The Use of Animal Models in Behavioural Neuroscience Research

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Abstract Animal models are used in experiments in the behavioural neurosciences that aim to contribute to the prevention and treatment of cognitive and affective disorders in human beings, such as anxiety and depression. Ironically, those animals that are likely to be the best models for psychopathology are also likely to be considered the ones that are most morally problematic to use, if it seems probable that (and if indeed they are initially selected as models because) they have experiences that are similar to human experiences that we have strong reasons to avoid causing, and indeed aim to alleviate (such as pain, anxiety or sadness). In this paper, against the background of contemporary discussions in animal ethics and the philosophy of animal minds, we discuss the views that it is morally permissible to use animals in these kinds of experiments, and that it is better to use less cognitively complex animals (such as zebrafish) than more complex animals (such as dogs). First, we criticise some justifications for the claim that human beings and more complex animals have higher moral status. We argue that contemporary approaches that attribute equal moral status to all beings that are capable of conscious strivings (e.g. avoiding pain and anxiety; aiming to eat and play) are based on more plausible assumptions. Second, we argue that it is problematic to assume that less cognitively complex animals have a lesser sensory and emotional experience than more complex beings across the board. In specific cases, there might be good reasons to assume that more complex beings would be harmed more by a specific physical or environmental intervention, but it might also be that they sometimes are harmed less because of a better ability to cope. Determining whether a specific experiment is justified is therefore a complex issue. Our aim in this chapter is to stimulate further reflection on these common

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assumptions behind the use of animal models for psychopathologies. In order to be able to draw more definite conclusions, more research will have to be done on the influence of cognitive complexity on the experience of (human and non-human) animals.

Contents

1 Introduction

Much research in behavioural neurosciences is aimed at the prevention and cure of cognitive and affective disorders in human beings. These disorders, such as anxiety, depression, and alcohol addiction, have a severe impact on individuals' quality of life. While virtually anyone would applaud the aim of neurobehavioural science to relieve human suffering, the moral acceptability of the use of non-human animals in reaching this aim is a matter of controversy. It is significant that animal models are used precisely because we consider the use of human beings in such experiments morally impermissible. If the use of animal models is morally justified, there must be a relevant difference between human beings and the animals used in these experiments that justifies the differential treatment. Yet, if these animals are indeed good models for certain psychopathologies, it might be considered likely that they have experiences that are similar to human experiences that

we consider to have strong reasons to prevent or cure (such as anxiety or sadness). What, then, justifies the use of animal models? Also, in the practice of animal experimentation we see that it is considered preferable to use animals that are less like or further removed from human beings, e.g. rats rather than apes, and zebrafish rather than rats.[1] Is such a preference morally justified?

To determine whether the use of specific animal models is morally justified, we need, first, to determine the basis of moral status. This is an issue that is widely discussed in moral philosophy. The concept of moral status will be explained in more detail below, but roughly, it involves whether and how much a being should count in our moral considerations. We shall see that moral status is often linked to the possession of specific kinds of capacities, e.g. sentience (being able to have negative and positive physical and psychological experiences) or rationality.

Besides determining the sensory or cognitive capacities required for moral status, we need to investigate whether specific species of animals (rats, zebrafish etc.) have these capacities. This will also help us determine whether their interests differ from ours and vary between different kinds of non-human animals. If non-human animals suffer much less from the experiments performed on them than human beings suffer from the pathologies we aim to cure, this might be considered a reason to regard the use of these animal models justified. To find an answer to the question what capacities specific species of animals have, and what they can be thought to experience, we require empirical evidence on different species of animals, e.g., data on their behaviour and neurophysiological responses in certain situations. However, there is an interpretational gap between data and meaning: between test results and what they actually tell us about what certain animals can do and experience. This is why this is also an issue in what is called "philosophy of mind". Philosophy of mind studies the nature of the mind and consciousness, and its relation with the brain.

We do not intend to give an exhaustive discussion of all positions in animal ethics (or moral philosophy, more generally) and the philosophy of animal minds. These are very rich and complex fields, and we cannot fully do them justice in this chapter. We have more modest aims. First, to bring to the fore some of the more important questions that need to be considered to determine whether using animals in neurobehavioural research is morally acceptable and whether it is more justified to use certain animals than others. Second, we want to show that common assumptions about the moral status or capacities of animals that may lie in the background of the use of animal models in the behavioural neurosciences are not uncontroversial, and indeed, that there is good reason to question them.

We will argue that common defences of the view that human beings have a higher moral status than animals (or even that non-human animals lack moral status altogether) involve implausible assumptions or implications. We will present two very divergent positions in contemporary moral philosophy that nevertheless both defend attributing equal moral status to all beings that consciously strive to attain

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[1] See Hagen et al. (2012) and Stafleu (1994).

goals, and point out the comparative merits of these views. Furthermore, we shall also question views that less cognitively complex animals have a somehow lesser sensory and emotional experience than more complex beings across the board (or even lack consciousness altogether). We shall argue that while there are good reasons to assume that there are differences in the way that different kinds of animals are affected by negative sensory or emotional states like pain, anxiety and depression, this does not necessarily mean that less complex animals are not seriously harmed by these states.

From the outset, it is important to note that it is extremely difficult to generalise about the cognitive and sensory capacities of animals; thus, different taxa may have widely different capacities for suffering, or for coping with any suffering which may be experienced: mammals may have totally different experiences in a given situation than fish or insects. While animal ethicists tend to talk rather loosely of animals in general, especially for the purposes of this chapter, it makes a lot of difference what type of animal we are discussing. Where appropriate, we will try to specify what group of animals we are discussing, although there remains the problem in many cases that at present, we do not have perfect knowledge about the emotional and cognitive abilities of those different animal taxa, nor do we have enough knowledge on the influence of cognitive complexity on different kinds of emotional suffering.

In our considerations below, we presuppose that all neurobehavioural experiments involve some kinds of physical and environmental interferences with animals, which are aimed at making them models of specific human psychopathologies. The question is whether specific examples of such interferences are morally problematic.

2 Moral Status

2.1 Introduction

To determine whether it is morally acceptable to use specific kinds of non-human animals in experiments in the neurobehavioural sciences, the first question that we need to answer is whether these animals have moral status. If animals have moral status, this means that we should take them into account in our moral decision-making. There are, however, different ways in which things can figure in our moral decision-making: directly or indirectly. Some people have thought that we only have *indirect* duties regarding animals. One example of such a view is that we should not treat animals cruelly only because this is likely to harden us to suffering and therefore to make it more likely that we will violate our duties to other *human* beings (e.g. Kant 2000, p. 6, 442). Also, it might be thought problematic to harm an animal, because in doing so, we harm the owner of that animal. However, the concept of moral status is generally used to signify that a being counts in its own right. If animals have moral status, we that should treat them in a certain way

(e.g. not treat them cruelly) *for their own sake*, rather than for the sake of others, say, human beings. We then do not merely have duties *regarding* animals, but also *to* them.

To determine whether animals have moral status, we need to know what is a necessary and sufficient basis for moral status to be accorded to them. We shall first critically discuss some justifications of attributing *unequal* status to human beings and the other animals, and to animals with different degrees of cognitive complexity. These are based on some general assumptions about the nature and basis of morality that we will argue involve implausible assumptions or implications. Then we shall discuss two different approaches in moral philosophy, that both advocate attributing equal status to all conscious animals. As these two authors also conclude, we will argue that it makes sense to consider moral questions from the perspective of all beings that have an evaluative perspective.

2.2 Unequal Moral Status

One view of the basis of morality is the idea that it is in our mutual self-interest to accept moral constraints in our dealings with one another. It might be thought that animals do not have moral status, as we cannot make a mutually advantageous agreement with them, and expect them to uphold their side of the bargain by reciprocating (e.g. Morris 2011). However, we think that the incapacity of animals to reciprocate does not give us a sufficient basis for denying them moral status. Undoubtedly, a lot of rules in social life and much of the practice of politics centre around the idea of reciprocity, but this does not seem to cover the whole content of even human morality. After all, we take it to be wrong to exploit people who are too weak (or too far removed from us) to reciprocate or take their revenge on us. If we think morality goes beyond the confines of mutual interest through reciprocation, we need to find another basis for such duties.

