Acta Baltica Historiae et Philosophiae Scientiarum
Volume 14, Number 1 (Spring 2026)
DOI: 10.11590/abhps.2026.1.02

# Some animals have self-knowledge: the key consequence of Elpidorou's functional theory of boredom

**Miriana Maio**

University of Tartu
Ülikooli 18
Tartu 50090, Estonia
miriana.maio@ut.ee

**Abstract:** The identification of animal self-knowledge has traditionally focused on self-reflection, producing non-compelling results and often overlooking the need to employ alternative methods to assess this capacity, which is fundamental to securing animal welfare. This paper argues that accepting the functional theory of boredom, developed by philosopher Andreas Elpidorou, carries an important implication: some non-human animals have self-knowledge. This, in turn, implies that for a subject to experience situational boredom, they must have self-knowledge. The article demonstrates that this key consequence leads to the methodological conclusion of my argument: if the premises are true, Elpidorou's functional theory of boredom constitutes an as-yet-unrecognised method for identifying animal self-knowledge. The analysis shows that situational boredom necessarily requires self-knowledge—specifically, the ability to monitor a mismatch between one's expectations and what the environment offers. The recognition of animal self-knowledge allows for a better understanding of animal welfare and a more ethical consideration of animals' lives in impoverished environments.

**Keywords:** *animals, boredom, Elpidorou, functional, self-knowledge, self-reflection*

## Introduction

A growing interest in the cognitive abilities of animals, together with increased global attention to the ethical treatment of non-human animals (henceforth, 'animals'), has led to extensive scientific investigations into the minds of animals. Central to this debate is the equilibrium between their physical and mental well-being, commonly referred to as animal welfare. When this equilibrium is precarious, special attention must be devoted to mental health, as it is considered paramount to physical health.

In this regard, Ian J.H. Duncan and J. Carol Petherick claim that animal welfare depends exclusively on "the mental, psychological, and cognitive needs of the animals. … if these mental needs are met, they will cover the physical needs" (Duncan and Petherick, 1991, p. 5017). Consequently, safeguarding the animal's mental well-being is a top priority: "as long as the animal's mental state is protected (i.e., as long as the animal "feels" all right) then its welfare will be all right" (Duncan and Petherick, 1991, p. 5018).

Building on this premise, it is crucial to identify the cognitive mechanisms that allow an animal to "feel all right". Distress may be understood as mental suffering resulting from detrimental environmental changes. It includes adverse feelings such as boredom (Morton, 2009, p. 2). The core argument of this paper is that the acceptance of Andreas Elpidorou's functional theory of boredom implies the acceptance of self-knowledge as the fundamental tool through which an animal monitors their own mental equilibrium. Without such a tool, "feeling all right" would remain a passive state rather than an active cognitive process regulated by the animal themselves. Ultimately, without self-knowledge, an animal would be unable to intentionally engage in activities to restore cognitive engagement in boring situations, making it impossible for them to maintain their own welfare.

Independent of these functional considerations, ample empirical research has been conducted to explore whether animals have self-knowledge. In these studies, the primary method employed is to investigate whether they can engage in self-reflection (e.g., Basile *et al.*, 2009; Beran and Smith, 2011; Call, 2010; Call and Carpenter, 2001; Hampton, Zivin and Murray, 2004; Kornell, Son and Terrace, 2007; Rosati and Santos, 2016; Royka, Johnston and Santos, 2020; Smith *et al.*, 1995).[1] Indeed, self-reflection is here treated as a sufficient condition for self-knowledge: if self-reflection occurs, then self-knowledge is inferred. For this

[1] I will use the pronoun 'they' instead of 'it' when I refer to animals to recognise their subjectivity.

reason, self-knowledge is understood as being self-reflective, namely as thinking about one's mental states.

At this point, some clarification is needed. In these studies, self-reflective self-knowledge is referred to as *metacognition*, which is defined as "thinking about thinking, or cognition about cognition" (Smith, 2005, p. 241; see also Boström and Lassen, 2006). The authors of these studies consider self-reflection to be a form of metacognition. Self-knowledge is then treated as a special case of this metacognition: one where the thought about a mental state (e.g., belief, desire, knowledge) satisfies the required criterion for that state to count as knowledge, typically through self-reflection.

