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Dimensions of animal wellbeing

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Abstract

Whether animals fare well or not is of ethical significance. For this reason, their capacity for wellbeing, i.e., how good or bad the lives of animals can go, is of ethical significance as well. I assume that the wellbeing of most animals is mainly determined by their phenomenally conscious experiences. If consciousness differences between species determine wellbeing differences, then the kinds of conscious experience species are capable of may entail that some species systematically (can) have higher or lower wellbeing than others. Then, I argue that not all phenomenally conscious states contribute to wellbeing equally. I discuss which features of consciousness are constituents of wellbeing and which can, for ethical purposes, be ignored. In addition, I scrutinize how much different features of experience contribute to wellbeing and how their presence can be detected empirically. This way, this paper exemplifies a novel consciousness-centered approach for the empirical investigation of animal wellbeing. The strengths and weaknesses of this approach are analyzed. While subsequent research is needed to refine the framework, I already note some preliminary implications for animal ethics.

Keywords

Animal consciousness · Animal welfare science · Hedonism · Judgement bias · Animal ethics · Wellbeing capacity

Whether animals fare well or not is of ethical significance. This is why it is important to investigate animal wellbeing. In this paper, I will tackle an important problem for animal welfare assessments which has only recently entered the literature (Browning, 2023; Gaffney et al., 2023; Višak, 2022): interspecies differences in the capacity for wellbeing. Due to differences in other capacities, particularly in the kinds of conscious experience different animal species are capable of, some species may be capable of higher (or lower) levels of wellbeing than others. For instance, it has been argued that elephants can experience PTSD (Hoffman, 2020). If this is true and some other animals lack this kind of experience, then the lowest possible wellbeing levels of elephants might be lower than that of some other species. Given these assumptions and all other things being equal, we have stronger reasons to make sure that elephants live in good conditions than animals with a lower wellbeing capacity.

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The main goal of this paper is to develop a novel framework for the investigation of interspecies differences in wellbeing capacity and, by extension, interspecies comparisons of wellbeing. Those comparisons are notoriously hard to make since the measures typically used in animal welfare science, e.g. preference tests (Dawkins, 2021), appear insufficient. The preferences of an animal can tell us which of two states it prefers and thus, presumably, where its wellbeing level is higher. However, it is not clear how we can reliably determine that an animal has a level of wellbeing higher than another (if both are positive). Even if the first animal has its highest possible wellbeing level, the other animal might have a higher wellbeing if it has a higher capacity for wellbeing. Even if a bee is on its highest possible wellbeing level, the wellbeing of a chimp might nevertheless be higher if the latter has a higher wellbeing capacity. Since we currently lack an accepted framework for tackling interspecies differences in wellbeing capacity, this is what this paper aims to provide.

I presuppose that interspecies differences in wellbeing capacity, if they exist (Višak, 2022), are primarily rooted in interspecies differences in conscious experience. This motivates a three-step research program. First, we need to develop a classificatory scheme which is detailed enough to describe all relevant aspects of the conscious experience of various animals and to make room for distinctions between different kinds of consciousness. Thankfully, Birch et al. (2020) have already made significant advances on this task. So, I will use their framework as a basis.[1] Second, it is necessary to investigate which features of consciousness are constituents of wellbeing and which can, for ethical purposes, be ignored. This way, we can arrive at a framework which describes the different dimensions which jointly constitute animal wellbeing. This paper contributes to this endeavor. Third, subsequent empirical research efforts into animal consciousness should consider ethical reasons to prioritize features of animal consciousness which constitute wellbeing. Once we have gained sufficient knowledge of the relevant features of animal consciousness, we are in a position to ascertain animal wellbeing in a way which respects the possibility of interspecies differences in wellbeing capacity and thus enables interspecies comparisons of wellbeing.

This paper is structured as follows. In §1, I will introduce the terminology relevant to frame this discussion. I will elaborate on the concepts of wellbeing, consciousness and constituent of wellbeing, situate this discussion with respect to the most important philosophical theories of wellbeing and motivate the importance of gaining knowledge about interspecies differences in wellbeing capacity. §2 contains a summary of the framework for the description of consciousness developed by Birch et al. (2020) which I subsequently rely on. §3 and §4 make up the core of the paper. In these sections, I examine which features of animal consciousness are relevant to wellbeing, why and how much. Where not already done by Birch et al., I suggest empirical tests for these features. In §5, I will discuss how the

[1] For a recent multi-dimensional framework of animal consciousness which builds upon Birch et al., see Dung & Newen (2023).

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research program I propose differs from an approach to interspecies comparisons of animal wellbeing which is rooted in the proprietary tools of animal welfare science, as developed by Browning (2023), and where its respective strengths and weaknesses lie. §6 mentions some potential ethical implications of the framework and summarizes the paper.

1 Animal wellbeing

1.1 Wellbeing and consciousness

This paper explores which aspects of consciousness contribute to wellbeing. My usage of the terms 'wellbeing' and 'consciousness' is in line with the philosophical literature (Fletcher, 2015; Van Gulick, 2022). In this paper, I use 'consciousness' as a shorthand for 'phenomenal consciousness'. A being possesses *phenomenal consciousness* if and only if it undergoes states which are *phenomenally conscious.* Mental states are phenomenally conscious if and only if they involve a subjective experiential feeling like smelling coffee or seeing a red rose often do in humans. This pertains to how the state is experienced from the first-person perspective respectively "what it's like" (Nagel, 1974) to be in such a state. Comparative cognition researchers often refer to the same kind of property (e.g., Gibbons et al., 2022; Mason & Lavery, 2022; Nieder et al., 2020; Panksepp, 2010).

Wellbeing is what is intrinsically good for the very person whose wellbeing it is (Crisp, 2021). In other words, wellbeing grounds the *prudential* value of a life. This value is intrinsic (or non-instrumental), i.e., the value of wellbeing is independent from its relation to other states it may bring about, and it is conceptually independent from whether a life is morally good. Prudential value only concerns whether things are *good for* the person in question. Importantly, negative wellbeing is what is intrinsically bad for the person who is subject to it.

When philosophers discuss what wellbeing is, they are asking about the property (or the set of properties) which determines to what extent someone's life is intrinsically and non-morally good or bad, i.e., they are asking which property wellbeing *consists in* or is *constituted by.* Happiness may be one example. I will call this property a "ground" or "constituent" of wellbeing. Like wellbeing itself, constituents of wellbeing are intrinsically good or bad. This distinguishes them from the *conditions for wellbeing* (Browning, 2020). Conditions for wellbeing may be things like health or a comfortable shelter. Conditions for wellbeing are only non-intrinsically valuable, for their value derives from the fact that they causally affect wellbeing in virtue of affecting the constituents of wellbeing. Finally, an *indicator* of wellbeing or of consciousness is a property which can be used to detect the wellbeing level or conscious experiences of an animal. Typically, these indicators are causally related to consciousness or wellbeing. For instance, it has been argued that a stress response, for example expressed in a higher heart rate

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and the release of epinephrine and norepinephrine, indicates compromised welfare (Duncan & Fraser, 1997).

1.2 Theories of wellbeing and broad hedonism

In philosophy, there are three broad families of entrenched theories of wellbeing, i.e., views on the grounds of wellbeing. According to hedonistic theories, wellbeing is determined by the balance of conscious mental states with positive and with negative valence (Bramble, 2016; Crisp, 2006; Moore, 2019). Positively valenced experiences, like enjoyment of a fine meal, are pleasant and (at least defeasibly) motivate us to continuously seek them. Negatively valenced experiences, like pain, are unpleasant and (at least defeasibly) motivate us to avoid them. In addition to its valence, the determinants of the contribution a mental state makes to wellbeing encompass its intensity and its duration. According to hedonism, a life is good when the positive experiences outweigh the negative ones and a life is bad – or "not worth living" – if the negative experiences outweigh the positive ones (as weighted by their intensity and duration).

According to desire-fulfillment theories, our wellbeing is determined by the extent to which our desires (weighted by their strength) are fulfilled (Bruckner, 2010; Heathwood, 2016, 2019). Importantly, the constituents of wellbeing are not the positive feelings that may arise from the satisfaction of preferences; otherwise, the theory would collapse into a version of hedonism. Instead, the constituent is the experience-independent fact that certain desires have been fulfilled.

The last candidates are objective list theories (Fletcher, 2013; Griffin, 1988; Lin, 2014). According to such theories, whether a life is (prudentially) good is determined by whether it contains some subject-independent list of goods. For instance, a good life may require friendship, play, knowledge and pleasure (Rice, 2013). Objective list theorists hold that some catalog of features is necessary and sufficient for wellbeing irrespective of whether the subject desires them. In contrast to hedonistic views, these features are regarded as consisting not only in types of conscious experience.

These three families are general theories of the constituents of wellbeing: Wellbeing is claimed to be constituted by conscious experiences, the satisfaction of desires or the possession of the set of goods on the objective list, respectively.