Another proposal for the basis of (human) morality is social sentiment. Most humans are not only motivated to pursue their self-interest, but are at least to some degree sympathetic to others. The famous 18th century philosopher Hume based morality on sympathy. However, he noted that we have limited sympathies, and that our sympathy is greatest for those closest to us and similar to us (Hume 1978; Cohon 2010). While our sympathies are not limited to human beings,[2] it has been noted that we are generally more emotionally attached to members of our own species (Midgley 1998). Wenz (1988), suggesting a "concentric circles" model of justice: we have the strongest duties to those we are in a closest relationship with, and our duties to others become less strict with distance. We do not want to deny here that human social sentiments and capacity for sympathy may play a very large

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[2] Indeed, virtue ethical accounts in animal ethics aim to base duties to animals in our sympathy for them (eg. Walker 2007).

role in morality. We do want to question the view that our basic moral duties vary with how close we feel to the other, or what relationships we have with others, especially duties not to harm others. Hume himself noted that our moral judgments on the characters of those who harm or help others do not vary along with our sympathies for those affected. He proposed that we estimate the effects of people's character from a "common point of view", which abstracts from our own self-interest but rather involves the viewpoints of everyone affected by the action (Hume 1978, T 3.3.1).[3] It might be argued that we have stronger positive duties (duties to assist) those whom we have relationships with, but it seems implausible to hold that negative duties (duties not to interfere) depend on the strength of (affective) bonds. Such a view could justify harmful treatment of those with whom one is or feels less connected, like those with a different ethnic background or those on the other side of the world.

A final way to argue for unequal moral status would be to resort to 'everyday moral judgment' which says that rational beings, such as humans, matter more than merely sentient beings, such as many animals. Balzer et al. (2000), for example, say that it fits better with our considered intuitions to assign a hierarchy of inherent moral standing to different kinds of beings. Similarly, DeGrazia (2008) argues that moral status varies with the capacities of beings, e.g. being conscious, self-aware, moral agency, language, and so on. This does appear to be the common view. However, is this view justified? We need to ask *why* exactly it matters whether a being is capable of language or is a moral agent for how we ought to treat them. Sure, it would be problematic to defend a moral theory that has no connection at all to our views about the content of morality. However, we think that a view being commensensical alone does not suffice to justify moral claims. After all, we now consider views that were once common, such as the view that slavery is morally right, as completely morally unjustified. We think we need to dig a little deeper to determine whether our everyday moral judgments are indeed justifiable.

It is important here to consider what a hierarchy of moral status actually means. It means that different creatures would all have moral standing, but would have so to a varying degree. In other words, if we need to decide how to treat two different creatures, the creature with higher moral status would automatically receive preferential treatment, regardless of the specific interest of the creatures involved in that specific dilemma. So, for example, if we must choose to hurt either a rat or a human being, even if their pain would be equally severe, we should choose to spare the human being, because her/his interests matter more *in principle*. However, this begs the question as to why this human being's interests matter more. It cannot be because she/he experiences more pain, because in this example the pain was equally severe for the rat and the human. Could it then be because the human can use

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[3] Hume appears to be describing human nature; explaining what human beings do when they make moral judgments. One can question whether and why we *should* take such a common point of view. We describe a utilitarian and a Kantian argument for a similar idea in the next section.

language or is a moral agent? This raises the question why these differences would be relevant in this context. Again, more than a simple reference to common sense is necessary to explain such a position.

2.3 Equal Moral Status

So far, we have argued that three of the most common arguments for attributing unequal moral status to humans and animals are problematic. What bases could there be for attributing *equal* moral status? In this section, we will discuss the views of the prominent practical philosophers from two very different moral-philosophical backgrounds. Peter Singer is a proponent of the theory of utilitarianism, and a prominent animal ethicist. Christine Korsgaard is a Kantian philosopher, and has in recent years discussed the place of animals in her wider philosophical work. While there are important differences between them, the two authors both think that we have moral duties to others that are not dependent on reciprocity or sympathy for others and both are critical of everyday moral judgments. We will now explain how they justify moral claims.

Singer (1999) takes a basic starting point for the moral point of view to be that one should consider what ought to be done not just from the standpoint of self-interest, but from the interests of all involved. The basis of morality, in Singer's view, is the principle of equal consideration of interests: all comparable interests should be weighed equally. If interests differ, however, then this should be taken into account. For example, all people have an equal interest in mobility, but for disabled people this means getting access to facilities like a wheelchair, while for able-bodied people it doesn't. Equal consideration of interests, then, may lead to dissimilar treatment. Singer suggests that not only human beings, but also certain species of animals may have interests. Singer understands interests in terms of the satisfaction or frustration of preferences. The question then is what animals can have preferences. In Singer's view, a minimal requirement to be able to say that a being can form preferences is that the animal can have positive or negative experiences. Singer appears to regard all negative affective states as forms of suffering which they have a preference to avoid and all positive affective states as forms of joy which they have a preference to strive for. [4] If an animal can suffer negative experiences such as pain, or fear, it will have a positive motivation, a preference, to not suffer. Such animals may

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[4] Note that it is our aim here to introduce the philosophical reasoning of Singer, and not to add new insights to the debate about what constitutes animal welfare. More in general, suffering could be described as 'strong, negative affective states such as severe hunger, pain, or fear' (Fraser and Duncan 1998) and can result from 'experiencing a wide range of unpleasant emotional states such as fear, boredom, pain, and hunger' (Dawkins 1990). A discussion is possible about the question whether all negative affective states in fact amount to suffering as such. After all, animals can often adapt their behaviour to short-term negative states, such as hunger or fear, in a way that is rather functional for them. Real suffering may result only from intense or prolonged exposure to negative stimuli combined with a negative stance towards such experiences.

also have preferences for positive states, unconnected simply to the avoidance of suffering, e.g. play or food or being with conspecifics.

Singer is a utilitarian, and that means that he thinks that in determining the right thing to do, we ought to compare, aggregate and maximise the interests of everyone involved. Thus, for example, in choosing whether to help someone with her homework, or bring someone with a serious injury to the hospital, we ought to do the latter, because that is here the more important interest. Singer noticed that in practice, even when human and animal interests are considered comparable, for example when humans and animals are thought to experience the same amount of pain after a specific procedure, the human interest is generally considered more important than the animal interest. He posed critical questions about this, and popularized the term "species-ism", meant to signify discrimination on the basis of biological species, which he considers as unjustified as sexism and racism. Only when different species in fact have different interests, it is justified to treat them differently. For example, dogs cannot benefit from human education, so it would not be speciesist to deny them access to schools. He also attacked the idea that it is specific capacities of human beings that make them especially morally significant, such as rationality or their being moral agents. After all, we also think that human babies' pain matters equally to adult beings' pain, even if they are less rational than adult humans, and we accept that just as we may not harm rational humans, nor should we harm intellectually disabled humans.

As a utilitarian, Singer thinks that we should always maximise the satisfaction of the interests of everyone involved. Traditionally, this approach to morality is most contrasted with the moral views inspired by the 18th century philosopher Immanuel Kant. Kant (1785, and more recently reprinted 1998) thinks that we should not act morally for the sake of an external goal, such as self-interest or even the interests of others, but simply from respect for moral law. He sees the moral law not as legislated by an external authority, such as God, but as a law of our own reason. In acting on the moral law, human beings are autonomous (literally: self-legislating). Kant claims that the capacity of autonomy makes human beings "ends in themselves": we ought to respect them for their own sake, not only use them as means to another end (e.g. our self-interest). Kant thinks we do not have any direct moral duties to animals, as they lack the capacity of autonomy. He does think we ought not be cruel to animals, but that is because it undermines a duty to ourselves: to cultivate those capacities (e.g. sympathy) that enable us to do our moral duty (Kant 2000, p. 6, 442).