To clarify what self-reflection is, let us consider, for example, a study conducted by Joseph Call and Malina Carpenter (2001). In their experiment, chimpanzees had to select the correct tube in which the experimenter had previously hidden food.[2] Under seen conditions, chimpanzees could see the baited tube (the one containing food), whereas in unseen conditions they could not. The subject had to choose the correct tube, namely the one with the bait. Under seen conditions, the subjects displayed greater confidence and correctly chose the baited tube. In unseen conditions, chimpanzees exhibited information-seeking behaviour because they were uncertain about where the food was. This uncertainty seems to show results compatible with metacognition. As the researchers wrote, "the results of this study are consistent with the hypothesis that subjects knew when they did not know where the reward was, and that, when necessary, they could act to obtain this knowledge" (Call and Carpenter, 2001, p. 218).

However, the results of these studies are not compelling enough to generate a broad consensus on the existence of animal self-knowledge. This lack of agreement is rooted in the impossibility of obtaining verbal reports from animals about their internal states, making it difficult to definitively conclude that they engage in self-reflection (cf. Hampton, 2009, p. 19). Consequently, alternative *non*-metacognitive explanations are proposed to account for the observed behaviours, including, among others, learned association (e.g., Call and Carpenter, 2001), which is a response consisting of learning, such as that "the bait [food] would be in the last tube if the first tube(s) were empty" (Call and Carpenter, 2001, p. 218). However, according to Call and Carpenter (2001, p. 218), this association is difficult to learn "because it involves both a compound conditional cue (i.e., if the first two tubes are empty then the third tube is baited) and a spatially

[2] Children were also involved in this study; however, this article is primarily concerned with the behaviour of chimpanzees.

incompatible response (i.e., choose the tube that is not associated with the cue)". Another alternative explanation is response competition, which occurs when two responses (i.e., performing the task and opting out[3]) compete, specifically when they are presented simultaneously, thereby creating competition (Hampton, 2009, pp. 19–20).[4] A further alternative non-metacognitive explanation is the first-order explanation (Carruthers, 2008), which provides a simpler explanation for the animal's behaviour without appealing to metacognition but rather to "beliefs and desires of varying strengths interacting with one another in accordance with plausible principles of practical reasoning" (Carruthers, 2008, p. 84). After having seen where the food is, animals may have a *strong belief* that the food is in tube A, and another *strong belief* that if the previous belief is true and A is selected, then they have food; in this case, they may have the *strong desire* for food and another *strong desire* to select tube A (Carruthers, 2008, p. 79). These beliefs and desires interact with each other, and thus, there is no metacognition.

These challenges highlight the need for an approach that does not treat self-reflection as a sufficient condition for self-knowledge but rather understands the latter as being non-metacognitive (or direct) and thus less demanding. In fact, to avoid any conceptual ambiguity, it is important to clarify from the outset that the notion of self-knowledge employed here does not refer to a self-reflective form, but to a more graded notion. Indeed, it will be understood as being non-metacognitive, non-representational and functional. It is non-metacognitive because it does not require reflection of one's thoughts; non-representational because it does not require mental representations of one's mental states and, finally, functional because, within Elpidorou's framework, it monitors whether the environment is meeting a subject's expectations.

To offer such an approach, this paper explores a theoretical implication of a functional theory of boredom, arguing that accepting Andreas Elpidorou's functional theory of boredom entails one key consequence: some animals have

[3] In opting out, animals would usually still receive food, albeit less rewarding.

[4] In unseen conditions, when the animal subjects are uncertain about which tube is the baited one, the probability that they choose to opt out is greater, not because they are monitoring their knowledge, but because "no other competing response occurs immediately" (Hampton, 2009, p. 20). In seen conditions, when the animal subject is more confident about which tube is the baited one, the possibility of a correct answer is, instead, higher (see Hampton, 2009, p. 20). The dominant response in seen conditions is to perform the test, which may override the tendency to opt out or engage in information-seeking behaviour (Hampton, 2009, p. 20). This means that the behaviour displayed by the animal subjects in opting out of the test is not the result of metacognition, i.e., knowledge of their ignorance, but rather the result of an absent dominant response.

self-knowledge. This key consequence, as will be demonstrated, leads to the methodological conclusion of my argument: provided that the premises are true, Elpidorou's functional theory of boredom constitutes an as-yet-unrecognised method for identifying animal self-knowledge.

The functional theory of boredom defines situational boredom as an alerting and motivational state requiring a certain kind of self-awareness, whose function is to monitor a mismatch. Situational boredom is an aversive and transitional state that a subject experiences when they *realise that* they are no longer cognitively engaged with what they are doing (Elpidorou, 2014, p. 1; see also Elpidorou, 2024). *Realising that* one is not cognitively engaging with the situation is *monitoring* a mismatch between one's expectations and what the environment is offering. This monitoring is a direct, non-propositional act of detecting an internal condition, that is, the mismatch, that does not require the mental representation of a state. Thus, Elpidorou's functional theory of boredom entails a form of *functional* self-awareness, which I argue is, in fact, self-knowledge. This, in turn, implies that self-knowledge is a necessary condition for experiencing situational boredom; without self-knowledge, it cannot be experienced.