The preceding theories have been developed and refined in light of philosophical reflection on human wellbeing. Moreover, animal welfare scientists have come up with other notions of wellbeing (or 'welfare'). In the animal welfare literature, the three dominant families of theories focus on the affective state (equivalently to hedonism), the biological functioning and the natural behavior of animals, respectively (Appleby & Sandøe, 2002; Green & Mellor, 2011; Veit & Browning, 2020). In addition, Dawkins' (Dawkins, 2017, 2021) influential approach emphasizes animal health and the satisfaction of their preferences. I will set aside this tradition of conceptualizing animal wellbeing here, since I am interested in wellbeing as a

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normative concept.[2] By contrast, animal welfare – as understood in animal welfare science – is a *thick* concept which mixes normative and descriptive elements (Birch, 2022b; Robbins et al., 2018).

As a working hypothesis, I endorse a view of animal wellbeing according to which wellbeing of most animals is entirely constituted by conscious experience. I call this view 'broad hedonism' to distinguish it from 'narrow' hedonist views as presented earlier. According to narrow hedonism, wellbeing is not only exhausted by conscious experience, but by *valenced* conscious experience. However, I take it that it may be the case that conscious experiences which are not valenced intrinsically contribute to wellbeing. For example, Chalmers (2022) is sympathetic to the idea that Vulcans – beings who are conscious but do not possess any affects – have moral status, i.e., matter morally for their own sake. In a broad sense of 'affective', the class of affective states is coextensive with the class of valenced states. Arguably, it would be monstrous to kill a Vulcan, if nothing of moral significance is gained thereby. One possible explanation for why killing Vulcans for fun would be morally abhorrent is that they do indeed have a sort of wellbeing which is not grounded in valence. In general, imagining a Vulcan in various conditions makes the idea more appealing that non-valenced perceptual and cognitive experiences may intrinsically contribute to wellbeing.[3]

While non-valenced conscious states may be direct constituents of wellbeing, is may also be the case that non-valenced properties of conscious experience impact[4] wellbeing in virtue of changing how valenced states are experienced. For instance, in beings who are self-conscious, a conscious feeling that it is oneself who is suffering may permeate pain experiences and thus modify the character of the pain, even if it does not change its intensity. Perhaps this change in the character of pain consciousness also changes its contribution to wellbeing.

Both possibilities, influence on wellbeing via non-valenced conscious experiences or via not valence-related properties of conscious experience, will be discussed further in the next sections. For now, it is sufficient to say that these prima facie reasons lead me to remain neutral on narrow hedonism. Nevertheless, I assume broad hedonism as a working hypothesis.[5] Hedonism about animal wellbe-

[2]Of course, the view that 'wellbeing' is a normative concept is compatible with holding that the constituents of wellbeing can be investigated empirically.

[3]One may alternatively take this as an argument that non-conscious states partially constitute wellbeing. This view is consistent with broad hedonism, as long as the latter view is only restricted to non-human animals. Nevertheless, an adherent to the idea that non-valenced conscious states partially constitute wellbeing is committed to the view that there are elements constituting Vulcan wellbeing which are absent in zombies (i.e., beings which are functionally identical to humans but do not possess consciousness).

[4]I intend to use the term 'impact' in a broad sense which includes non-causal influence since many conscious experiences not (necessarily) cause wellbeing, but constitute it.

[5]For an argument that hedonism is the correct theory of animal wellbeing, see Browning (2020). For an argument that hedonism is one among multiple valuable perspectives on animal wellbeing, see Veit & Browning (2020).

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

ing is more plausible than hedonism about human wellbeing since it is less clear that experience-independent goods like autonomy, authenticity, knowledge and accomplishment matter for their own sake to animals than that they matter to humans (Browning, 2020, Chapter 2). That being said, Wilcox (2021) explicitly argues that an objective list theory is true of non-human animal wellbeing.

Hence, it is important to note that broad hedonism is not necessary to establish the significance of this paper's project. Even if wellbeing is not exhausted by conscious experience, it is almost unanimously accepted that conscious experience *partially* grounds wellbeing (Birch, 2022a; Cutter, 2017; Kriegel, 2019).[6] On any remotely plausible view of animal wellbeing, whether animals experience, e.g., pain or joy, has huge bearing on their wellbeing. Hence, if broad hedonism turns out to be false, then a theory of an animal's capacities for consciousness does not amount to a complete theory of its capacity for wellbeing. Nevertheless, since a close link between consciousness and wellbeing is incontestable, an animal's capacities for consciousness will deeply inform our assessment of its wellbeing. Thus, an adequate assessment of animal wellbeing under the assumption of hedonism approximates the true account of animal wellbeing.[7]

1.3 Wellbeing capacity and wellbeing variance

As a further piece of conceptual clarification, I note that wellbeing can be ascribed to different time periods of an animal's life and that two different notions of wellbeing – both derived from the fundamental one that we just elucidated – can be so ascribed. We can ascribe a level of wellbeing to an individual regarding any time period we wish since any moment can be good or bad for a particular individual. Most frequently, we either refer to wellbeing at a specific moment or over an entire life. It is important to keep these two uses separate. Furthermore, we usually refer to a creature's *total* level of wellbeing which is determined by the combination of all the constituents that add to and subtract from its wellbeing. However, it is also possible to focus on some *subset* of constituents and ask whether they ground positive or negative wellbeing. For example, we might want to know whether an animal has a mild feeling of hunger which contributes negatively to its wellbeing, even if its total level of wellbeing is positive. Again, conflating these uses may lead to confusion.

Finally, we need to distinguish between the actual wellbeing of animal species (and individual animals) and their *capacity* for wellbeing. The actual wellbeing of animals depends on contingent empirical facts regarding their conditions of living. For example, the average wellbeing of chickens may be very low, but it would improve if humans would stop exploiting them via factory farming. By contrast,

[6] For an opposing argument, see Kammerer (2019, 2022). For counterarguments, consider Dung (forthcoming, 2022a, 2022c).

[7] See Fischer (2022) for an argument that the choice of theory of wellbeing has a limited, although real and sometimes important, influence on estimates of the capacity for wellbeing.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

a species' capacity for wellbeing is independent of such factors. The capacity for wellbeing is how bad or good a creature's life can go, i.e., the range between a creature's possible maximum positive and its possible maximum negative wellbeing level (Schukraft, 2020a).[8] We say that a creature's capacity for wellbeing is 'higher' than another's if the difference between its maximum possible positive and its maximum possible negative wellbeing level is larger. For instance, it seems that the way humans treat other animals, e.g. farmed fish, presupposes that those animals have a lower capacity for wellbeing than humans.[9]

An examination of animal consciousness is important because it sheds light on animals' capacities for conscious experience and thus their capacity for wellbeing. The actual wellbeing is neglected in this investigation since it is a function of a creature's capacity for wellbeing and the contingent conditions for wellbeing it finds itself in. In practice, when we want to estimate the wellbeing of chickens in factory farming, we need to factor in both, their living conditions as well as their capacity for wellbeing which, I argue, should be assessed based on an investigation of their capacities for conscious experiences.

The basic assumption here is that creatures with a higher capacity for wellbeing ground more intrinsic value and are, thus, (*ceteris paribus*) morally more relevant. Note that this assumption does not presuppose any particularly contentious ethical view, such as utilitarianism. The view that there are *pro tanto* moral reasons to increase wellbeing, including animal wellbeing, which is all that is assumed here, is shared by a large majority of ethicists (Beauchamp, 2019; Pandit, 2021). The only difference is that non-utilitarians hold that other considerations can, in many cases, override reasons based on wellbeing.

Actual wellbeing, rather than wellbeing capacity, cannot be the crucial moral factor since our moral deliberation depends on how different actions would affect an animal's wellbeing, and only indirectly on what their actual wellbeing is. However, the nexus between moral weight and capacity for wellbeing depends on the empirical assumption that animals with higher capacity for wellbeing tend to have a higher variance in their wellbeing levels, measured as average distance from the neutral wellbeing level, i.e., such animals tend to more frequently enter extremely bad or extremely good states (Schukraft, 2020a).

This is crucial because this wellbeing variance is what we actually care about: If an animals wellbeing deviates more often and more strongly from relatively neutral wellbeing levels, it grounds more positive and negative intrinsic value. Thus,

[8] As pointed out by Schukraft (2020a), practical considerations should guide the scope of the possibilities involved here. While the notion of *possible* wellbeing states should not collapse into a notion too close to designating only actually experienced states, we care about wellbeing states that animals in reasonably normal living conditions can achieve. Which kinds of wellbeing states occur in remote, nomologically possible worlds – involving, for instance, pervasive genetic or technological manipulation – is irrelevant.

[9] Crucially, positing differences in wellbeing capacity is not the only way to justify privileging human interests over animal interests. Most importantly, one may also claim that there are differences in moral status across species (Kagan, 2019).