Christine Korsgaard, a prominent contemporary Kantian author, has offered an internal criticism of Kant's position.[5] Korsgaard (2011) argues that Kant was wrong in thinking we only have duties to autonomous beings. Like Kant, she takes

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[5] An external criticism of this view has been given on the basis of the previously mentioned analogy with humans without rational capacities: if we do not have direct duties to animals because they are not rational, what about human beings with similar lack of rational capacity, such as babies or severely mentally challenged people? Should we only not treat them cruelly because of the implications for other beings? Such an argument (e.g. Singer 1999; also Regan 2004) points to an inconsistency in the way that we treat different kinds of beings with similar capacities.

morality to be based on a law that human beings legislate to themselves. As humans, we cannot simply go along with our impulses, but we need to have reasons for what we do. Insofar as we consider our choices rational, we must think that the objects of our choices are objectively good. Korsgaard emphasises, however, that the *content* of our reasons cannot be given by respect for autonomy itself. Rather, we find reasons in what is naturally good for us (Korsgaard 2011, p. 108). While things can be said to be good or bad for plants, only conscious animals care about their own natural good (Korsgaard 2009a, pp. 34–35).[6] Animals can act purposively, to avoid things that they dislike, and to attain things they want (Korsgaard 2009b, pp. 10–15). When we avoid pain and suffering, we act for a purpose we share with other conscious animals. But even if we value ends that other animals do not share, we still value what is good or bad for the kind of beings that we are. When we, rational beings, act for the sake of an aspect of our own good, we take something's being naturally good for us as objectively good: as a law for ourselves and others (Korsgaard 2011, pp. 107–108).

Korsgaard says that we thereby accord ourselves a certain standing: of an end in itself. Kant thought that we only have to respect ourselves as ends in ourselves insofar as we are rational, or autonomous. Korsgaard explains that Kant conflates two different conceptions of the end in itself: (1) the source of legitimate moral claims that should be recognised by all rational agents, and (2) someone who can give the force of law to his claims, or participate in moral legislation. She notes that a law can protect someone who did not participate in the making of it (2005, p. 21). In legislating a law that what is naturally good or bad for us is objectively good or bad, we confer value on our animal selves. We therefore have to accept duties to all those who have a good that they care about, even if they cannot claim respect for it. Korsgaard argues that on the basis of this reasoning, conscious animals too should be regarded as "ends in themselves" (2011, pp. 108–109). We should respect their good for the sake of the individual animals involved, and not just treat them as means for our own ends.[7]

Utilitarianism and Kantianism are usually understood as very different approaches, and some important differences will come to the fore when we apply these theories to the practise of using animal models in neurobehavioural research (in Sect. 4). Here, we want to point out what these specific variants of these

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[6] Note that Korgaard is making a philosophical argument here to the effect that those animals who actually experience pain and pleasure and have positive or negative emotions care about their own good in a way that insensate beings cannot. Of course, her argument does not hold for the group of animals who do not have these experiences. To what group of animals such emotions are restricted is a question that should be answered by use of biological research together with reflection about the philosophy of animal minds.

[7] Other animal ethicists, such as Taylor (2011) or Rollin Smulewicz-Zucker (2012) have also emphasised that animals have moral status because they have a good of their own. Korsgaard's theory differs to Taylor's in the sense that in her view, animals should care about their own good in order to have moral status. She differs from Rollin in the structure of her moral theory. Korsgaard tries to show that, as rational agents, we cannot rationally avoid accepting moral duties to all conscious animals.

approaches have in common. They offer basically the same reason for extending equal moral status to all animals that strive to attain goals on the basis of preferences. They attribute moral status to sentient animals, but not, say, to plants, because we can only consider what should be done from the perspective of beings who have preferences or who care about what happens to them. Cars or plants don't care what happens to them, while sentient animals do. We can put ourselves in the place of animals, because it matters to an animal what happens to it.

We cannot completely defend these views of Singer and Korsgaard here, as this would require much more sophisticated reasoning in moral philosophy. We just want to point out that, if we think that those to whom we attribute moral status is something that is not based on reciprocity, then it seems to make sense to take perspective not just from ourselves but also from the other as an experiential being. What animals actually belong to the class of experiential beings is a matter of discussion, even amongst biologists. For example, biologists disagree about the question whether and if so, which, fish can experience pain, and whether they have capacities such as memory and flexible learning. Regarding insects and crustaceans there are even more unknowns. As we will see, an answer to this question depends on how we interpret consciousness, and this requires reflection in the field of philosophy of mind. While this subject is treated exhaustively in the chapter by Droege and Braithwaite (this volume), we are not able, nor intend, to resolve these complex discussions here, but restrict ourselves to pointing out where more research is needed and how this is relevant for animal ethical considerations.

3 Consciousness in Animals

3.1 Introduction

In the previous section we have seen that certain capacities are taken to be the criterion for moral status. Singer takes preference satisfaction as morally important, and Korsgaard argues that all beings who consciously pursue purposes have moral status. These capacities involve that the being in question is sentient, and that it has positive attitudes towards certain goods—such as food or playing—and negative attitudes towards others—such as threats. These attitudes correlate with affective states. For example, fear does result in aversive behaviour *because* it constitutes an unpleasant feeling that motivates a being to avoid what it is afraid of. According to Singer and Korsgaard, consciousness makes a crucial difference with regard to moral status: if a being is not conscious what we do to it will not matter to it (although, of course, it may matter to us). On the other hand, if a being is conscious, it matters to the being in question whether we frustrate or aid its pursuit of goods.

In this section we will focus on the questions whether and how we can know which animals are conscious, and whether there is a difference in consciousness between humans and other animals. Of course, the list of animals that are deemed

to have consciousness depends on how one defines consciousness in the first place and is constantly changing, as more research is done on species that were previously assumed to be unconscious. For example, cephalopod molluscs such as the octopus and squid were previously not considered to be sentient and cognitive beings, but are now being recognised as such. They have even been given the status of 'honorary vertebrates' in legislation on animal experiments in many countries (Kolar 2006).[8] Like much of the literature about animal consciousness, we will focus on the question whether animals have phenomenal consciousness, which refers to the experience of sensing what is around you and the feelings and emotions that this creates; also termed 'raw experience' (Block 1995). We assume that when you are conscious there is 'something it is like' to be you (Nagel 1974). The question then is 'can we say it is *like something* to be an animal'? Another way of describing this type of consciousness is as 'the subjective state of feeling or thinking about objects and events' (Griffin and Speck 2004, p. 6).[9]

As we will explain later, we think there are good reasons to believe that consciousness is not an 'on or off' notion, but rather that it is a matter of degree. If so, it may very well be possible that negative experiences as a result of experimentation also come in degrees. The question whether animal consciousness differs in important ways from human consciousness is important in the context of this chapter because it might be thought that, while animals do have moral status, it is less problematic to experiment on animals, if they experience less negative consequences from these experiments. This view seems to be based on the idea that animals are somehow less conscious of what happens to them. But what reasons do we have to conclude that animals are less conscious of pain and suffering than humans and therefore do not have the same interest in avoiding the negative experiences associated with experimentation as humans? The main difference between humans and animals in this context appears to be humans' greater cognitive complexity. Therefore, we need to address the question what the influence of cognitive complexity is on suffering. In order to do this, we first need to ask if and how we can know whether animals are conscious.

3.2 Can We Know Whether Animals Are Conscious?

Both in the philosophy of mind and in biology, we encounter scepticism about the question whether animals are conscious. One reason for this scepticism is that we simply do not—and in a strict sense cannot—know exactly what animals experience. What animals actually belong to the class of experiential beings is a matter of discussion, even amongst biologists. For example, biologists disagree about the

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[8] Thanks to Ruud van den Bos for pointing this out to us.
[9] Note that a distinction is sometimes made between consciousness and awareness. We will use the terms interchangeably.

question whether and if so, which, fish can experience pain, and whether they have capacities such as memory and flexible learning. Regarding insects and crustaceans there are even more unknowns. This has led scientists in the past to ignore the study of animal consciousness. As Griffin and Speck (2004, p. 5) put it, 'many behavioural scientists have been extremely reluctant to consider non-human consciousness on the grounds that it is impossible to obtain objective evidence about subjective experiences'. Therefore, some remain agnostic about animals' consciousness and others simply assume that an animal doesn't have experiences and cannot suffer pain. The obvious problem with this last line of reasoning is that it commits the fallacy of ignorance: lack of knowledge of a certain fact doesn't make the opposite true.