My argument will be defended in the following order: Section 1 introduces Elpidorou's functional theory of boredom. The main reason why I have chosen his theory is its well-defended theoretical framework in the literature on the philosophy of boredom. Furthermore, the theory provides a complete and robust explanation of the phenomenon by comprehensively considering both internal causes (e.g., lack of interest or of cognitive engagement) and external causes (e.g., lack of stimuli or monotony), as well as contributing factors such as behaviour or individual traits. This paper also presents Elpidorou's explanation for why we should accept that the kind of situational boredom experienced by some animals in some empirical studies is the same kind of situational boredom described in his functional theory of boredom. Section 2 argues that the key consequence of accepting the functional theory of boredom is that some animals have self-knowledge. My argument will focus on demonstrating that the functional self-awareness implied by Elpidorou's functional theory of boredom must be understood as self-knowledge. Finally, Section 3 will use this consequence of Elpidorou's functional theory of boredom as the central premise in my argument for the following methodological conclusion: if the premises are true, Elpidorou's functional theory of boredom constitutes an as-yet-unrecognised method for identifying animal self-knowledge.

This methodological conclusion follows from three premises:

*Premise 1*: If a subject is bored under Elpidorou's functional theory of boredom, then they have a functional self-awareness of their own mental states.

*Premise 2*: This functional self-awareness consists in an internal monitoring of a mismatch between what they expect and what the environment offers; as such, it aims to regulate a subject's behaviour by restoring lost cognitive engagement.

*Premise 3*: There exists empirical evidence of some animals experiencing situational boredom under Elpidorou's functional theory of boredom.

*Conclusion*: Therefore, provided that these premises are true, Elpidorou's functional theory of boredom constitutes an as-yet-unrecognised method for identifying animal self-knowledge.

In support of this methodological conclusion, I will argue that alternative non-metacognitive explanations that have emerged from studies on animal metacognition are either not applicable or—where applicable—not problematic when applied to studies on animal boredom.

## 1. Elpidorou's functional theory of boredom

In this section, I will briefly describe Elpidorou's functional theory of boredom and provide his explanation for why we should accept that the kind of situational boredom experienced by some animals, as observed in some empirical studies, is the same kind of situational boredom described in his functional theory of boredom. Understanding Elpidorou's functional theory of boredom helps us understand why it leads to the key consequence that some animals have self-knowledge.

Elpidorou defines situational boredom (henceforth, 'boredom') as "a functional emotion (or affective state)" (Elpidorou, 2023, p. 966; see also 2018a, p. 340; 2018b, p. 468), in which we are not cognitively engaged with the situation (Elpidorou, 2023, p. 971) and in which we realise that "our situation is no longer interesting, engaging, or absorbing to us; it appears instead to be devoid of significance, meaning, or opportunities for satisfactory engagement" (Elpidorou, 2024, p. 47). Boredom is thus understood as an experience of direct realisation of a mismatch between our expectations and what the environment is offering.

To clarify what 'functional' means, according to the functional theory of

boredom, boredom serves two functions: it is both an *alerter* and a *motivator*.[5] Firstly, boredom alerts us that something, such as an event or a situation, is not attracting our interest—namely, that it is not satisfactorily cognitively engaging, thereby signalling a mismatch between our expectations and what the environment is offering. Secondly, boredom pushes us towards some other situation or event that attracts our interest—one that is satisfactorily cognitively engaging, meaningful and in alignment with our desires and interests—thus motivating us to engage in other activities (see Elpidorou, 2014, p. 3; 2018a, p. 330; 2018b, p. 456; 2023; 2024, p. 51).

Due to the encompassing nature of the functional theory of boredom, multiple factors are taken into consideration to identify animal boredom, e.g., individual traits, behaviour, specific characteristics of that animal species, environment (Elpidorou, 2025, p. 254), but most importantly, three important abilities: (1) the ability to cognitively engage with the environment, (2) the ability to have expectations from this engagement and (3) the ability to monitor whether the expectations are met (Elpidorou, 2025, p. 247). Likewise, the causes of animal boredom can be diverse. Some examples include lack of interest or cognitive stimulation, monotony, predictability or lack of effective attention (Elpidorou, 2025, p. 252). Multiple causes, as well as responses, are considered in assessing animal boredom. Indeed, animals may display different responses, such as stereotypical behaviour or inactivity; however, these are not necessarily indicative of boredom (Elpidorou, 2025, chapter 9).