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

while our investigation of animal consciousness chiefly targets their capacity for wellbeing, it also needs to be sensitive to clues to how much of this capacity is realized, i.e., how often very good or very bad states indeed occur in normal circumstances of an animals' life.

1.4 Wellbeing, trade-offs, and moral weight

To complete this stage setting, I will zoom in on a vital, but inconspicuous practical question: Why is knowledge about differences in wellbeing capacity between species important? In essence, knowing the capacity for wellbeing of different animals is important information to our decision-making. If an animal's wellbeing range is higher, it is of higher importance that it finds itself in good conditions of living.[10]

However, it seems that knowledge of wellbeing capacities is not always necessary. This is, for instance, the case where it is sufficient to rely on precautionary principles to govern our conduct with respect to animals. For example, Birch (2017) proposes that such a precautionary principle should determine which animals fall under the scope of animal protection legislation. According to this principle, all animals should be included within the scope of these laws if there is credible evidence that at least one indicator of valenced conscious experience is present within an animal of the same order. To apply this principle, no knowledge about the extent of an animal's capacity for wellbeing is necessary.

An animal's capacity for wellbeing is relevant as soon as we deal with trade-offs. These trade-offs may concern different animal species, for example when a zookeeper deliberates on whether he should devote a given amount of money or effort to improve the zoo's aquarium or its lion cage, or choices between improving non-human lives and other causes, e.g., when philanthropists reflect on whether they should donate to animal charities or to charities aiming to alleviate human poverty. When we need to conduct trade-offs, we need to know how much to weigh the wellbeing of different animals which is determined by their capacity for wellbeing.[11]

Furthermore, trade-offs between various kinds of animal intervention are usually extremely sensitive to assumptions about animals' wellbeing. This is due to

[10] Alternatively, a skeptic of the approach proposed here might question why we need the detour through consciousness to measure wellbeing. Why do we not just ignore consciousness and directly test for wellbeing by means of the measures animal welfare science has developed (Dawkins, 2021)? A reason is that the notion of animal welfare which is *normatively* relevant refers, perhaps among other things, to consciousness (Birch, 2022b). §5 contains a deeper discussion comparing the approach to animal wellbeing proposed here and a strategy which relies more on the tools of animal welfare science.

[11] Of course, capacity for wellbeing is not the only consideration in such decisions. For instance, if – let us assume – lions have a higher capacity for wellbeing it can nevertheless be preferable to improve fish lives, e.g. when many more fish than lion lives can be improved by a single intervention.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

the fact that improving wellbeing is typically the main goal of such interventions and that we are currently extremely uncertain about when animals are doing well. For instance, there exist a variety of different estimates of the quantity of lifetime wellbeing cows experience on average during conventional factory farming (Browning, 2022). Those estimates even differ in whether they assess their wellbeing as positive or negative overall.[12]

However, this has tremendous consequences. If cow wellbeing is strongly negative, this aspect of meat production is probably morally objectionable, perhaps even reprehensible. On the other hand, if cow wellbeing is mostly positive, we may even be obligated to maintain factory farming practices to continually produce these above-neutral lives. Similarly, whether (assuming that we can integrate wellbeing assessments in a single numerical score) salmons' capacity for wellbeing causes them to have a wellbeing score of -3 or -9 when subjected to established farming practices makes a huge difference for how much we should prioritize alleviating salmon suffering. In the -9 scenario, the suffering caused by farming salmons is three times as bad.

The project of this paper is to relate animals' capacities for consciousness and the variety of experiences that are open to them to their capacity for wellbeing. If hedonism is true, wellbeing is entirely constituted by conscious experience. If we want to figure out what wellbeing animal species (can) have, we therefore need to examine which kinds of conscious experiences they (can) have. To answer this question, I will introduce and adopt the framework for describing kinds of animal consciousness that was developed by Birch et al. (2020). Summarizing this framework is the task of the next section.

2 The dimensions framework of consciousness

2.1 The five dimensions

The framework developed by Birch et al. (2020) enables fine-grained descriptions of the conscious inner life of different animal species. I will summarize it now, since their account serves as a basis for our investigation of which features of consciousness constitute wellbeing.

Its key claim is that variations in the degree of consciousness of different species can be helpfully characterized along five different dimensions which all pick out features of an animal's conscious inner life: *Perceptual richness* characterizes the level of detail with which animals consciously perceive the world. It further decomposes into bandwidth (the amount of content experienced at any given time), acuity (the sensitivity to fine perceptual differences) and categorization power (the capacity to group perceived properties into more abstract categories).

[12] Independently of these numerical estimates, it seems that many studies take a critical perspective on cow welfare in factory farming (e.g., Mee & Boyle, 2020; Park et al., 2020).

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

Evaluative richness is the dimension concerned with the richness of experience of valence specifically. Again, animals differ in how much valenced content they can experience at any given time (bandwidth) and how fine-grained their evaluative appraisals of the world are (acuity). In addition, there are probably kinds of experience, e.g. grief or guilt, which not all species can experience. While *Integration at a time* (synchronic unity) concerns the degree to which experience is unified at any single point in time, *integration across time* (diachronic unity) is about the degree of temporal unity, i.e., whether the world is experienced as a continuous stream rather than through temporally fragmented experiences. Differences in synchronic unity seem to obtain, for example, in human split-brain patients or in animals like octopodes. In both, complex parts of the nervous system can act remarkably autonomously. Asynchronic unity is correlated with capacities for episodic-like memory, future planning or with the temporal fineness of grain of perceptual discrimination.

Lastly, an organism possesses *self-consciousness* to the extent that it is consciously aware of itself as distinct from the external world. According to Birch et al., distinguishing between experiences that represent external states and that represent internal bodily state in the service of movement may involve a minimal form of self-consciousness. Having an awareness of one's body as persisting object may be a more demanding form of self-consciousness, while an even more sophisticated capacity consists in attributing mental states to oneself, as distinguished from other subjects. Since it posits different dimensions of consciousness, I will call this account the 'dimensions framework' in what follows.

All those dimensions admit of degrees, e.g., evaluative experiences can be more or less rich and different experiences can be more or less integrated. As a working hypothesis, it is assumed that those five dimensions vary to some extent independently from each other while different aspects of the same dimension, i.e., different ways for perceptual experience to be rich, tend to co-occur. Furthermore, the framework presupposes that there is no further dimension which is crucial for understanding the conscious inner life of an animal and conceptually distinct from the five dimensions mentioned. Thus, the nature of an animal's conscious experience can be sufficiently captured by situating it with respect to those five dimensions.

2.2 Empirical tests

In addition, the different dimensions can be probed independently in animal experiments. Birch et al. review and propose several experiments which each promise to shed light on one of the five dimensions. Let's look at three of them. To ascertain perceptual richness, one has to test for conscious perception of various different stimuli in different sensory modalities and for the ability to discriminate between slightly different experiences. To achieve this, one needs means to detect when a stimulus is perceived consciously. One potential candidate is trace conditioning.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

Trace conditioning differs from standard classical conditioning only in that the unconditioned and the conditioned stimuli are separated by a temporal interval. Evidence by Clark & Squire (1998) suggests that trace conditioning in humans might require conscious awareness of the stimuli and the time gap separating them. If so, when a non-human animal is able to perform trace conditioning on some stimulus, this is an indication that the stimulus is perceived consciously.[13] If an animal can do trace conditioning on a wide range of stimuli in different modalities, that arguably reveals some significant degree of perceptual richness.

Furthermore, to investigate the evaluative richness dimension, the dimensions framework recommends motivational trade-off paradigms. In such experiments, animals are forced to trade-off between different types of stimuli which either constitute rewards or punishments. For instance, in the experiment of Millsopp & Laming (2008), fish reduced their feeding attempts in a part of an aquarium where they received a shock. The more intensive the shocks were, the less feeding attempts were conducted by the fish. Yet, when the fish were increasingly food-deprived, the number and duration of feeding attempts increased. Thus, fish seem to trade off their need for food with their aversion to noxious stimuli (i.e. electrical shocks).[14] This requires processing and integrating (crossmodally) different kinds of information to enable actions which appropriately take into account one's overall internal state. Birch et al. point out that integration and flexible use of information is often considered a hallmark of consciousness.

Third, a famous paradigm relevant to self-consciousness, which Birch et al. adduce, is the so-called mirror self-recognition test. It probes whether an animal is able to recognize a mark seen in a mirror as belonging to its own body. If an animal can recognize itself as itself in the mirror, then it needs to possess at least some form of self-consciousness, one might think. While the three mentioned experimental strategies belong to the ones especially emphasized by Birch et al., they present a more encompassing overview of promising empirical tests which I cannot summarize here.

In the next section, I will discuss different aspects of the dimensions framework in relation to wellbeing. The goal is to shed light on which dimensions – and which of their aspects – are relevant to an animal's capacity for wellbeing and how much.