Moreover, as Panksepp (2011) convincingly argues, neuroscience does now give us objective evidence about animal feelings, at least about mammals. As he explains, historically, it was believed that 'emotional feelings are a subset of cognitive processes' and many still believe this to be the case (Panksepp 2011, p. 4). This has meant that without higher cognitive functions, animals were not regarded as being able to experience emotions. However, animals, including humans, that had their brain's cortex removed, still showed emotional responses (Panksepp 2011, p. 6).

Similarly, in the philosophy of mind it has historically been thought that because of their lack of cognitive complexity, animals lack the human characteristics that are necessary for consciousness, namely language or higher-order thought. Language is considered important because in order to be conscious a creature must have something going on in its mind. Purposive action is usually understood to be an interplay between beliefs and desires, e.g. wanting to eat food and believing that the food is in the refrigerator, and therefore going to the refrigerator. To have beliefs and desires a creature must be able to think. But in order to think a creature must have complex concepts and this in turn requires language. We can only say that a dog that chases a cat actually thinks it is chasing a cat, when we assume that this dog has a concept of 'cat'. This requires a higher level of abstraction that can only be reached by creatures with language (Lurz 2009).

This view rests on some problematic assumptions: While we humans need language to be able to use complex and abstract concepts, this does not mean we cannot think about things without language or abstraction. Language is only required to communicate those ideas to others, while rather than necessarily articulating ideas as abstract concepts, it is perfectly possible to visualise such constructs 'in pictures'. Temple Grandin, for example, a well-known animal welfare specialist with autism, reports not having generalised concepts, for example of a tree, but rather seeing many pictures of different trees; she projects that certain animals might similarly 'think in pictures' (Grandin 1995). Further, if we were to accept that language is necessary for consciousness how do we reconcile this with the observation that many humans (most notably babies) cannot use language either? Most people would not conclude that they are therefore not conscious.

Some philosophers of mind claim that most non-human animals are not conscious because second-order or higher order thoughts are necessary for one to be conscious, and animals—perhaps with the exception of some primates and

cetaceans—don't have such thoughts. Higher-order thought (HOT) theory of consciousness says 'that what makes a mental state conscious is the presence of a suitable higher-order thought about that state' (Gennaro 2009). Another way of saying this is that only animals that have I-thoughts, or meta-cognition, are conscious. Carruthers (1992) for example argues that all animals (except perhaps primates and dolphins) lack higher-order thoughts and therefore lack phenomenal consciousness. In fact, he goes as far as to claim that only beings that have "theory of mind"—the ability to attribute thoughts to others—are conscious. Gennaro (2009), however, convincingly argues that HOT theory is in fact compatible with ideas of animal consciousness, since a higher-order thought need not itself be conscious. One can make meta-cognitive judgments without being explicitly conscious of them: for example, when a being is afraid, he or she is aware of experiencing fear, but need not know that she/he is aware of experiencing fear (Gennaro 2009, p. 190).

3.3 How Can We Find Out Whether Animals Are Conscious?

In daily life most people have no qualms about attributing consciousness to animals. When we step on a dog's tail and it runs off yelping, we do not find it strange to say that the dog is in pain. When it comes up to us with its leash in its mouth, we have no trouble inferring that it wants to go for a walk. However, some people also tend to talk about plants or computers as if they were conscious, as when we say that a plant is not feeling well, or a computer doesn't feel like working today. How do we discriminate between the latter unwarranted cases of anthropomorphism and warranted attributions of human-like states to non-humans?

We are interested, then, in determining whether there is something "that it is like" to be an animal. When can we take aversive behaviour to be indicative of consciously felt pain, anxiety or sadness? And when can we take appetitve behaviour towards a positive goal as a sign of consciousness? Some biologists base the idea that there are relevant experiential similarities between humans and other animals on the analogy postulate, first proposed by Romanes (1882). The postulate states that:

A greater or lesser degree of similarity in the subjective experience of a certain animal species, and of the human being may be assumed, relative to the degree of similarity between the structure of the sensory nervous system of that animal species with the human sensory nervous system, and relative to the degree of similarity between the reaction shown by the animal to a specific stimulus and the human reaction to the same stimulus' (Verheijen and Buwalda 1988).[10]

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[10] Note that the analogy postulate would more aptly be named the 'homology postulate', as it is looking at homologous structures and functional homology.

The idea is, simply stated, that if certain animals have similar capacities involved in the experience of pain and suffering as humans and if animals respond with similar behaviour to certain stimuli as humans, we can assume that these animals also experience stimuli similarly to humans. The postulate also leaves open the possibility that some animals have more similar experiences to humans than other animals and this could mean that we find varying degrees of consciousness in the animal kingdom. There are two aspects to the analogy: behaviour and physiology. Many animals, most notably mammals, exhibit similar behaviour to humans when confronted with a stimulus that causes pain in humans. Think of vocalisations, running away, rubbing the damaged spot, and trying to avoid future interaction with the stimulus. Also, the sensory nervous system of many vertebrates shows similarities to that of humans.

Determining an analogy is a difficult matter and it is important to note that considering either behaviour or physiology on their own is not sufficient. Let us discuss the case of pain, as a relatively large amount of research has focused on the question whether we can take pain experience to be conscious. What we need, is a way of distinguishing between a reflex-like response to a noxious stimulus, and an actual experience of pain. Many animals have nociception, which provides the physiological basis of pain. But it is commonly thought that in order for the pain to be experienced, a signal has to be sent from the nociceptors through the spine to the relevant areas in the brain. Flies and sea slugs, for example, have nociceptors, but they lack a central nervous system, and therefore no signal can be sent to their brain. Some argue only on the basis of behavioural responses that certain invertebrates do seem to experience pain. For example, Elwood and Apple (2009) have shown that hermit crabs remember in what type of shell they received an electric shock and tend to avoid such shells in future. Similarly, Sherwin (2001) cites research showing that cockroaches, flies, and slugs have memory and show pain responses. It may be possible, therefore, that pain could be experienced by beings without a conventional (vertebrate) central nervous system and that in organisms with different nervous organisation or neural structuring, pain might still be expressed, simply via alternative physiological systems. Especially if we were to assume that there are varying degrees of consciousness, it may be possible that dissimilar nervous systems might simply result in a different style, or degree of conscious experience between mammals, birds, fish, invertebrates, etc. rather than presence or absence of consciousness as such. However, there remains a lot of discussion about this among biologists themselves and the consensus at this point in time seems to be that only vertebrates experience pain (Braithwaite 2010).[11]

Even when consideration is restricted to vertebrates, there is still discussion about the question whether animals can only sense pain, or can also suffer from it, in the sense that the animals 'mind' the pain. In other words, we can distinguish between a sensory and an affective aspect of pain, and there is discussion about the

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[11] New research indicates that crayfish show anxiety-like behavior, which led to an increase in serotonin in the brain and was suppressed by the injection of opiates. See Fossat et al. 2014.

question of whether these two aspects can be completely separated (Sufka et al. 2009). Evidence in favour of such a separation is that people who have been given morphine report feeling pain, but not minding it (Shriver 2006). This observation is supported by the fact that different neural pathways are involved in the sensory and in the affective aspects of pain. Research shows that the anterior cingulate cortex (ACC), which is part of the medial pathway, plays an important role in the affective aspect of pain (Shriver 2006). The medial pathway responds much better to anaesthetics than the lateral pathway, which is associated with the sensory aspect of pain (which, for example, enables us to locate pain in a particular area and assess its intensity). This would explain the disconnect between feeling and minding pain in patients who have been administered morphine (Shriver 2006). While it is therefore at least theoretically possible to sense pain, but not mind it, it is important to note that non-human mammals also have an anterior cingulate cortex, and hence that there is no reason to assume at the outset that only humans, but no non-human animals can both sense and mind pain.[12]

However, only from pointing out *physiological* similarities between humans and animals we cannot conclude that humans and animals must feel the same. A first step towards such a conclusion can be made if we also look at pain *behaviour* in animals. Tests with rats have shown behaviour that could be interpreted as 'feeling pain, but not minding it' (Shriver 2006, p. 437). In short, in these tests rats, who usually prefer to spend more time in dark rather than light chambers, were given shocks while in the dark chamber. When their paws were made very sensitive to noxious stimuli they spent more time in the light chamber, except when their anterior cingulate cortex was lesioned. While they still showed withdrawal reflexes after electric shocks, they stayed in the dark chamber, suggesting that they sensed the pain, but did not mind it (Shriver 2006). In other words, we have reason to believe that rats with an intact ACC not only sense, but also mind pain.

