to a novel object in the water tank. Measurement was the distance of fish to the novel object reflecting learning abilities. To clarify, fish tend to avoid novel objects during the first interval since the objected is introduced to their living environment. Thus, the task is rather complex in the cognitive sense- fish must first differentiate between novel and known objects and then have the capacity to “learn” and understand that the new object is novel and therefore need to be avoided. Furthermore, based on human research, we know that under the influence of pain- learning abilities are dramatically impaired. Taken all together, if fish’s pain interacts their presumed consciousness, then we shall expect fish in the pain group to engage more closely with a novel object than fish in the control group. This was the hypothesis of Braithwaite’s team which was confirmed; fish in the pain group indeed swam significantly closer to the novel stimuli than fish in the control group. Finally, in the second experiment and in order to gather more evidence for the conclusion- the researchers repeated the design (pain group and a control group) only that this time all fish were also injected with morphine, a painkiller. As hypothesized by the researchers, the difference between the group disappeared, all fish avoided the novel object. This final variation of the research has provided the evidence with double dissociation- the effect is caused by pain, and the effect cancels in the absence of the cause- pain.

What can we conclude from such experiments? Are fish conscious? In light of the showed evidence, the conclusion is positive- fish are likely to be conscious. The evidence comes for a serial of experiments with the final one achieving a double dissociation between fish pain and learning abilities. First, fish show behavioral flexibility- a notion that was offered to approve conscious experience by Griffin (1992). Fish were able to adjust their behavior, e.g. food consumption and spatial orientation, in relation to a physical sensation and feedback. Secondly, we see a clear ability to draw a mental representation of novel versus familiar objects. Namely, first order processes of consciousness- the required standard of consciousness for the representationalist approach. Finally, in according to Tye’s (1997) theory of consciousness, all four standards are met. Fish were able to have the content of the mental state of pain(IntentionalContent) without knowing the stimuli causing the pain (Abstract) nor the concept of pain (Nonconceptual) as well as the ability to form the belief that an object is novel or not and draw behavior according to that decision (Poised).

Nonetheless, we are left with two approaches of consciousness that are yet touched or confirmed by the above research- Neurological research/Non-representationalism. In order for these schools of thoughts to reward fish with the gift of consciousness- a neural structure corresponding to the limbic system in humans (pain activated region in human brain) must be found.

It has been argued that fish cannot feel pain because of the absence of such structure (Rose 2002, 2007). In fact, this reduction drifted to such an extreme that these researchers concluded that fish cannot possess any feeling as all!

Portavella et al. (2004) have found a structure in fish brain that is similar to the amygdala (a central notion of the limbic system) in humans. The amygdala in humans is a vital structure for the formation of fear conditioning. Hence in order to test the hypothesis regarding the “fish amygdala” the researchers have lesioned the found structure in one group of golden fish and then sequentially, engaged in fear conditioning trails. Fish with lesions to the amygdala-like structure were unable to learn the connection to an aversive shock and thereby failed avoiding it. This research gives evidence to an amygdala-like structure in fish.

The above research has provided us with the final piece- neural correlates in fish that match humans’ brain structure! In accordance to the Neurological research together with the Non-representationalism- the conclusion that fish are conscious is supported!

To sum up, it can be concluded that fish are likely to be conscious. This conclusion rests on evidence from several researchers as well as in line with two opposite schools of thoughts and an additional theory of consciousness.

# Conclusion and Discussion

In light of the presented evidence and argumentations, a few points can be concluded. Firstly, consciousness has the capacity to influence cognitive findings. As demonstrated, the conscious experience of an animal (fish pain) had direct impact on the results of cognitive measures and predictions (learning ability and object recognition of fish). This has dramatic implications to further research- research must devote serious attention into the notion of consciousness in animals in order to fine its results and accuracy- a matter I will further elaborate in the dissection. Secondly, the possibility of consciousness in animals, rises serious ethical concerns. If consciousness is alternating cognitive results, and animals have different consciousness than we do- why should one utilize animals to understand the human mind, and not the animal mind. Thirdly, the construct of consciousness constitutes a global warning to the scientific community as whole- as every field consists of agreed assumptions and axioms, scientific research must always strive to the maximal amount of caution and critique of its fundamentals and assumptions. Consciousness is agreed to be irrelevant to cognitive research, a conclusion that is gradually doubted, lacks empirical evidence and seems to damage the value of truth.

The question of practical implications of consciousness in animal science shall naturally follow the above conclusion. How can one embed consciousness in his or her own research? Well this question is for itself a positive progression. I believe that first the notion of consciousness must be vastly recognized and then a general guideline and research on consciousness can be accomplished. Nonetheless, a plausible direction is the topic of consciousness disorders in animals. It makes prefect logical sense due to the obvious point that if a creature does not possess quality X- it cannot impair or damage it. Vitally an anecdote must be made in relation to the logical reasoning behind my suggestion;

P1) if animals can have consciousness disorders, then they possess consciousness (if p then q)

P2) Animals can have consciousness disorders (p)

C) Animals are conscious (q)

This is a clear reflection of model’s pones. That is logically equivalent to say that if animals don’t possess consciousness (not-q) then they do not have consciousness (not-p). However, one must be extremely careful- if we find that animals cannot have consciousness disorders (not-p) that does not mean they are not conscious (not-q)- that is to make the logical fallacy of denying the antecedent! The meaning of this later case, means that science will have to ponder upon new ways to study the existence of consciousness among animals.

Consciousness has tremendous implication to both eh quality of psychological research as well as to the ethical utility of animals as subjects. Given this conclusion, it is the mission of future scientists to develop clever paradigms in order to study the existence, definition and impact of consciousness in animals.

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