[13] For a more detailed examination of the relation between trace conditioning and animal consciousness, see Droege et al. (2021) and Mason & Lavery (2022). For an analysis of the general rationale for treating trace conditioning as well as other features as evidence of consciousness, see Dung (2022b).

[14] For discussion relevant to ethical issues of inflicting pain on or killing animals in the context of experiments on animal welfare and consciousness, see Mazor et al. (2022) and Webb et al. (2020).

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

3 Dimensions of animal wellbeing I: Perceptual and evaluative experience

3.1 How can there be differences in wellbeing capacity?

In this section, we will use the dimensions framework to uncover the different dimensions along which animal wellbeing can be characterized. Crucially, for this exercise to be valuable, an animal's capacities for consciousness need to substantially contribute to its capacity for wellbeing. The dimensions of wellbeing may be interpreted in one of two ways: Perhaps each dimension captures a different constituent of wellbeing, such that a single numerical wellbeing score can ultimately be computed by weighting the different dimensions based on their importance for wellbeing and adding them together.[15] Alternatively, wellbeing may be irreducibly pluralistic such that different dimensions of consciousness constitute different kinds of wellbeing which cannot be integrated into a one-dimensional wellbeing assessment.

Further developing an idea by Schukraft (2020a), I posit that there are three ways for an animal (species) to possess a higher capacity for wellbeing (in virtue of its conscious experience):[16] First, an animal may be able to attain more of the specific (token) experiences which partially constitute wellbeing. For instance, an animal may be able to have more subjective pain experiences per objective unit of time than others. Second, an animal may be able to have kinds of experiences which are not accessible to others. For instance, some animals may have the capacity to experience crushing guilt while others are not able to have this feeling. Third, some animals may experience a shared experiential type differently than others. For instance, it is conceivable that some animals have the capacity for stronger pain experiences than others. To illustrate this threefold distinction, suppose that, e.g., dogs have a higher capacity for wellbeing than bees. This may be the case either because they can have experiences bees cannot have, say joy, or because the (e.g.) joy dogs can feel when playing surpasses the joy that bees can experience or because dogs can have more experiences like joy in the same amount of (objective) time.

Given broad hedonism, animals which do not possess consciousness can't have any wellbeing. Yet, it may well be that even some conscious beings do not possess any wellbeing, for perhaps not all kinds of consciousness are constituents of well-

[15] To make this exercise more complicated, the contribution of one dimension may not be constant but depend on how an animal scores on that particular dimension or other dimensions, i.e., a dimension may require a high weighting in extreme cases (say, an extremely synchronically disunified consciousness) but a low weighting in ordinary cases.

While the two interpretations of wellbeing dimensions seem to exhaust all genuine options, hybrids are also possible. Some wellbeing dimensions might be incommensurable, while others can be placed on a single scale.

[16] This includes the capacity for negative wellbeing. Therefore, a higher capacity for wellbeing may also be explained by a higher capacity to attain constituents of negative wellbeing (like pain).

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

being. My aim is to investigate which kinds of conscious experience do constitute wellbeing. In the following, we will scrutinize the five dimensions contained in the dimensions framework in order. Usually, I will skip over the question how the relevant features of conscious experience can be detected empirically, since I am in broad agreement with the suggestions by Birch et al. regarding operationalizations of consciousness dimensions.

3.2 Perceptual consciousness

Let's start with perceptual richness. As already discussed, Vulcans elicit the intuition that valenced experience is not necessary for wellbeing. However, one may trace attributions of wellbeing to Vulcans to their non-conscious states, as opposed to their non-evaluative conscious states. Vulcans – according to Chalmers' (2022) thought experiment – can possess active lives replete with colorful and rich activities. Perhaps this is what constitutes the intuition that they possess a wellbeing? To rule this out, we should look at another case inspired by Chalmers (2022): Suppose there are conscious beings who do not possess affective states and spend their entire time carefully perceiving their environment. They do not move and do not engage with what they perceive. Would we say that the lives of these inert beings can go better or worse for them?

I am torn on this question. I feel an intuitive pull to answer affirmatively but this intuition may be caused by the artificial assumptions build into the thought experiment. It is hard to imagine perceptual experience which is not accompanied by some form of valence, like the feeling elicited by finding something beautiful. *If* perceptual experience can constitute wellbeing, then it seems plausible that higher bandwidth (i.e., more perceptual content) increases the level of wellbeing. That being said, it seems that the wellbeing range of our inert observer would in any case be vastly narrower than the range available to typical human beings. Even if mere perceptual experience constitutes wellbeing, its contribution is miniscule compared to the wellbeing grounded in positive or negative affect. Thought experiments make this clear. If we have the choice between reducing pain or fear experiences in some animals, on the one hand, and improving the conditions of hypothetical inert beings whose life consists only in a sequence of perceptual experiences, on the other, we should almost always favor the former. For practical purposes, we can – save for instrumental reasons mentioned below – largely ignore the dimension of perceptual richness when considering trade-offs involving animal wellbeing. To summarize, perceptual richness is a possible ground of wellbeing, but lacks much practical significance.

However, perceptual richness is instrumentally important. It correlates with forms of evaluative richness since it is a prerequisite for some of them. For instance, we mentioned the positive experience distinctive of appreciating beauty. Having this kind of experience depends on the appropriate sensory organs and perceptual processes which fall into the domain of perceptual richness. Further-

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

more, high-bandwidth and fine-grained evaluations of environmental features are only possible if those features can be distinguished perceptually. A good example is pain which – according to the standard view – has distinct and dissociable sensory and evaluative components. While the sensory component of pain can appear without the negative evaluation, as in pain asymbolia (Grahek, 2001) and sometimes under morphine, the reverse seems impossible. Pain needs to be experienced perceptually to be experienced with a negative valence. Whenever evaluative experiences are experiences of sensory features, evaluative richness presupposes some degree of perceptual richness. Hence, while perceptual richness may not constitute wellbeing, it causally affects constituents of wellbeing. For this reason, an investigation of animal wellbeing cannot leave out the perceptual richness dimension completely.

3.3 Evaluative consciousness

The next dimension is evaluative richness. It is obvious that evaluative consciousness is a constituent of wellbeing. Since (as in Birch et al., 2020) evaluative richness refers to the feeling of valence, not to any kind of sophisticated cognitive evaluation, it is plausible that many animals, perhaps even invertebrates, have evaluative experiences (Crook, 2021; Crump et al., 2022; Galpayage Dona et al., 2022; Gibbons et al., 2022). Things can be good or bad for animals because they feel good or bad to them. The more serious question is whether there are non-evaluative constituents of wellbeing, not whether there are evaluative ones. In addition, it seems clear that the contribution of evaluative experiences to wellbeing is extremely large and often outweighs all other considerations. However, one can still ask which aspects of evaluative experience are the ones that are relevant for wellbeing and how they are weighted.

First, evaluative experiences differ in their *intensity* or strength. This aspect is not explicitly mentioned by Birch et al., but obviously possesses extreme, or even paramount, importance.[17] Pain experiences, to reuse the example of a paradigmatic and ethically crucial evaluative experience, can not only be more or less rich, but also more or less strong.[18] How strong they are – a mild pinch or a cluster headache – is central to their contribution to wellbeing. Intuitively, it seems to me as if the intensity of emotions – consider guilt, sadness and joy – also varies partially independently of their richness. A numbing feeling of sadness does not need to be complex and multi-faceted to have a large negative impact on wellbeing, if it is sufficiently strong.

[17] This feature corresponds to what Dung & Newen (2023), in their multidimensional analysis of consciousness, call 'evaluative intensity'.

[18] According to an influential view, two dimensions – valence and arousal – are the core building blocks of affective experience (Mendl et al., 2010; Panksepp, 2010). The valence dimension seems to correspond to the degree to which a single experience is unpleasant. Thus, what I call 'intensity' is a (very important) component of valence. By contrast, the arousal dimension does not seem to contribute to wellbeing.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

Based on conceiving of various scenarios and observing actual cases, e.g., patients with cluster headaches (May, 2005), I am inclined to hold that the intensity of a valenced experience is most important when it comes to its relation to wellbeing. Nevertheless, there are other features of evaluative consciousness which also constitute wellbeing. For starters, different types of valenced experience may differentially impact wellbeing. For instance, perhaps fear has a higher (negative) impact on wellbeing than the experience of emotional stress, even if they share the same intensity, duration and richness. On average, I expect that the negative impact of negatively valenced experiences outweighs the impact of positively valenced experiences of the same intensity.[19] Thus, two properties of evaluative experience besides its richness, namely its type and its intensity, contribute to wellbeing.