Although empirical studies on animal boredom are limited, relevant and recent examples (Burn, Ng and Parker, 2025, p. 56; Hintze, Heigl and Winckler, 2024, p. 1) include a study with rats. This study showed that rats experience boredom when the foraging task becomes monotonous (Burn, Ng and Parker, 2025). As a response to boredom, rats displayed escape behaviour, whereas variation in sensory stimuli helped reduce boredom (Burn, Ng and Parker, 2025, p. 56). These findings indicate that rats recognised that the environment is not providing them with what they expect and regulate their behaviour accordingly: the escape response thus serves as a functional transition from a state of cognitive disengagement to the restoration of cognitive engagement. This confirms that animal boredom is functional insofar as it indicates that some actions should be taken to restore mental well-being, which, in turn, has a positive impact on

[5] 'Functional' is here understood in a broader sense: where a state is defined by what it performs. In this context, boredom is defined by the function of alerting that one's expectations are not met and of restoring cognitive engagement.

physical well-being. Without such a recognition of a mismatch between the rats' expectations and what the environment is providing, the rats would not display such behaviour, and more importantly, we would not witness a reduction of the escape behaviour in case of sensory variation.

Further evidence of boredom was found in caged minks. Rebecca K. Meagher and Georgia J. Mason (2012) showed in their study that some caged minks experienced boredom, characterised by an increase in lying awake behaviour, and the reduction of boredom by the increase of exploring various stimuli. Their study showed that some caged minks experienced a clear cognitive disengagement with the environment, which is visible through a decrease in activity, and an increase in engaging with a wide range of stimuli: not only rewarding stimuli but also ambiguous and even aversive stimuli, those associated with fear-related behaviour (Meagher and Mason, 2012, pp. 7–8). This clearly demonstrates how this study is related to Elpidorou's functional theory of boredom: it provides evidence that boredom is defined by what it does: (1) it alerts the animals about a mismatch between their expectations and what the environment is offering, as seen in their decreased activity, and (2) it motivates them to resolve this mismatch, as demonstrated by their rapid exploring of other stimuli, including neutral and aversive stimuli. The choice of the caged minks to engage in aversive stimuli is telling, as it suggests that in order to escape from the state of boredom, they prefer engaging in negative stimuli, which they would otherwise avoid, over the lack of stimulation. Again, boredom in this study is functional as it signals the mismatch and pushes the animal to regulate their behaviour to restore cognitive engagement, even if this means engaging in aversive stimuli.

This empirical evidence is bolstered by extensive observations of animals in confined environments, such as zoos, shelters and laboratories (see Wemelsfelder, 1984, for an in-depth discussion). Animals in captivity often display abnormal behaviour that is a reliable indicator of boredom (Wemelsfelder, 1984). Examples of abnormal behaviours include stereotypic behaviours consisting of repeated motor patterns (Wemelsfelder, 1984, p. 124; see also Morton, 2009, pp. 5–6), such as pacing; redirected behaviour, such as tail-biting or feather-pecking (Wemelsfelder, 1993, p. 85); vacuum behaviour, such as the air-chewing displayed by sows and over-reactiveness (Wemelsfelder, 1984, p. 124). These observations further confirm not only that animals, when cognitively disengaged, behave atypically to restore cognitive engagement, but also that boredom is a widespread and real phenomenon. In general, environmental enrichment has been shown to reduce boredom and its associated negative effects (e.g., abnormal

behaviour), as shown in studies by Burn, Raffle and Bizley (2020), Meagher and Mason (2012), and more recently reported by Mieske *et al*. (2022).

In light of this evidence, accepting Elpidorou's functional theory of boredom also leads us to accept that the boredom experienced by some animals in these cases is of the same kind described by his account. His theory encompasses the responses and the causes of boredom described in the above studies (see Elpidorou, 2025, chapter 9 for a full discussion), and, as I argue, it is equally applicable to the observations discussed by Françoise Wemelsfelder (1984). In the above empirical studies—and, I would add, in the observations discussed by Wemelsfelder—animals displayed a lack of cognitive engagement with their situation and a motivation to restore cognitive engagement through the display of atypical behaviour (see Elpidorou, 2025, section 9.2). Their expectations were not met and, therefore, they felt motivated to do something to stimulate themselves and thus restore cognitive engagement. In cases of environmental enrichment (e.g., sensory variation), responses to boredom tend to reduce or disappear when cognitive engagement is restored (see Elpidorou, 2025, section 9.2 for further discussion).