The risk of relying on the analogy postulate is that it is always open to the objection that next to analogies, disanalogies exist between humans and animals (Allen 2011). The question is, therefore, whether we should focus on the similarities or on the differences between humans and animals. Such criticism of the analogy postulate can be dispelled when a theoretical underpinning can be given for why similarities in certain behaviours and physiological states are relevant (Allen 2011). One consideration of such theoretical underpinning could be the role of pain in learning. As Shriver (2006, pp. 438–439) explains, 'Minding a sensation often causes us to desire to avoid it in the future… there appears to be an important relationship between the affective pathway and learning, which may in turn be suggestive of an evolutionary role that the conscious experience of pain could play'. It could still be objected that even lesioned spinal cords can learn to respond to noxious stimuli. However, more complex forms of learning are more likely to require consciousness (Allen 2004).

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[12] It is as yet unclear whether animals besides mammals, such as fish, have something functionally similar to an anterior cingulate cortex. More research is needed into this question.

Researchers tend to take flexible learning as a sign of consciousness, as non-learned responses to novel situations cannot be based on a reflex response or innate, 'pre-programmed' behaviour. If neither the animal nor its ancestors have encountered this novel situation before, the animal's response cannot be the result of 'instinct'. If an animal can deal with a new and unpredictable situation this seems to imply that it can combine different informational cues in its mind and can plan at least in the short term, a phenomenon referred to as insight learning (Griffin and Speck 2004). In this context a distinction could be made between goal directed and merely goal oriented behaviour (Saidel and Lurz 2009). Only for the former one needs desires and beliefs. For example, evolution can structure plants to follow the position of the sun, but the plant does not thereby have a desire to turn to the sun. In contrast, organisms that display goal-directed behaviour do so in order to achieve a goal they have; they can overcome obstacles in a flexible manner. They need to have distinct representations of the goal and the means to achieve that goal in order to have goal-directed behaviour. This means that they could stop a particular behaviour and adopt another behaviour while still aiming at the same goal (for instance when a barrier is erected so the previous behaviour will not allow the animal to reach the goal anymore; it then has to respond flexibly). This in turn means that animals that have goal-directed behaviour are able to learn in a way that other animals cannot. They have to learn to form a new association between goal and means to achieve the goal. Conditioned learning, on the other hand, does not depend on having representations (although Griffin and Speck (2004) cite evidence showing that even Pavlovian conditioning in humans cannot be accomplished without awareness, and they suggest that it is unlikely that it would be possible completely without awareness in animals). If animals can respond flexibly to their environment, for example by adopting a new way to get food, this will give us evidence of mental representations. Tool-making in primates is an example of such evidence, and more evidence of this kind exists in, for example crows (Emery and Clayton 2004) and many other animals (Shettleworth 2012).

Besides looking at criteria such as analogies between brain areas displaying behaviour indicative of painful and pleasant experiences, and the ability for flexible or insight learning, other criteria can be put forward to strengthen reasoning by analogy. Elwood and Apple (2009, p. 1243) mention 'showing trade-offs between stimulus avoidance and other motivational requirements; having opioid receptors; and reduction of responses to noxious stimuli by analgesics and local anaesthetics'. In this vein, Sufka et al. (2009) argue that researchers implicitly hold that their animal models display the same symptoms as human patients. If an animal model performs well, and for example responds to the same treatment as human patients, they propose that the emotional states of these patients are accurately simulated in the animal model. Their premise is that 'if the animal simulation is valid—that is, it compares well with its corresponding human neuropsychiatric disorder in terms of aetiology, symptomatology, pathophysiology, and response to treatments—one is entitled to argue that the animal shares an emotion similar in kind to the human counterpart' (Sufka et al. 2009, p. 533).

Of course, the fact that researchers use animals and that their experimental set-up seems to work on its own is not sufficient to conclude that animals experience something similar to humans. However, the fact that medication works in the same way for certain animals and humans certainly is a telling fact. Additionally, as Panksepp (2011) explains 'if our *predictions* about changing internal feelings in humans, derived from the animal data, are supported by human self-reports, as has often been the case, we have additional reasons for confidence that both humans and animals are having similar (albeit not identical) experiences (our italics)'. However, even though we have good reasons to assume that animals with similar behaviour and nervous system as humans can have similar experiences, we should be careful not to conclude that those animals that do *not* exhibit these similarities therefore do not have similar experiences as humans.

We have two reasons to be cautious of drawing hasty conclusions: First, we are so different to some animals that we have difficulty relating to them and we may not be able to interpret their behaviour appropriately. Fish, for example, do not have facial expressions that we can discern, they do not make sounds that we can hear, and the fact that they live in a different medium to us—water—also makes that their behavioural repertoire is by necessity very different to ours. And even in the case of closely related species we have difficulty interpreting facial expressions; we might interpret upturned corners of a gorilla's mouth as a smile, while in reality it could be a sign of aggression. In order to find out whether they do exhibit behaviour indicative of feeling pain, we need to devise tests that are sensitive their way of being (see for example tests carried out by Sneddon et al. 2003). In general we might not be able to discern from animal behaviour that an animal experiences something, but by way of preference tests we can see that the animal avoids particular stimuli. We need to bear in mind, however, that for different animals different behaviour is adaptive. In nature it is often functional not to show pain, because this may attract predators or might show an opponent that one is afraid.

Secondly, the fact that some animals do not have brain structures similar to those of humans does not mean that these animals do not have different brain structures that have the same function. In other words, having a different neuro-sensory organisation does not necessarily mean that an animal cannot feel or experience in an analogous way. For example, the eyes of octopus have a completely different structure to those of humans, but they also see in colour and may have an even greater visual acuity. Similarly, birds do not have a prefrontal cortex, which is a part of the human brain associated with complex cognition. However, certain birds, such as corvids, do exhibit complex cognition; there is evidence of causal reasoning, flexibility, imagination and prospection in these birds. In their brain the 'prefrontal' functions can be found in the parts that are analogous in function to the mammalian cortex, namely the mesopallium and the nidopallium (Seed et al. 2009). In the same way, while fish do not have a prefrontal cortex, some of the functions of this brain area appear to exist in fish brains as well, in the telencephalon (Chandroo et al. 2004). We should therefore not simply look at similar brain structures, but at *functional* analogies. In general, it is important to stress that the elements of the postulate should not be examined in isolation. Just

looking at animal vocalisations after painful stimuli is not enough, for example. Tests with rats and pigs show increased vocalisations after a stimulus even if this stimulus has led to less sensitivity or when the animal was actually anaesthetized (Allen and Bekoff 2007).

3.4 Why Caution Requires Attributing Consciousness to Certain Animals

Many reasons have been put forward, then, to argue that at least certain animals are conscious: they share behavioural repertoires and physiological make-up with humans, they show complex and flexible learning, they can be used as valid models for human disorders, and they respond similarly to anaesthetics. In addition, it seems unlikely that consciousness evolved all of a sudden in humans and it is more reasonable to anticipate that both rudimentary as well as more evolved levels of consciousness can be found throughout the animal kingdom. However, these arguments may not convince sceptics about animal consciousness. For any piece of empirical evidence cited, it will never convincingly prove that an animal is conscious. In theory, it is possible that animals, like complex machines, can display very sophisticated behaviour without actually experiencing anything. The difficulty is that we can never have access to another being's experiences. This goes for other humans as well; I can have a look at brain scans and at behaviour of other humans and I can listen to what a person tells me about her experiences. On the basis of this I can try to put myself in this person's place, but I can never know for certain that there is something that it is actually like to be that person, nor what it feels like exactly. With animals it is even more difficult to determine what it is like to be them, because they cannot tell us.