Is richness important? To begin with, we have to distinguish different kinds of richness. Evaluative experience of an animal can be asynchronically rich in the sense that the animal is able to experience multiple types of evaluative experiences, i.e., types of pain, pleasure, emotions etc., albeit not simultaneously. If different types of conscious experiences differentially impact wellbeing, this is relevant for wellbeing. However, we already mentioned this point. 'Richness' in the sense which is relevant here is a synchronic notion. It can be subdivided into type and token richness. Type richness consists in the fact that an animal can have evaluative experiences of many different types at once. By contrast, token richness consists in the fact that an animal's evaluative experience is fine-grained and has high bandwidth, i.e., the animal is able to experience much and finely differentiated evaluative content, comprising many token experiences, at once.

The rationale for why token richness intrinsically contributes to wellbeing is obvious. Given that single evaluative experiences ground wellbeing, it stands to reason that a higher number of evaluative experiences will ground a higher amount of wellbeing. Having high evaluative token-richness implies that an animal can experience many contents (or especially complex contents) at the same time, such that its total wellbeing is, ceteris paribus, likely able to reach more extreme values.

The case for the impact of evaluative type richness on the capacity for wellbeing is less clear-cut. High evaluative type richness involves a complex and multifaceted affective life, including many kinds of bodily sensations and especially emotions. Plausibly, some animals are not able to experience the feeling of (e.g.) love, guilt or embarrassment which makes their consciousness less evaluatively rich. It is an open question whether the capacity for the simultaneous presence of many experiential types increases an animal's capacity for wellbeing when we control for the factors mentioned above that some experiences may in virtue of their kind have higher impact on wellbeing, that the amount of total evaluative content is likewise relevant for wellbeing capacity and that experiences differ in their intensity. If type richness is indeed relevant, cognitively sophisticated animals – like

[19] Alternatively, one may opt for a conceptual scheme which ascribes a higher average intensity to negative experiences.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

mammals and birds – may have (in this respect) a higher capacity for wellbeing, since they seem to have an emotional repertoire which surpasses simpler animals.

In total, we discovered that the main contribution to (the capacity for) wellbeing stems from the evaluative dimension. In particular, evaluative intensity and token richness are very likely grounds of wellbeing and have much impact on wellbeing capacity. In addition, the type of experienced evaluative content and the number of types that can coincide in a single total evaluative experience may also be grounds of wellbeing. If so, they likely have less impact on wellbeing capacity than evaluative intensity. Importantly, these features can be examined empirically, although we are still in the early stages of learning to track such fine distinctions between conscious experiences.

3.4 Empirically accessing evaluative consciousness

Most accessible to empirical testing is the question which kinds of evaluative experience animals possess. Given that an animal possesses the requisite mechanisms for consciousness and that it can represent the evaluative content E (let's say, the emotion fear), it is a reasonable assumption that the animal sometimes experiences E (fear) consciously. Since there exist tractable empirical research programs on animal emotions (de Vere & Kuczaj, 2016; Kremer et al., 2020), we can use knowledge on the distribution of consciousness to draw inferences on conscious affect in various species. Nevertheless, we mustn't neglect the fact that this inference is defeasible. While the capacity to occupy mental state M and the capacity to have conscious mental states jointly provide good evidence for the capacity to consciously experience M, they don't *imply* the latter capacity.

Tests for the intensity of evaluative experience are harder to come by. In respect to pain, one may investigate the threshold that – when crossed by some noxious stimulus – causes pain reactions. Given the assumption that pain thresholds correlate with thresholds for conscious pain experience and that the correlation between noxious stimulation and actual pain is approximately linear, a lower pain threshold indicates that an animal experiences more intensive pain when subject to noxious stimulation. However, both assumptions are controversial and the second assumption likely breaks down when we are confronted with cases of drastic interspecies differences in the intensity of conscious experience.

Furthermore, one may estimate the strength of experiences via their effect on animals' preferences. For example, present the animal with the choice between two rooms: In the first, there is an object it extremely likes but the room is cold. The second has no special features. Observing changes in preference while continually varying the room temperature sheds light on the animals' experience of temperature. By frequently using this method with objects whose attraction to the animal we have measured antecedently, we can thereby gain insight into when the temperature experience starts to assume a negative valence and how strong it is for different values of objective temperature.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

Though this method is helpful, it also falls short of perfect reliability and validity. For we can't be sure how closely preferences track the intensity of experience, especially relative to other evaluative features of conscious experience. Insofar as we think that, e.g., evaluative richness contributes to the impact an experience has on wellbeing, it is plausible that richness also partially causes an animal to prefer rich experiences. This problem becomes more obvious when we try to extend this method to interspecies comparisons.

In this paper, we aim to find differences in animals' general capacity for wellbeing. However, we cannot argue for these differences directly in terms of differences in preference strength. It is not clear what it would mean for one animal to behaviorally express stronger preferences generally than another one. Plausibly, the behavior of animals is guided by whatever preferences are in combination the strongest at any moment. Thus, how preferences affect behavior depends only on the relations between different preferences. There is no stronger behavioral expression for preferences which are not just in relation to others, but absolutely, stronger.[20] While observations of animal behavior can be used to construct the preference function of an animal on an interval scale, we need something more demanding (see also: Browning, 2023). The claim that an animal has in general stronger preferences than another one can only be derived when it is possible to express the preference functions of both animals on a common scale. Based only on behavioral evidence, it seems impossible to construct such a common scale. Yet, if we cannot discern absolute differences in preference strength between animals, we cannot detect absolute differences in wellbeing and consequently wellbeing capacity.

Besides taking preferences as a direct indicator of wellbeing, one may regard preference tests as specific measures of one constituent of wellbeing, i.e., of one feature of conscious experience. Yet, the same problem arises. Behavior cannot reliably express that one animal has in general much stronger preferences than another, while we are looking precisely for such general differences in capacities for conscious experiences.

Moreover, preferences seem to be caused by the total evaluation contained within an experience, not by its components in isolation. Animals prefer situations which cause good experiences and avoid situations which cause bad experiences, regardless of how different features of experience conspire to create this valence. Thus, preference tests are no targeted measure of evaluative intensity or any other individual component of wellbeing. That being said, as suggested earlier, varying one feature of the environment and studying subsequent preference changes while holding other variables constant can provide clues as to how strongly this variation is experienced.

[20] An example for the assumption that such an absolute difference in preference strength exists would be the claim that the preferences of species S_1 are in general three times stronger as the preferences of species S_2. This difference cannot be expressed in behavior. However, differences in wellbeing capacity can have this form. Thus, preferences cannot both be measurable and map onto differences in the capacity for wellbeing.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

More generally, this discussion has shown that our current tools for studying evaluative intensity are, though useful, rather limited. At some point, we will probably add neuroscientific measures to our toolkit to track distinct features of evaluative experience in isolation. In the next section, we will move on to the remaining dimensions concerning synchronic and diachronic unity as well as the self.

4 Dimensions of animal wellbeing II: Unity and the self

In this section, we are looking at the relation between the remaining dimensions and capacity for wellbeing. This may seem puzzling: We already granted that one plausible view, namely narrow hedonism, holds that wellbeing is entirely constituted by evaluative experience. This begs the question: If narrow hedonism is true, how can the other dimensions intrinsically contribute to an animal's capacity for wellbeing? The answer has to be that – if narrow hedonism is true – other dimensions constitute wellbeing, if they do, in virtue of modifying the capacity for evaluative experience.[21] That is, they either make new types of valenced experience possible or change the properties valenced experiences otherwise (tend to) have. Unity and self-consciousness are therefore no distinct third category of consciousness experience but change the character of the other two, i.e., perceptual and evaluative consciousness.

4.1 Synchronic unity: Mere correlation and split consciousness

With that prelude in mind, let's continue our investigation of the constituents of animal wellbeing. How does synchronic unity, i.e., the integration of conscious contents into one single coherent experience, impact the capacity for wellbeing? Prima facie, it seems even unclear whether a higher score on the synchronic unity dimension should be seen as increasing or decreasing capacity for wellbeing. In favor of a positive connection, one may suggest that a high degree of unity indicates a high degree of information integration which is connected to cognitive sophistication. Although this matter is far from straightforward (Schukraft, 2020b), the typical view is that more intelligent animals which possess abilities such as creativity, imagination, episodic memory, deliberation and agency possess a higher

[21] One might dispute that these other dimensions actually pick out constituents, rather than a special class of conditions, of wellbeing. This question is not essential, as long as one grants that the way consciousness dimensions contribute to wellbeing differs markedly from other conditions of wellbeing like health and shelter. Some conscious experiences are the constituents of wellbeing. Differences in consciousness dimensions directly shape which conscious experiences animals can have. The influence of typical wellbeing conditions is much more indirect.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

capacity for wellbeing. However, put this way, this suggests merely a correlation between synchronic unity and capacity for wellbeing. This is insufficient because the question at issue is whether synchronic unity partially constitutes wellbeing, i.e., whether it makes a non-instrumental contribution to wellbeing, not whether it correlates with features that do so.