## 2. Self-knowledge as the key consequence of Elpidorou's functional theory of boredom

This section presents the key consequence of Elpidorou's functional theory of boredom: if accepted, the theory entails that some animals have self-knowledge. I argue that the form of self-awareness required by the functional theory of boredom is, in fact, self-knowledge, since the definition of boredom involves a functional self-awareness, which is an internal monitor of whether a subject's expectations are met. This direct and functional awareness of the mismatch is the defining characteristic of self-knowledge, thereby distinguishing it from the more complex self-reflection.

To present the key consequence of the functional theory of boredom, two definitions are worth reminding. First, the definition of boredom provided by Elpidorou's functional theory: boredom is the realisation of not being satisfactorily cognitively engaged with the environment. Second, the definition of self-knowledge I used in this paper: self-knowledge is the non-metacognitive, non-representational, functional awareness of one's mental states. Within this

framework, this means that the mere awareness of a certain mental state, such as "the mismatch between one's expectations and what the environment is offering", inherently constitutes a direct, non-representational awareness of being in that state—namely, that mismatch.

*Realising that* one is not cognitively engaging with the situation is *monitoring* a mismatch between one's own expectations and what the environment is offering. To be bored, a subject must be aware of a specific mental state—namely, the mismatch between their expectations and what the environment is offering. Crucially, the mismatch is an internal condition concerning one's cognitive engagement, which is not satisfied and exists insofar as the subject's expectations are not met. This awareness is required by Elpidorou's definition of boredom. Since self-knowledge is defined as the non-metacognitive, non-representational, functional awareness of one's mental states, and boredom requires awareness of a mental state (the mismatch), the former is necessary for the latter. Therefore, it follows that a subject cannot experience boredom without having self-knowledge. To realise that there is a mismatch between one's own expectations and what the environment is offering is compatible with being directly aware of this internal condition; consequently, to be bored, a subject must have self-knowledge.

This key consequence allows me to develop an argument for the methodological conclusion that, provided that the premises are true, Elpidorou's functional theory of boredom constitutes an as-yet-unrecognised method for identifying animal self-knowledge. In the following section, I will demonstrate this methodological conclusion and argue that the alternative non-metacognitive explanations that emerged for studies in animal self-knowledge are not applicable or, where applicable, not problematic when applied to studies on animal boredom.

## 3. Methodological implication: Elpidorou's functional theory of boredom constitutes an as-yet-unrecognised method for identifying animal self-knowledge

In defence of this methodological implication, I argue that Elpidorou's functional theory of boredom implicitly provides an analytical bridge between an affective state, that is, situational boredom, and self-knowledge. In doing so, the theory offers a novel as-yet-unrecognised framework for identifying animal self-knowledge, moving beyond traditional metacognitive views that regard self-reflection as the exclusive path to self-knowledge and thus neglect other viable ways to identify it.

As derived from the functional theory of boredom, self-reflection is not a prerequisite for experiencing boredom. A subject does not need to think about their own thoughts to know whether they are bored. For a subject to realise that they are not cognitively engaging with the environment in a satisfactory way, they do not need to think about it; they only need to monitor a mismatch.

However, self-reflection is useful if a subject wants to *analyse* their own boredom experience. For instance, one may reflect on the reasons why they feel bored. We can engage in self-reflection to consider how to respond to a situation that bores us, to examine the behaviour or attitude we adopted, or the assumptions we made (Elpidorou, 2024, p. 57). In this sense, self-reflection can play a crucial role in analysing the experience of boredom. Yet, self-reflection, as already argued, does not play a vital role in experiencing boredom itself.

Thus, self-knowledge, as understood here, does not require linguistic abilities to be ascertained. Conversely, the necessity of language for evidence of self-reflection makes it a methodologically demanding criterion, often leading to widespread scepticism. In response to this impasse, provided that the premises of my argument are true, Elpidorou's functional theory of boredom emerges as an as-yet-unrecognised method for identifying animal self-knowledge, as it relies on observable functional responses as evidence of internal monitoring—specifically, a recognised mismatch—rather than on verbal reports.

In support of this methodological conclusion, I argue that some of the alternative non-metacognitive explanations provided for the studies on animal metacognition are either not applicable or, where applicable, not problematic when applied to studies on animal boredom, as these alternatives have been

proposed to explain why animals do not engage in self-reflection. It is worth reminding that the alternative non-metacognitive explanations at issue are learned association, response competition and first-order explanation.

Let us begin with the first alternative non-metacognitive explanation: learned association. The study by Charlotte C. Burn, Ka Ho Timothy Ng and Matthew O. Parker (2025) demonstrated that rats exhibited an escape behaviour when a foraging task was monotonous. This response was significantly reduced under conditions of environmental enrichment (i.e., sensory variation). It is plausible that the rats learned an association between the monotonous foraging task and the subsequent escape behaviour. However, this response is best understood as a signal of the unpleasant state that the rats are experiencing, namely boredom, and as a means to escape it. Therefore, even if the rats were making an association, this finding is not problematic for the functional theory of boredom. The learned behaviour (escape behaviour) is simply a functional response motivated by boredom, aimed at restoring cognitive engagement.