The question is where lies the burden of proof. From a sceptic's point of view, it might be though most legitimate to assume that animals are unconscious, until proven otherwise, but this is actually not at all obvious. From an evolutionary perspective it seems plausible to think that creatures that were confronted with similar environmental and social pressures as our ancestors would have been selected similarly as those ancestors and therefore consciousness would have evolved at least in animals of similar sociality. As Jamieson (2009, p. 17) eloquently puts it: 'it would be surprising, perhaps even the biological equivalent of the Immaculate Conception, if we were nature's only minded creatures'. As discussed above, there are many similarities between humans and animals' behaviour and physiology that suggest continuity in their experiences.

There are also moral reasons not to start with the assumption that animals are unconscious. As Shriver (2006) points out, for the purpose of making a moral judgment about our treatment of animals, we do not require a knock-down argument for or absolute proof of animal consciousness. As long as it is reasonable to hold that at least certain animals are conscious—and we believe it should be clear from the above that it is reasonable—this is sufficient to call for caution in our

dealings with these animals. After all, if we erroneously treat animals as if they were unconscious when they in fact are, the moral costs are very high (Shriver 2006). According to the precautionary principle, if there is a reasonable projection of harm, we should not wait for absolute proof before we act to remedy this harm.

3.5 Degrees of Consciousness, Pain and Suffering

When we look at empirical evidence based on the analogy postulate and additional criteria mentioned above, it seems likely that all vertebrate species do experience pain (Braithwaite 2010). Moreover, some invertebrates with more complexly organised brains, in particular cephalopods and some crustaceans, show behaviour that could be interpreted as pain behaviour (Sherwin 2001; Elwood and Appel 2009). And if we are willing to look beyond the analogy postulate and consider that differently organised species may have evolved different ways of structuring pain sensations, other animals that can experience pain may be identified in the future. We should bear in mind, however, that different species may experience sensations differently: concluding that animals can experience emotions does not entail concluding that these emotions are identical to human emotions.

As mentioned before, we think we should regard consciousness not as an 'on- off' notion; it is not as if you are either conscious or you are not, but rather, some animals have higher, or more complex, levels of consciousness than others. How should we understand these different levels of consciousness? What consequences does the view that consciousness comes in degrees have for the question whether it is more justified to use certain animals than others for neurobehavioural research? In order to answer this question, we need to consider whether more complex cognition makes suffering worse. As Yeates (2011) explains, it is far from self-evident that more complexity leads to more pain. For example, more cognitively complex animals can in some cases cope better with pain, if the pain is short and the animals realise the pain will be over quickly. On the other hand, if they realise the pain is chronic, they could cope less well, because they know the pain will go on.

No clear picture emerges when we take these kinds of considerations into account. In some cases animals with simpler cognitive capacities are likely to experience pain more frequently and more intensely, for example because they cannot distract their attention and tend to focus on the most biologically important stimulus (namely pain). In other cases, animals with more complex cognitive capacities will experience more pain, for example when they suffer from anxiety, which tends to increase pain experience. In any case, Yeates (2011) raises doubts about the question whether these cognitive influences make so much difference on pain experience that this is meaningful for the animals in question.

Of course, pain experience is only one aspect of suffering. Suffering also—perhaps even more urgently—has to do with the frustration of one's goals and there are forms of suffering that are not so much experienced as pain sensations, but rather as adverse mental states. These kinds of suffering are typically involved

in research into cognitive and affective disorders. A relevant question is then what it is like for animals to be, for example, afraid, anxious, or depressed. Because humans have more cognitive complexity, we will have different, and perhaps more varied, experiences than animals, but does this mean it is worse for us to have negative experiences than it is for animals? We think that, like in the case of pain, it is not self-evident that the answer is yes; rather, a more varied picture emerges if we consider how cognition influences mental and emotional suffering. While we have not done empirical research into this question, we want to at least raise some questions and make the point that the answers are not self-evident.

In experiments into neurobehavioural disorders the emotional states that are examined are for example fear, anxiety, depression, and paranoia. If we assume that animals live more in the present moment than humans do, could we say that they therefore experience these emotions to a lesser degree than humans? At first sight, we may say this is the case. After all, the 'subject' or 'content' of the depression, paranoia or anxiety is more complex in humans. However, we might also come to the opposite conclusion: these experiences might be completely overwhelming for them exactly because they live in the present moment. They have no way of telling themselves that their suffering is relative, or will be over soon. They can take no distance from their own suffering, but can only undergo it.

There are types of fear, anxiety or paranoia that animals likely do not experience, because they require abstract concepts. For example, animals are not likely to have existential anxiety as they have no concept of death and do not wonder what the meaning of their life is. Neither will they suffer from thoughts of conspiracies mounted against them. Having abstract concepts, such as a concept of death, does make humans and animals different in a morally relevant way. It may mean that killing a human being is worse when she/he can anticipate his/her death, because it creates supplementary suffering of anticipation that the animal does not experience, but having such abstract concepts does not automatically make all fear experiences worse. Fear, after all, is a very primordial experience, which animals share with humans.

The next question we need to raise is what consequences the presence of higher-order thought has for the interests that a being has. For example, human beings can experience a tension between 'the person they want to be' and 'the person they are' (see also Korsgaard 2009c, pp. 13–20). They may regret the impact of their cognitive or affective disorders on their lives, for example because it interferes with their achieving their larger goals in life. Also, human beings may be aware that their condition influences their social status. This in turn may impact their self-esteem. As a consequence, for human beings, conditions like chronic anxiety disorders, or depression may completely undermine their ability to live the lives they wish to live. It is difficult to determine whether the feelings of anxiety or sadness caused to animals in experiments have a similar dimension for animals. On the one hand, it seems that animals have less at stake: a big picture of who they want to be and the lives they wish to lead. On the other hand, as Korsgaard (2009b, pp. 21–30) also points out, while it matters *to humans* to live out their lives as a project at which they can succeed or fail, this does not matter to animals (and, we

might add, not to all human beings either). Animals may care as much about their own purposes as we do about ours. Emotions like anxiety, or the effects of alcohol dependency, are very unpleasant on their own, and will also undermine animals' ability to effectively pursue their other purposes.

It is difficult to determine the comparative meaning of cognitive or affective disorders for different types of animals. On the one hand, it seems reasonable to assume that such disorders are much worse for human beings, as they are acutely aware of how these disorders impact their lives. On the other hand, primitive feelings such as sadness or anxiety might be just as vividly experienced by animals like mice and zebrafish, and perhaps even more so, as these animals cannot learn ways of dealing with their emotions, put them into perspective, or even give meaning to their suffering. In certain cases it is quite possible that cognitive complexity makes suffering (or in general: the frustration of interests) as a result of neurobehavioural disorders worse (for example when a human being has time to reflect on the terrible experiences that lie ahead of her), but other cases are imaginable where the opposite is true (for example when an animal is very afraid and has no way to deal with the feeling, and no idea that it may pass).

There is a reason why these considerations are all rather speculative. As Panksepp (2011) notes, while earlier brain functions that generate primary-process emotions form a common basis for the experience of, at least, all mammals, there is more diversification in the animal kingdom when it comes to later brain functions, in particular those involved in higher cognition. It is a lot more difficult, therefore, to use a principle like the analogy postulate to make inferences about similarity in experiences on the cognitive level than regarding pain experience. At the same time, this raises the question whether animal models in neurobehavioural research can really give us answers regarding our own situation. While the evolutionary sources of human emotion can be studied with the use of animal models, as these stem from 'the fundamental level of brain organisation upon which the rest of the mental apparatus relies… studying the primordial sources of emotional feelings, important as they are, cannot clarify the whole emotional story' (Panksepp 2011, p. 8). As Panksepp (2011, p. 9) argues, 'such thoroughly cognitivized tertiary-processes thought-related emotions, engendered culturally by social learning are, at present, next to impossible to study rigorously at causal levels and most certainly not in animal models'.