As soon as we distinguish between constitution of and correlation with wellbeing, it starts to become unclear why synchronic unity should be involved in animal wellbeing. Why should it be good (or bad) for an animal to have more unified experiences? We already clarified that this involvement would probably have to occur mediated through the influence of unity on evaluative experience. But here the same question arises: Why should a unified experience feel better or worse than a disunified one? There is no specific reason to think that unity impacts wellbeing. However, since our grasp of what disunified experience even feels like is limited, it may be best to conclude that we don't know whether synchronic unity is relevant to an animal's capacity for wellbeing.

Nevertheless, there is an exception. Typical examples of beings which score low on the synchronic unity dimension are split-brain patients and octopodes. Sometimes, it is hypothesized that more than one stream of consciousness resides in their mind (Carls-Diamante, 2017; Godfrey-Smith, 2020). In other words: They may have two – or arguably in the case of octopodes multiple – conscious perspectives on the world. This raises the intriguing possibility that we would need to ascribe one wellbeing score to each of the conscious selves and thus – when talking about the wellbeing of the whole organism – add them together.[22]

If we have no systematic reason to believe that these octopus or split-brain consciousnesses individually have a lower capacity for wellbeing than the unified consciousness of other animals, then we should expect the multiple octopus consciousnesses to jointly have a higher wellbeing capacity than animals whose experience is unified into a single conscious stream.[23] If that is true, then having very low synchronic unity actually contributes to the capacity for wellbeing. It seems that this connection is non-linear. Moderately high synchronic unity does not contribute to wellbeing capacity relative to very high unity. The connection only obtains for types of consciousness which are so disunified that we should treat them as plurality of conscious streams. In conclusion, it is possible that synchronic unity is, to some extent, a ground of wellbeing.

[22] One may insist on other ways to compute the total wellbeing score of, e.g., a split-brain patient than addition. I have no objection to this but establish the following constraint: If the two hemispheres of a split-brain patient indeed constitute separate streams of consciousness with individual wellbeing levels, then the total wellbeing of that patient should be determined in whatever way is usually used to determine the total wellbeing of a group of animals when various typical individual animals are involved.

[23] See Gottlieb (2022) for a view according to which the octopus brain does not contain multiple distinct wellbeing subjects.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

4.2 Asynchronic unity: Speed of consciousness and mental time-travel

Next up is asynchronic unity. I think that especially two features regarding the temporal unity of conscious experience are relevant to wellbeing capacity: The first is the rate of conscious experience, the second is the capacity for mental time-travel. In respect to the first feature, I will rely on the detailed treatments of Schukraft (2020c, 2020d). As described by Schukraft (2020d), "animals with faster rates of subjective experience undergo more subjective moments per objective unit of time than animals with slower rates of subjective experience." This means that, when a painful stimulus is present for a particular interval of objective time, animals with a higher rate of experience are subjectively longer in pain.

There are many reasons to think that differences in the rate of subjective experience exist (Schukraft, 2020d). First, there are pervasive differences in neural functioning, especially in the speed with which information is transmitted and processed, between the brains of different animals. Second, how fast animals have to experience the world to successfully cope plausibly depends on their ecological niche. Obviously, the latter varies extremely between animal species. Third, humans frequently report – especially in extreme conditions such as during accidents or under the influence of drugs – that they experience time as passing slower or faster than usual. If there can even be intra-human differences regarding the rate of conscious experience, differences between animals having extremely different bodies and brains and inhabiting different habitats seem almost but guaranteed. Fourth, as the second point would suggest, animals differ vastly in how quick they can react to stimuli.

Fifth, studies of the temporal resolution of perception are at present arguably the most promising way to ascertain an animal's rate of conscious experience (Schukraft, 2020c). Temporal resolution is examined by measuring an animal's critical flicker-fusion frequency (CFF). This is the threshold beneath which an animal experiences a flickering light not as series of flashes, but as a continuous stream of light (Inger et al., 2014). If animals have a low CFF, this means that they are bad at discriminating stimuli which follow each other closely in time, i.e., they have low temporal resolution.[24] CFF has already been tested for a large range of animals (for an overview, see Schukraft, 2020c). Surprisingly, humans exhibit merely an average CFF of 60 Hz. They are, for instance, surpassed by chickens (CFF of 87 Hz) and Tsetse flies (145 Hz). In general, even animals which are relatively close to each other evolutionarily can exhibit vastly different CFFs. That being said, there is a tendency that birds and insects have high CFF. While the temporal resolution of perception does not directly translate into the temporal acuity of *conscious*

[24] As it stands, CFF is a measure of *visual* stimulus discrimination. Thus, it disadvantages animals which tend to rely on other sensory modalities. For this reason, one needs to transfer the basic insight motivating CFF – that the threshold up to which stimulus frequencies can be distinguished points to the temporal resolution of perception – to other sensory modalities.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

perception, CFF is a (defeasible) indication of the speed of conscious perception nonetheless.[25]

Why does a faster rate of subjective experience increase a creature's capacity for wellbeing? In reusing an argument pattern familiar from the discussion of richness, we can recognize that a faster rate of consciousness entails that an animal undergoes (ceteris paribus) more conscious experiences than an animal with a slower rate of conscious experience.[26] If conscious experiences constitute wellbeing, then a higher number of conscious experiences can constitute more wellbeing. For example, experiencing pleasure for five minutes of subjective time is not as good as experiencing pleasure for 20 minutes of subjective time. Thus, if one experiences more subjective moments per objective unit of time, then one can attain higher or lower wellbeing in the (objective) time period in question, i.e., one's capacity for wellbeing is higher.

Arguably, the capacity to (consciously) perform mental time-travel, i.e., to relive past events and to imagine future events, impacts an animal's capacity for wellbeing. There are several mechanisms through which this connection may obtain. First, mental time-travel might increase the number of experiences with strong valence that occur. For instance, this applies when an event that causes extreme fear is not just experienced once, but relived in memory and possibly anticipated in episodic foresight. Second, being able to situate one's experience in time may increase or decrease its impact on wellbeing. For example, knowledge or imagery of the fact that a negative experience will last for a long time or memory of a former traumatic experience of the same kind may make the experience worse. On the other hand, one can imagine that knowledge of the fact that a negative experience will be short-lived can decrease its unpleasantness. In addition, mental time-travel facilitates the ability to detach from the present moment and focus on a potentially better future (Schukraft, 2020b). This, again, may decrease how bad negative experiences and how good positive experiences feel.

Finally, the sense of time accompanied by the capacity for mental time-travel may enable an animal to form interests regarding its own long-term future. The animal may entertain goals like eating a piece of cached food seven days from now on (Clayton & Dickinson, 1998). This entails that animals able to mentally time-travel might have more interests which can be satisfied or frustrated. Given a view which ties wellbeing to the satisfaction of preferences, this directly increases their capacity for wellbeing. Even on a hedonist view, the advent of future-directed preferences might increase animals' wellbeing capacity if animals consciously experience the satisfaction and frustration of their preferences. Thus, there are several

[25] Since I do not have space here to defend the significance of CFF for the speed of conscious perception extensively, I refer the reader to Schukraft (2020c) instead.

[26] My way of formulating the argument might seem to presuppose a form of temporal atomism (Hurley, 1998), i.e., the assumption that experiences decompose into snapshots with minimal temporal duration. However, if one is uncomfortable with this view, one may just as well talk about the subjective duration, not about the number, of conscious experiences.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

arguments in favor of a relationship between mental time-travel and capacity for wellbeing. Most of them point in the direction that mental time-travel increases an animal's capacity for wellbeing.

In conclusion, both the rate of conscious experience and the capacity for mental time-travel are likely grounds of animal wellbeing.

4.3 Self-consciousness and suffering

The final dimension concerns self-consciousness. The connection between self-consciousness and wellbeing capacity is rather unclear, but potentially very significant. The basic intuition is that harms feel worse when they are explicitly experienced as pertaining to *oneself*, rather than in a sense which does not involve a conscious self-representation. In reverse, the same might be true of positively valenced experiences. It is open how exactly being attributed to a self would make experiences better or worse. One idea could be that self-attribution of experiences causes harms to attain an existential dimension, i.e., to become threats for the continued existence of the self. Another is that being attributed to a self makes conscious experience more focused and concrete which might cause them to ground more wellbeing.

According to a possible view, wellbeing and self-consciousness are intimately related. Namely, one might hold that no conscious experience can constitute wellbeing, unless it involves self-consciousness. According to this line of thought, (wellbeing-relevant) suffering and pleasure require that they are experienced as the suffering and pleasure of someone, i.e., oneself (Dennett, 1995; Metzinger, 2021). However, it is doubtful that this move is very plausible. When we start to consider thought experiments, it seems clear that an animal which lacks self-consciousness is nonetheless worse of when it is in excruciating pain and agony than otherwise. The only way to undermine the coherence of this kind of thought experiment is to embrace the view that all consciousness necessarily involves a form of (pre-reflective) self-consciousness (Damasio, 1999; Duncan, 2019; Gallagher, 2010; Zahavi, 2014).