To clarify why learned association is not problematic for the functional theory of boredom, consider the human experience. Suppose we are required to perform a monotonous task. It is likely that we will become bored, resulting in a physiological or behavioural response. Over time, we may indeed learn to associate the specific task with boredom. Consequently, this association can immediately trigger a learned response, such as mind-wandering or distraction. However, even in this human case, the learned association is not problematic for the functional theory of boredom. The association serves as an adaptive tool; mind-wandering occurs because it helps relieve the unpleasant state of boredom. Thus, the learned response remains a functional tool that serves the theory's core purpose: the restoration of cognitive engagement.

What about the alternative non-metacognitive explanation of response competition? This explanation generally posits that behaviour arises from two simultaneous responses that create competition. In the study by Burn *et al.* (2025), the primary available response was performing the foraging task in both the Monotonous and Varied treatment (i.e., when sensory variation was present). Thus, it is possible that the experimental design did not create behavioural competition. Therefore, this alternative non-metacognitive explanation is not applicable to the observed behaviour, suggesting that it does not account for studies on animal boredom.

Let us assume, for the sake of argument, that response competition is applicable. We can imagine that in the foraging task, the two competing responses are

engaging with the task or opting out/escaping. In the Burn, Ng and Parker (2025) study, the first response represents task engagement, while the second represents the observed escape-related behaviour. It is plausible that competition between these responses was present in both the Monotonous and Varied treatments, though task engagement remained dominant in the latter. Even so, this competition does not cause a problem in identifying boredom. This is because the escape-related behaviour itself is a response driven precisely by boredom. That is, rats exhibit escape behaviour to alleviate the monotony of the foraging task. Since the observed behaviour (escaping) is compatible with and explained by the experience of boredom (Burn, Ng and Parker, 2025), the presence of response competition is not problematic to the identification of boredom, and consequently, to the identification of self-knowledge.

Lastly, consider the first-order explanation described by Carruthers (2008), according to which behaviours arise from the interaction of first-order mental states (i.e., varying beliefs and desires). A first-order explanation is not applicable to boredom as defined in this paper because a first-order account is fundamentally a representational account. Boredom, and the self-knowledge it entails, is a direct awareness of the mismatch between one's own expectations and what the environment is offering, and not a process of representing various beliefs and desires that interact to *cause* it. That is, the functional definition of boredom is *compatible* with a direct, non-representational awareness of the mismatch between one's expectations and what the environment is offering. This form of immediacy and non-representationality directly conflicts with the nature of the first-order account, making it inapplicable to explain boredom.

Yet, supposing the first-order explanation was applicable, it would not be entirely problematic, as self-knowledge would still remain a necessary component for boredom. If boredom arose from the interaction of varying beliefs and desires, the resulting state would still require the subject to monitor and to recognise the mismatch. This recognition presupposes the form of self-awareness I have argued is self-knowledge. However, we must acknowledge that this experience would fundamentally alter the nature of both boredom and self-knowledge. Boredom would become representational—merely the result of interacting beliefs and desires—and no longer be the direct and non-representational awareness of the mismatch between one's expectations and what the environment is offering. In this case, the necessary self-knowledge would be a representational awareness of one's own mental states (i.e., beliefs and desires), diverging from the non-representational directness posited here. Although the first-order explanation

alters the fundamental nature of boredom experience, it does not eliminate the necessity of self-knowledge, which remains the central claim of this paper.

Having addressed the major counterarguments, I can conclude that the alternative non-metacognitive explanations often proposed in studies on animal self-knowledge—learned association, response competition and first-order explanation—are either not applicable or, where applicable, not problematic to studies on animal boredom. This validates the methodological conclusion that, provided that the premises of my argument are true, Elpidorou's functional theory of boredom emerges as an as-yet-unrecognised method for identifying animal self-knowledge.

## Conclusion

Two conclusions can be drawn from this analysis: one conditional and the other methodological. According to the conditional conclusion, experiencing situational boredom necessarily requires self-knowledge. The methodological conclusion is that, provided that the premises of my argument are true, Elpidorou's functional theory of boredom emerges as an as-yet-unrecognised method for identifying animal self-knowledge. These results have crucial implications for animal ethics, as they allow us to identify a form of self-knowledge that is functional and, consequently, understand that the animals in question are active agents able to monitor a mismatch of expectations and regulate their behaviour accordingly. In doing so, they engage in activities to restore cognitive engagement, finding stimulation despite the detrimental effects of an impoverished environment. Such animals do not merely undergo passive suffering; rather, they recognise that their mental equilibrium is disrupted and take action to restore it.