4 Should We Use Animals for Neurobehavioural Research?

4.1 Introduction

In this section, we will apply the considerations above to the practice of neuro-behavioural research. The preliminary question is whether we should use animals at all in experiments to develop cures and find ways to prevent cognitive and

affective disorders for human beings. We have argued that it is not self-evident that humans are morally more important than other animals, and that there seem to be good reasons to attribute moral status to all beings that are sentient and pursue purposes. We have also argued that it makes sense to attribute consciousness, which is required for these capacities, to at least certain kinds of animals, who are, e.g. capable of flexible learning.

We shall see what this means for the acceptability of this kind of research. First, what moral considerations count against using animals in such research? Second, can the benefits that the outcomes of these experiments may give to human beings justify such research? We shall conclude that there can be different views about this from utilitarian and Kantian positions. The discussed Kantian approach will categorically oppose such experiments, while utilitarians may think that, in limited cases where the benefits outweigh the harms, such experiments are justified.

If we do think that experiments on animals are in principle justified, then is it worse to use cognitively more complex animals than less complex animals? We have argued above that there are differences between animals and human beings and between different kinds of animals, related to their different cognitive capacities, and different interests. However, the relevance of this will depend on the specific experiment, and how the beings involved are affected by it.

4.2 Moral Considerations Against the Use of Animal Models

What follows from the general approaches of Singer's utilitarianism and Korsgaard's Kantianism for the acceptability of using animals in neurobehavioural research? To know that, we have to consider what specific moral duties follow from their general frameworks. In general, on the basis of these approaches, we should not harm others, understood as treating them in a way that they have a negative attitude to. This generates duties not to cause others pain, but also other types of suffering, e.g. anxiety, sadness, extreme boredom. If, then, specific kinds of animals experience these kinds of suffering, this is prima facie morally problematic. We have suggested that at least vertebrates, mammals, birds and fish, and the "honorary vertebrates" (cephalopods) at least seem to consciously experience pain. Whether they actually experience the other types of suffering is more difficult to determine.

To take anxiety as an example, animal models are used in some protocols (e.g. zebrafish) that show fear responses to certain stimuli (e.g. Gerlai 2012). Braithwaite and Droege in this volume cite many forms of evidence that indicates considerable flexibility in fish behaviour, which together with physical structures in the fish, seem to suggest consciousness (Sneddon et al. 2003). They explicitly do not claim not to have the final word on whether and how fish are conscious, but based on precautionary reasoning suggested above, it may be right to assume that these fish at least experience a primitive type of conscious fear. There may, however, be important differences between human and zebrafish anxiety. This may make the use of human beings (or more cognitively complex animals) more

problematic, but it does not mean that using zebrafish would be morally *un*problematic. If they experience some primitive type of fear (which may be quite intensely experienced), this is a moral reason against using them in this type of research.

It is generally agreed that we should not cause animals unnecessary pain. Killing animals painlessly, on the other hand, is often regarded as unproblematic. The question whether painless killing is indeed morally unproblematic is very relevant for the issue of experimentation, as it routinely involves "sacrificing" the animals involved after the experiment. The issue of the wrongness of killing is a rather vexing one, also in the case of human beings. There is a philosophical problem about death: it is not a bad state to be in, so how can it be thought to harm someone when we kill them? Hence sometimes it is said that it is only bad for those left behind. Still, we commonly think that death is a serious harm. We might think death is bad because we do not want to die. But then the value of life reduces to this single desire. Sometimes people are suicidal, but we still consider death bad for them, for example if there is a possibility for them to be cured from a depression. Another view is that death is bad because it is a deprivation of future goods (Nagel 1993). Life is not in itself valuable (e.g. living in a permanent state of coma does not seem preferable to death), but life is valuable as a precondition for doing whatever we want to do. In death we lose the possibility of future activities and experiences that we would have valued had we not been killed. This goes for animals too (Kaldewaij 2008; Bovenkerk and Braithwaite, forthcoming).

This could provide an additional reason why experiments on animals, or at least on certain types of animals are morally problematic. The animals involved are not just caused suffering, they are also deprived of all possibility of future experience. If killing animals is indeed morally problematic, this is also relevant when we are faced between a choice of using more animals but causing them less discomfort in an experiment, or using less animals with more discomfort. It is by no means clear that we should use more animals, while discounting for the death of these animals. It should also be pointed out here that an animal interest in life sheds an alarming light on the fact that many animals are bred for research purposes but killed without ever being used, for a variety of reasons, such as the creation of a specific line, or the necessity of only using males of one line. In the Netherlands alone this can amount to 530,000 bred but unused animals annually.[13]

If we follow either of the two philosophical approaches selected for discussion, we have prima facie moral duties not to harm, including not to kill, animals. We speak of "Prima facie moral duties", because our overall duties may be thought to depend on the duties in favour of these experiments. These are negative duties, duties not to interfere with them in certain ways. These same philosophical approaches also give a basis for positive duties to others: to assist others in specific ways. Singer's view leads to quite extensive duties to others, as he holds that we ought to further the preference-satisfaction of everyone affected by our actions,

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[13] http://www.google.nl/-workshop-gefokt-maar-niet-gebruikt-bred-but-not-used.pdf.

including animals who have preferences. Positive duties also seem to follow from Korsgaard's account, notably from her idea that we must assign normative value to the natural good of a being who cares about its own good. If so, it seems that we ought to further the ends of others when we can (when this does not conflict with other, more stringent, moral duties that we have). However, Korsgaard says that, while she also recognises that it would be good if we had a world in which every animal is happy and comfortable, for the Kantian, morality is not about bringing about a world that is as best as possible, but about how we should interact and relate to others. She, therefore, focuses on treating those with whom we interact in a beneficial and fair way (Korsgaard 2011, p. 111). What may be thought problematic about animal experiments, on this basis, is that they not only make animals suffer, but also deprive them of living a good life, while we should help them to attain this.

4.3 Do the Benefits to Human Beings Justify the Harms to Animals?

There are, then, strong moral reasons against using animals as models in experiments in the neurobehavioural sciences: when these experiments involve causing animals suffering, when they are not able to live a good life as an animal of its kind, and when they are killed far before the end of their natural life span. Adding the extra responsibility we have for beings for which we are responsible, and which are completely dependent on our care, this seems to amount to a strong case against animal experiments. However, the experiments are undertaken to provide benefits to human beings. They are aimed at finding cures and ways to prevent debilitating human diseases involving a lot of suffering, such as anxiety disorders, depression, alcohol addiction, and so on. Can the benefits to humans justify using animals in these experiments? This is a question that utilitarians, like Peter Singer, and Kantians, like Christine Korsgaard, would answer in very different ways.

   As explained, Singer thinks ethics is about weighing the interests of different individuals equally, and then trying to maximise the total amount of satisfaction of interests. This is actually quite similar to common thought behind public policy about animal experiments and the procedures used in ethics committees. In both cases, human and animal interests are weighed against each other, and the aim is to find the route to the optimal outcome. However, in practice, in determining public policy and in ethics committees, human interests are given much more weight, even when they are considered comparable to the animal interests in question. Singer would object to this, and say that the interests have to be given equal weight when they are comparable (e.g., when the same amount of pain or other types of suffering is involved).