However, if this view is true, then the demand that conscious experiences must involve self-consciousness to constitute wellbeing is empty. Furthermore, if consciousness necessarily presupposes self-consciousness, then the presence of self-consciousness, as opposed to its absence, cannot be relevant to wellbeing. However, even then, it is still conceivable that the degree of self-consciousness makes a difference to the capacity for wellbeing. For instance, someone may argue that the pain experiences of someone who has a sophisticated self-model which, inter alia, allows for the application of a general theory of mind to oneself, are experienced as worse. However, in the absence of a compelling argument to this effect, I do not endorse this claim. Thus, it is unclear whether self-consciousness is a ground of wellbeing.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

In the next section, I will shed further light on the strengths and weaknesses of the framework I propose by contrasting it with the account for interspecies comparisons of welfare developed by Browning (2023). We will see that both approaches can serve complementary roles in the investigation of animal wellbeing.

5 Wellbeing from an actualist welfare and from a possibilist consciousness perspective

The preceding considerations are meant to display the potential of a general research program for the study of animal wellbeing. In a nutshell, it comprises two steps: First, researchers should investigate: which consciousness dimensions and which aspects of them are plausible constituents of wellbeing and how much wellbeing do they ground? Second, researchers should aim to identify which of these dimensions of consciousness and which of these aspects of them are present in a given animal species and to what extent. In principle, following this procedure tells you the wellbeing capacity of every animal species. Obviously, both steps are connected to a multitude of challenges in practice. For the distinctive features of this approach to emerge more clearly, it is instructive to compare it to extant approaches to research on animal wellbeing.

5.1 Browning's framework for interspecies welfare comparisons

While there is a thriving research program on the measurement of wellbeing within individual animals or perhaps individuals within the same species (for an introduction, see Dawkins, 2021), the challenge that different species might differ in their wellbeing capacity is usually ignored. An admirable exception is Browning (2023). I will describe her framework for interspecies welfare comparisons in what follows, as it is the best account of how the tools of animal welfare science can be fruitfully directed to the investigation of differences in wellbeing capacity.[27]

According to Browning, the main problem of interspecies comparisons of animal wellbeing (which take into account differences in wellbeing capacity) is the underdetermination of hypotheses about welfare by the empirical evidence. Suppose we want to compare the wellbeing level of two species and have agreed upon a plausible indicator of wellbeing applicable to both species. For purposes of illustration, I will take heart rate and the amount of vocalization as examples of

[27] I sometimes use the notion 'welfare' when discussing Browning's framework, as this expression underlines the connection between her ideas and the methods of so-called 'animal welfare science'. However, since Browning characterizes welfare in terms of subjective experience, the target of her approach is the notion of 'wellbeing' as I use it. Thus, the two expressions can be treated as synonyms here.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

indicators of fear experience. Suppose we find that – across many situations – species A manifests faster heart rate or more intense vocalization than species B. There are two possible conclusions:

(i) Species A has stronger experiences of fear than species B.

(ii) The relation between the fear experience and the indicator differs between species A and B: The same fear experience leads to a stronger indicator response in A than in B.

The empirical results by itself do not tell us which conclusion to draw, i.e., they do not tell us whether the difference in responses between A and B indicates a difference in wellbeing or not.

In the face of this conundrum, Browning proposes two methods to proceed: First, in respect to particular animals and particular indicators, one can justify a similarity assumption with respect to the relation between wellbeing and wellbeing indicators. In particular cases, it might be plausible that the relation between wellbeing level and indicator is constant between species. For instance, this might be the case if the indicator response is controlled via deep physiological pathways (arguably in the case of heart rate) and the animal species are closely related evolutionarily. If the relation between wellbeing and indicator response is assumed to be constant, variation in indicator responses can be unambiguously traced back to differences in wellbeing level.

Second, a special case of the first method, evidence on wellbeing differences that is obtained in virtue of multiple independent indicators which all point in the same direction can defuse the underdetermination problem. If many indicator responses point to the same wellbeing difference and the processes producing the responses are independent, then it seems to become increasingly improbable that all the different relations between wellbeing and indicator responses differ between two species in the same direction. Thus, at some point, we might start to trust convergent evidence of interspecies differences in wellbeing level.

Thus, Browning's framework shows how, in principle, we could use similarity assumptions and convergent evidence to assess wellbeing levels of various animals. If we can ascertain the wellbeing level of animals in diverse situations, we also learn their maximum and minimum wellbeing levels, i.e., their wellbeing capacity. How does Browning's framework differ from the wellbeing dimensions approach I have described and where do respective strengths and weaknesses lie?

5.2 Comparison between the wellbeing dimensions approach and Browning's framework

There are two main differences between the approach I proposed and Browning's framework. Browning's approach is more direct in two respects. First, Browning proposes *direct* measures of wellbeing while I propose to examine wellbeing *indirectly* via the dimensions of conscious experience. Since Browning understands wellbeing as the evaluative character of conscious experience, this differ-

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

ence might in the end be merely or mostly conceptual, but it is relevant nonetheless.

For Browning's approach takes the tools of animal welfare science to be the main instruments for investigating animal wellbeing while I resort to the methods of animal consciousness science. Research in animal consciousness science ideally aims to isolate different types of conscious experience and reveal their specific features, e.g., different types of emotional experience. By contrast, research in animal welfare science (insofar as it investigates conscious experience) typically aims to find measures of the integrated evaluative state of the animal, i.e., measures of how (good or bad) the animal experiences its state in total, given all the different experiences of the animal.

Second, Browning's approach is *actualist* in the sense that it aims to directly assess the wellbeing level of various species (where these are comparable across species) and use this as a basis to derive their wellbeing capacity. By contrast, my approach is *possibilist* in the sense that it takes wellbeing capacity as the more fundamental target of research which can then – in conjunction with knowledge about actual living conditions and the tools of animal welfare science (preference tests etc.) – be used to infer wellbeing levels which admit of interspecies comparisons.

What are the advantages of Browning's framework? I will focus on what I see as its most important virtue. To make this virtue concrete, we need an example for a plausible indicator of the total wellbeing (at a specific point in time) of an animal. In other work, Browning favors judgement biases as such an indicator (Browning, 2022). There is ample evidence suggesting that the overall affective state of an animal influences whether it tends to interpret ambiguous stimuli as positive ("optimism bias") or negative ("pessimism bias") (Lagisz et al., 2020). The strength of the disposition to interpret stimuli optimistically or pessimistically can then be used as an indicator of how good or bad the animal feels overall.

Assuming that judgement bias is indeed a valid indicator of wellbeing and that we can detect specific features of conscious experience, judgement bias can be used to test whether various features of consciousness contribute to wellbeing (and how much). Take our earlier hypothesis that, ceteris paribus, the magnitude of an animal's (positive or negative) wellbeing is increased the more different types of evaluative experiences it undergoes, e.g., many different emotions. Assuming that the total wellbeing of the animal can be measured via judgement biases, we can (in principle) compare the total wellbeing of various animals given changes in the richness of types of evaluative experience to see which impact those changes have. This tells us the impact of the richness of types of evaluative experience on wellbeing. One might say that the judgement of the importance of various features of consciousness to wellbeing does not need to be made by human researchers, because it can instead be deferred to the animals themselves.[28]

[28] This method generalizes to some, but not all, consciousness dimensions. For instance, it is unclear how this method could reveal the impact of the rate of consciousness to wellbeing (see below).

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

We have just said that the framework proposed by Browning provides a way forward for assessing the total wellbeing of an animal and can also illuminate which features of consciousness are relevant to wellbeing and by how much, i.e., complement the wellbeing dimensions approach. This raises the question: Given the potential of Browning's framework, why should we pursue the latter approach as well, i.e., take consciousness dimensions as the starting point for investigating wellbeing?

The dimensions approach is needed because there are clear limitations to Browning's framework. First, as she readily admits, as soon as we compare species which differ heavily in terms of their physiology, brain anatomy and evolutionary history – think of comparing mammals and invertebrates although cases of less radical dissimilarity are probably also sufficient – we don't have a good justification for the requisite similarity assumption. In these cases, the relation between wellbeing and indicator response probably differs widely between species.[29] Second, it seems very likely that the traction convergent evidence provides on animal wellbeing capacity is rather limited. Take typical indicators of wellbeing as used in animal welfare science, like judgement biases or heart rate. How can these indicators tell us that there are interspecies differences in wellbeing capacity? Presumably, the idea that these indicators actually reveal some interspecies differences in wellbeing capacity entails that the strongest judgement bias, fastest heart rate etc. found in animal species A are stronger than the maximum judgement bias, heart rate and so on found in animal species B.