In future studies, adopting this method, which does not consider self-reflection as the only path to self-knowledge, may shift our perspective on how we study animal self-knowledge. By moving beyond the constraints of traditional self-reflection tests, we can focus more on the impact of environments on animal welfare, ultimately improving the ethical treatment of animals.

## Acknowledgements

I am extremely grateful to Prof. Andreas Elpidorou for his invaluable comments on an earlier draft of this paper and his guidance in ensuring a correct interpretation of his functional theory of boredom. Earlier versions of this paper were presented at the Tartu–Turku workshop at the University of Turku (September 2025) and at the 'Ethics and Emotions' workshop at the University of Tartu (November 2025). I thank the participants for their helpful comments and suggestions. I would also like to thank my supervisor, Prof. Bruno Mölder, for his guidance and continued support, as well as Prof. Alexander Stewart Davies and Prof. Uku Tooming for their helpful suggestions on earlier versions of this manuscript. I am also grateful to my colleague S.G. Zaki for helpful discussions on the early development of my argument. Finally, I would like to thank two anonymous reviewers for their constructive comments, which significantly helped in refining the logical and methodological framework of this study.

## References

Basile, B.M., Hampton, R.R., Suomi, S.J. and Murray, E.A. (2009) 'An assessment of memory awareness in tufted capuchin monkeys (*Cebus apella*)', *Animal Cognition*, 12(1), pp. 169–180. Available at: https://doi.org/10.1007/s10071-008-0180-1

Beran, M.J. and Smith, J.D. (2011) 'Information seeking by rhesus monkeys (*Macaca mulatta*) and capuchin monkeys (*Cebus apella*)', *Cognition*, 120(1), pp. 90–105. Available at: https://doi.org/10.1016/j.cognition.2011.02.016

Boström, L. and Lassen, L.M. (2006) 'Unraveling learning, learning styles, learning strategies and meta-cognition', *Education + Training*. Edited by E. Sadler-Smith and C. Evans, 48(2/3), pp. 178–189. Available at: https://doi.org/10.1108/00400910610651809

Burn, C.C., Ng, K.H.T. and Parker, M.O. (2025) 'Rat boredom-like behaviour in a monotonous versus a varied foraging task: effects of sensory variation', *Animal Cognition*, 28(1), article 57. Available at: https://doi.org/10.1007/s10071-025-01979-6

Burn, C.C., Raffle, J. and Bizley, J.K. (2020) 'Does "playtime" reduce stimulus-seeking and other boredom-like behaviour in laboratory ferrets?', *Animal welfare* (South Mimms, England), 29(1), pp. 19–26. Available at: https://doi.org/10.7120/09627286.29.1.019

Call, J. (2010) 'Do apes know that they could be wrong?', *Animal Cognition*, 13(5), pp. 689–700. Available at: https://doi.org/10.1007/s10071-010-0317-x

Call, J. and Carpenter, M. (2001) 'Do apes and children know what they have seen?', *Animal Cognition*, 3(4), pp. 207–220. Available at: https://doi.org/10.1007/s100710100078

Carruthers, P. (2008) 'Meta-cognition in animals: a skeptical look', *Mind & Language*, 23(1), pp. 58–89. Available at: https://doi.org/10.1111/j.1468-0017.2007.00329.x

Duncan, I.J. and Petherick, J.C. (1991) 'The implications of cognitive processes for animal welfare', *Journal of Animal Science*, 69(12), pp. 5017–5022. Available at: https://doi.org/10.2527/1991.69125017x

Elpidorou, A. (2014) 'The bright side of boredom', *Frontiers in Psychology*, 5. Available at: https://doi.org/10.3389/fpsyg.2014.01245

Elpidorou, A. (2018a) 'The bored mind is a guiding mind: toward a regulatory theory of boredom', *Phenomenology and the Cognitive Sciences*, 17(3), pp. 455–484. Available at: https://doi.org/10.1007/s11097-017-9515-1

Elpidorou, A. (2018b) 'The good of boredom', *Philosophical Psychology*, 31(3), pp. 323–351. Available at: https://doi.org/10.1080/09515089.2017.1346240

Elpidorou, A. (2023) 'Boredom and cognitive engagement: a functional theory of boredom', *Review of Philosophy and Psychology*, 14(3), pp. 959–988. Available at: https://doi.org/10.1007/s13164-021-00599-6