   For Singer, then, the question is exactly how much suffering these experiments would be able to prevent, and weighing this against how much suffering they cause

to the animals involved. This is a very difficult calculation to make, as we are not quite sure what the animals involved experience. There may be important differences between the exact interests at stake for different beings. Again, let us, using precautionary principles, assume that some experiments at least involve some pain and other kinds of suffering, like nausea, fear or sadness, which will probably be quite intensely experienced. In addition, killing the animals involves taking away future well-being or preference-satisfaction. If many animals are used, then this is a very large cost to be outweighed. We know that not all experiments lead to positive results for human beings immediately. However, when such positive results are found, they might lead to a large improvement in well-being for many people suffering from anxiety disorders, depression, and so on. We also have to take into account future generations that might benefit from the cumulative benefits of these experiments. It is still a real question whether this would outweigh the harms to the animals involved. More empirical research on the actual benefits to be expected from these experiments and the animals used, and the harms involved, would be needed to find a satisfactory answer to this question. Moreover, when we also take into consideration the (possible) development of alternatives that lead to less animal suffering, the calculation might lead to a rejection of animal experimentation.

Kantians do not agree with the view of moral decision-making as weighing benefits against harms. In Korsgaard's view, it is a mistake to aggregate the interests of everyone involved and try to maximise total well-being. There is no one who benefits from an increase in overall well-being. Rather, we should respect individuals as "ends in themselves". Respecting an individual involves respecting its good (2009b, p. 25). Korsgaard notes that animals cannot give informed and uncoerced consent to how we treat them. She suggests that we treat animals in ways to which we think they would consent if they could, that is, in ways that are mutually beneficial and fair. Using animals in ways that cause them suffering for scientific information, she says, is something they would not consent to (Korsgaard 2011, p. 110). In general, in Kantian views, we may not violate a strict duty to an individual, e.g. not to kill them or harm them in a serious way, for the sake of providing benefits to other people. This makes experiments in which subjects are harmed and killed morally impermissible. It involves using a being as a means for the satisfaction of another being's preferences.

One might wonder what the Kantian view implies for the practical assessments of animals experiments. For example, EU guidelines require us to make a harm-benefit analysis for each experiment. The guidelines are based on the idea that the use of animals in experiments should be justified. There is a tendency to translate this into a simple cost-benefit analysis, but from a Kantian perspective we have reasons to take a wider perspective on such justification. While even a Kantian has to take into account the interests of all those involved, it is important to realise that not everything is reducible to a weighing of minuses and plusses.

It may be thought that that using animals in experiments is 'a necessary evil' or 'the lesser of two evils', suggesting that we see ourselves faced with an unavoidable choice between harming an animal or allowing human beings to be in

a harmed state. While there is good reason to assume that when we are in an emergency situation, such as in a lifeboat, it is more justified to throw a dog overboard than a human being, if one of them has to go (Regan 2004), we reject the comparison between animal experiments and life-boat situations. In a life-boat situation immediate action has to be taken and there is no alternative. In the practise of animal research there are often alternatives and even if there are not, it is unlikely that one specific experiment will directly lead to saving human lives. Also, and even more importantly, an animal experiment is not a case in which everyone will die, unless one of them is sacrificed. In the case of an experiment to find cures for others, individuals are actively brought to the laboratory and used as means for the sake of saving others.

There is, then, no consensus among those attributing moral status to animals on whether we may use them in experiments to benefit other beings. Utilitarians think we may, if all similar interests involved are weighed equally, while Kantians think we may never use a being as a means to further the well-being of others.

4.4 When We Do Decide to Use Animals in Research, Which Animals?

We started this chapter by noting a tension between, on the one hand, using animals in research because they are in the relevant respects similar to human beings, but on the other hand, assuming we are justified in using them because their interests matter less. If they are so similar to humans, should they not also have similar moral status? As we have argued, we cannot simply assume that it is better to use less complex animals because they may not suffer less. What could be good reasons to choose one animal model over another?

In practise, the choice for a particular species as a model tends to be based on practical considerations, such as ease of handling, space needed, reproduction rate, and costs. However, if we would decide purely on a normative basis what species to use as a model in scientific or medical research, only two considerations should be relevant: first, the impact that the experiment has on animal interests, the discomfort and suffering the animals are likely to experience; and secondly, the quality of the research design. When we are talking about suffering in the case of neurobehavioural research, we refer not only to pain, but also to emotional suffering such as fear and anxiety, and also to the fact that positive experiences may be taken away from the animals due to the research setting. The quality of the research design is important, of course, because if research has been poorly designed it is not likely to yield useful results and animals will have been sacrificed for nothing. But it can also be a relevant criterion for animal choice, because if we ensure that for a given disease the animal model that has most predictive value for the human situation is chosen, the number of animals that need to be used may be reduced.

Still, we can see in the practise of animal experimentation that different animal species are treated differently. Researchers are more reluctant to use large animal

models and three species of animal in particular have a privileged status in legislation: cats, dogs, and non-human primates. Cats and dogs are given privileged status for reasons of public concern (Hagen et al. 2012). We can wonder whether public concern is in itself morally relevant, however. To the extent that people were to suffer from the knowledge that cats and dogs are used in research, according to utilitarianism this could be a reason to restrict the use of these animals. But one may wonder whether there is not as much reasons for public concern about mice and zebrafish as there are about cats and dogs, if they are similarly affected by these experiments.

Moreover, EU Directive 2010/63/EU stipulates that non-human primates may only be used when no other animals can be used to study a specific research question (Hagen et al. 2012). A recent lawsuit in the United States aims to grant chimpanzees the right to freedom, by requesting that these animals be given the status of persons.[14] Three reasons have been mentioned for this: (1) public concern; (2) highest similarity to humans; (3) more complex cognitive abilities and advanced social and behavioural skills (Hagen et al. 2012). Are these arguments sound? Neurobiological research makes much use of non-human primates, especially because their cognitive capacities are so similar to those of humans (Brukamp 2012). Their ability to form social bonds and their communication skills make them interesting animal models, for example because they respond similarly to social isolation as humans. At the same time these characteristics may give them a higher moral status according to some theories. Non-human primates are often granted a special status based on their resemblance to humans. Brukamp (2012, p. 66) for example states that 'primates possess extraordinary cognitive, social, and moral capabilities, which closely relate them to humans, and therefore, primates may need to be ascribed a higher status as moral subjects in comparison to other animals'. But is this justified? Certainly resemblance to humans on its own is not a good reason to grant an animal higher moral status. The question is whether this resemblance is morally relevant. This comes back again to the question of whether these specific resemblances make the animals suffer more from experiments. Only if animals with more complex cognitive capacities suffer more from experiments than less complex animals, then the former should be replaced by the latter.

Is it possible to study such disorders without also creating negative experiences in these animals? And can we know with certainty that they don't experience these states similarly to us, or whether they are even more overwhelmed by them than us? Of course, at least in theory it could be possible to examine only part of the mechanism of depression without creating a whole depressed animal model, but the question then rises whether this still counts as a good model for human depression. On the other hand, if animals can really be depressed, then this raises questions about the moral acceptability of these experiments.

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[14] This lawsuit was filed on December 2, 2013, by the Non-human Rights Group with the help of animal rights lawyer Steven Wise. See http://www.nonhumanrightsproject.org/2013/12/02/lawsuit-filed-today-on-behalf-of-chimpanzee-seeking-legal-personhood/.

5 Conclusion

When deciding whether to use animals in experiments, we should only take into account the importance of the purpose of the experiment, the quality of the research setup, including a consideration of which animals offer the best translation to the human situation, and the effects on the animals' interests. If animals are indeed good models of human psychopathologies like anxiety and depression, they are likely to have experiences that are similar to human experiences that we consider to have good reason to avoid and cure. More research is needed linking cognitive complexity to suffering. However, this type of research is by definition very difficult, for due to the layered organisation of the brain, there is more diversity between animals on the cognitive 'tertiary level'. Consequently, it is a lot more difficult to use a principle like the analogy postulate to make inferences about similarity in experiences on the cognitive level than regarding pain experience. Even though it is reasonable to assume that consciousness comes in degrees, and more conscious animals may in many cases have richer experiences, in our view it is not self-evident that cognitive complexity will always make suffering worse, although there are definitely forms of mental suffering that animals will not experience. In the latter case, the question should be raised how well the animal model can be translated to the human situation under study. Of course, there is also a more fundamental question that we have to consider: whether moral acceptability is indeed a matter of cost-benefit analysis, or whether it is in principle impermissible to use some beings in seriously harmful ways for the benefit of others.

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