But finding this sort of convergence would be quite strange. It seems relatively clear that the maximum indicator responses animals can have are mostly determined not by their maximum wellbeing level, but by other factors. The maximum heart rate is determined by basic physiological constraints. The maximum judgement bias is most likely determined by basic psychological facts about how judgements are made in an animal. It seems to me that the same goes for other potential wellbeing indicators discussed in animal welfare science. Given that the maximum indicator responses seem not to be determined by facts about wellbeing, they are not indicative of wellbeing capacity. Thus, we can make the empirical prediction that we will not find a strong convergence of many wellbeing indicators such that no species has a higher maximum indicator response on all of them.[30]

We have seen that typical indicators of animal welfare (like judgement bias) are not well-suited to pick up on differences in wellbeing capacity. This is were looking at consciousness dimensions provides an advantage: Given broad hedonism, differences in wellbeing capacity ultimately need to be based on differences

[29] Similarly, it becomes more challenging to find indicators of wellbeing which can be applied to both species at all.

[30] If we indeed discover some convergence, then it will be up for debate whether this convergence points to a hidden variable such that the indicators in question are not truly causally independent or shows that the level of the maximum indicator responses is actually a valid indicator of wellbeing capacity.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

in capacities for conscious experience. Thus, while it is hard to see which kinds of general welfare measures could provide the convergent evidence of wellbeing capacity differences Browning's framework requires, the wellbeing dimensions approach I favor can shed light on differences in wellbeing capacity by systematically investigating different consciousness dimensions. Moreover, the wellbeing dimensions approach has two further benefits:

First, welfare measures like cognitive biases aim to measure the total wellbeing state of an animal, as we mentioned earlier. This is helpful both because this information is often desired and because we can use it to assess the contribution to wellbeing of individual consciousness dimensions. By contrast, the dimensions approach distinguishes potential constituents of wellbeing which brings its own benefits. For by distinguishing which features of consciousness contribute to wellbeing, it can guide the search for and refinement of relevant measures of total wellbeing. If those measures aspire to measure total wellbeing, they should be supplemented to detect the constituents of wellbeing discovered by the dimensions approach, if they do not already do so.

Second, the dimensions approach captures constituents of wellbeing which seem like they are inaccessible to measures of animal welfare, as the latter are usually understood. We have seen that the rate of conscious experience of an animal or the question whether its consciousness is split into distinct conscious streams might have a huge significance for its wellbeing capacity. Typical measures of animal welfare, even suitably refined, cannot detect such basic structural features of consciousness. To take such features into account, one needs to first investigate an animal's conscious experience in its own right and, second, reflect – using the means of philosophical value theory – on which of its conscious experiences *matter*.

To summarize, an investigation of animal wellbeing along the lines proposed by Browning (2023) promises to uncover valuable information about animal wellbeing and incorporates means to empirically test how much different features of consciousness contribute to wellbeing. At the same time, the wellbeing dimensions approach is better suited to detect differences in wellbeing capacity. Also, its insights can lead to the improvement of general welfare measures as favored by Browning and it can tackle aspects of consciousness which are inaccessible to the framework of Browning. Hence, it turns out that both approaches are complementary and should be pursued simultaneously because they can mutually enrich each other.[31]

[31] Since they look for a wide range of indicators of various kinds of conscious experience, I see the systematic and very comprehensive review conducted by Miller et al. (2022) as a successful first empirical implementation of the wellbeing dimensions approach.

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

6 Conclusion and preliminary ethical upshot

6.1 Summary

I have argued that the study of animal wellbeing will ultimately need to ground its assessments of wellbeing in a framework describing the kinds of conscious experiences various animal species can have. For the capacity for wellbeing animals have is closely related to – or entirely determined by – their capacities for consciousness. In this paper, we have arrived at a list of features of conscious experience that may constitute wellbeing and consequently are or may impact an animal's wellbeing capacity.

Definitely or very likely grounds of wellbeing are: 1. Evaluative intensity. 2. Evaluative token-richness. 3. Rate of conscious experience. 4. Mental time-travel.

Possibly grounds of wellbeing are: 1. (Non-evaluative) perceptual experience. 2. Evaluative type-richness. 3. Kinds of accessible evaluative experiences. 4. Synchronic unity. 5. Self-consciousness.

In the search for adequate dimensions of animal wellbeing, these nine are the most promising candidates. It deserves mentioning that it is an open question whether the capacity for mental time-travel increases or decreases an animal's capacity for wellbeing. This list already indicates the high uncertainty regarding the constituents of wellbeing. This uncertainty rests largely on the immaturity of the science of animal consciousness. Presently, the investigation of animal consciousness on an adequately fine-grained level is largely in its infancy. When we accumulate knowledge of what animals consciously feel like in various situations and what these feelings consist in, we can expect that our intuitions regarding the conscious states in which they feel good or bad and to what extent will successively sharpen. In addition, as explained in §5.2, animal welfare science allows us to empirically learn about the contribution different features of consciousness make to wellbeing. Nonetheless, the question which conscious experiences are good for an animal and how much involves an inextricable element of ethical reflection as well.

6.2 Preliminary ethical upshot

In spite of this uncertainty, we can see the contours of a picture where an animal's capacity for consciousness assumes the role of the dominant arbiter of its moral weight, i.e., how much it matters morally for its own sake. In virtue of its relation to wellbeing, consciousness can serve the requisite normative role, and thanks to the advances of consciousness science, it is also susceptible to empirical investigation.

While I take detailed normative assessments of animal wellbeing and moral weight to depend on a research program which must still progress into maturity, I will note at least four early normatively relevant implications of the wellbeing dimensions approach: First, there is a non-negligible chance that some animal species possess a similarly high or higher wellbeing capacity than humans. This

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

follows from the preceding sections. There are indications that some of the features we listed as potentially increasing wellbeing capacity, namely rate of conscious experience and synchronic disunity, are more pronounced in some other species than in humans. In regard to mental time-travel, and arguably other cognitive sophistications only available to humans (Schukraft, 2020b), there is something to be said in favor of the view that they don't increase, but decrease the wellbeing capacity of their possessor. In light of the connection between wellbeing and moral weight, depending on one's collateral ethical commitments, it may have strongly revisionary ethical consequences if humans turn out to have less wellbeing capacity than some of our fellow species.

Second, some of the ways in which human decisions (explicitly or implicitly) trade-off between the wellbeing of different animals pose potentially disastrous suffering risks. As a first example, forms of animal advocacy, e.g. leafletting, when they emphasize the suffering of large mammals, may cause substitution effects, where humans substitute for their lowered consumption of some meat, e.g. beef, with higher consumption of other meat, e.g. chicken and fish. If the capacity for wellbeing of chickens and fish is not decreased much more than one order of magnitude relative to cows, this substitution probably increases overall animal suffering, i.e. negative wellbeing, since one needs to produce many more chickens and fish to satisfy the same demand for calories than cows. Such a suffering risk through substitution effects is also posed by a tax on environmental harms of food products, since beef production causes more CO2 emissions than the production of fish and chicken meat (Ritchie, 2020) such that the relative price of the latter kinds of meat would decrease.[32]

A further example is insect farming which is sometimes praised as an ethical alternative to common forms of meat (for an overview, see Lambert et al., 2021). However, if the capacity for wellbeing of farmed insects is not numerous orders of magnitude below the wellbeing capacity of other farmed animals, the sheer number of insects which would be necessary to satisfy demand would guarantee that the suffering caused greatly surpasses the suffering stemming from factory farming of larger animals (Sebo & Schukraft, 2021). Knowledge about capacity for wellbeing is necessary to avoid such suffering risks.

This brings us to the third implication of the approach proposed here which is that the value of information about animal wellbeing and derivatively the kinds of conscious experiences various animal species are capable of is extremely high. Due to our uncertainty, credible estimates of animal wellbeing levels span many orders of magnitude (Muehlhauser, 2017). Due to the connection between moral weight and animal wellbeing, diminishing our uncertainty would have grave consequences for which interventions and trade-offs we deem worthwhile. Neverthe-

[32] As remarked by an anonymous reviewer, harmful substitution effects may also occur in animal experimentation where ethics guidelines advise researchers to, ceteris paribus, reduce the use of mammals in research in favor of seemingly less sophisticated animals, such as invertebrates (Lee et al., 2020; Mandal & Parija, 2013).

Dung, L. (2023). Dimensions of animal wellbeing. *Philosophy and the Mind Sciences*, 4, 9. https://doi.org/10.33735/phimisci.2023.9878

less, this kind of research is of course itself subject to ethical constraints (Mazor et al., 2022).

Fourth, we have seen that many actions that are meant to improve the lives of animals have effects on other animal species or humans. Sometimes, e.g. for some meat consumption substitution effects, these effects are unintended and subtle. Given that these trade-offs between the wellbeing of different species are ubiquitous, the scope of precautionary principles which urge us to prioritize the avoidance of risks of inflicting or allowing animal suffering is extremely limited. In most real-world situations, we have to compare the value of animal wellbeing with other values and ethical constraints. While the manner in which these trade-offs are conducted depends on the ethical framework one subscribes to, almost all theories place at least some weight on animal wellbeing. This is why we urgently have to learn more about it.

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