Elpidorou, A. (2024) 'The nature and value of boredom', in M. Bieleke, W. Wolff and C. Martarelli (eds) *The Routledge international handbook of boredom*. Routledge. Available at: https://doi.org/10.4324/9781003271536-5

Elpidorou, A. (2025) 'Animal boredom', in A. Elpidorou (ed) *The anatomy of boredom*. Oxford University Press, pp. 240–260. Available at: https://doi.org/10.1093/9780197564363.003.0013

Hampton, R.R. (2009) 'Multiple demonstrations of metacognition in nonhumans: converging evidence or multiple mechanisms?', *Comparative Cognition & Behavior Reviews*, 4, pp. 17–28. Available at: https://doi.org/10.3819/ccbr.2009.40002

Hampton, R.R., Zivin, A. and Murray, E.A. (2004) 'Rhesus monkeys (*Macaca mulatta*) discriminate between knowing and not knowing and collect information as needed before acting', *Animal Cognition*, 7(4), pp. 239–246. Available at: https://doi.org/10.1007/s10071-004-0215-1

Hintze, S., Heigl, H. and Winckler, C. (2024) 'Towards a task to assess boredom-like states in pigs–Stimulus validation as a basis', *PLOS ONE*, 19(10), article e0311843. Available at: https://doi.org/10.1371/journal.pone.0311843

Kornell, N., Son, L.K. and Terrace, H.S. (2007) 'Transfer of metacognitive skills and hint seeking in monkeys', *Psychological Science*, 18(1), pp. 64–71. Available at: https://doi.org/10.1111/j.1467-9280.2007.01850.x

Meagher, R.K. and Mason, G.J. (2012) 'Environmental enrichment reduces signs of boredom in caged mink', *PLOS ONE*, 7(11), article e49180. Available at: https://doi.org/10.1371/journal.pone.0049180

Mieske, P., Hobbiesiefken, U., Fischer-Tenhagen, C., Heinl, C., Hohlbaum, K., Kahnau, P., Meier, J., Wilzopolski, J., Butzke, D., Rudeck, J., Lewejohann, L. and Diederich, K. (2022) 'Bored at home?—A systematic review on the effect of environmental enrichment on the welfare of laboratory rats and mice', *Frontiers in Veterinary Science*, 9, article 899219. Available at: https://doi.org/10.3389/fvets.2022.899219

Morton, D.B. (2009) 'Distress in animals: its recognition and a hypothesis for its assessment', *Sentience Collection*, 14. Available at: https://www.wellbeingintlstudiesrepository.org/acwp_asie/14 (Accessed: 10 April 2026).

Rosati, A.G. and Santos, L.R. (2016) 'Spontaneous metacognition in rhesus monkeys', *Psychological Science*, 27(9), pp. 1181–1191. Available at: https://doi.org/10.1177/0956797616653737

Royka, A.L., Johnston, A.M. and Santos, L.R. (2020) 'Metacognition in canids: a comparison of dogs (*Canis familiaris*) and dingoes (*Canis dingo*)', *Journal of Comparative Psychology*, 134(3), pp. 303–317. Available at: https://doi.org/10.1037/com0000246

Smith, J.D. (2005) 'Studies of uncertainty monitoring and metacognition in animals and humans', in H.S. Terrace and J. Metcalfe (eds) *The missing link in cognition: origins of self-reflective consciousness*. Oxford University Press, pp. 242–271. Available at: https://doi.org/10.1093/acprof:oso/9780195161564.003.0010

Smith, J.D., Schull, J., Strote, J., McGee, K., Egnor, R. and Erb, L. (1995) 'The uncertain response in the bottlenosed dolphin (*Tursiops truncatus*)', *Journal of Experimental Psychology: General*, 124(4), pp. 391–408. Available at: https://doi.org/10.1037/0096-3445.124.4.391

Wemelsfelder, F. (1984) 'Animal boredom: is a scientific study of the subjective experiences of animals possible?', in M.W. Fox and L.D. Mickley (eds) *Advances in animal welfare science* 1984. Dordrecht: Springer Netherlands, pp. 115–154. Available at: https://doi.org/10.1007/978-94-009-4998-0_8

Wemelsfelder, F. (1993) 'The concept of animal boredom and its relationship to stereotyped behaviour', in A.B. Lawerence and J. Rushen (eds) *Stereotypic animal behaviour: fundamentals and applications to animal welfare*. Wallingford: CAB International, pp. 65–95.

**Miriana Maio** is a junior research fellow in theoretical philosophy at the University of Tartu. Her research focuses on the philosophy of animal minds, specifically investigating whether non-human animals have self-knowledge.