The influence of stereotypic behaviour on non-experts' perception of the mental experiences of zoo-housed animals

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Abstract

Modern zoos play a multifaceted role in society, encompassing conservation, education, research, animal welfare enhancement, and entertainment. Zoos prioritise animal welfare, utilising insights from animal science advancements. The affective state orientation, recognising animals' positive and negative mental experiences, is crucial for assessing and improving welfare. The affective state orientation relies on robust human inferences about the mental experiences of animals.

Challenges to the social acceptability of zoos persist due to confined spaces leading to zoo-housed animals displaying a range of abnormal behaviours. One of zoos' most prolific animal welfare issues is the prevalence of stereotypic behaviour. Animals displaying stereotypic behaviours may be experiencing distress. The perception of distress will influence our moral judgements regarding which animals need intervention or protection. Various terms, like stereotypic behaviour, characterise behaviours observed in zoo-housed animals. Still, more clarity surrounding these terms is needed to infer animal experiences. Non-experts struggle to identify behaviours due to species-specific complexity, affecting the leap from observation to inference. Human perception further complicates this process as non-expert's perceptions and opinions influence the zoo's social license to operate. Human perception of animals significantly influences attitudes, behaviours, and willingness to affect change. Perception is moulded by physical attributes, familiarity, and anthropomorphism, all of which influence animals' perceived cognitive abilities and mind perception. If non-experts have negative perceptions of animal behaviour in zoos, this may affect the type or prioritisation of mitigation strategies. This perception could also affect animal welfare as certain animals could be perceived to have negative mental experiences and, therefore, poor welfare. This would reduce zoo's social license to operate, as welfare is something zoos are obligated to uphold. Assessing animal behaviour requires expert frameworks. However, the complexity of these frameworks makes applying species-specific assessments to diverse zoo-housed species nearly impossible. Qualitative Behaviour Assessment (QBA) involves assessors directly recording perceived mental experiences, bridging behaviour observation and inference. Therefore, this methodology represents a potential approach to exploring

non-expert perceptions about the mental experiences of zoo-housed animals. An approach similar to the methodology used in QBA formed the basis of this thesis.

In Study 1, participants viewed videos, each featuring a different animal displaying a specific behaviour. They responded freely, recording the perceived mental experience of the animal and attributing a valence (positive, neutral, or negative) to each term. In Study 2, a new group of participants watched the same videos. Participants rated the top 10 terms from Study 1 on a 0-10 scale, with zero meaning extremely unlikely to be experiencing the term and ten meaning extremely likely to be experiencing the term. They were then asked if they perceived any behaviours of concern in the video. A definition of stereotypic behaviour [1] was given, and they were then asked if any of the behaviours in the videos they watched met this criterion.

There were a total of 220 unique mental experiences recorded by participants in Study 1. The most commonly used term was hunger, followed by happy and bored. Valence was found to be ambiguous in most cases, with only two terms within the top 20 showing 100% consistency in response. In Study 2, principal component analysis (PCA) reduced the ten items (terms) into positive and negative components. Positively valenced terms from Study 1 loaded on the positive component in Study 2 and vice versa for the negative component. The polar bear video received the most negative rating, while the otter video was the most positive. The non-stereotypic tiger, zebra, and frog videos were classified as being more negative than the shark and giraffe videos, which were stereotypic. The polar bear video was classified as the most concerning and had the highest percentage of participants who watched it correctly, identifying it as a stereotypic behaviour. The otter, bee, and parrot videos had no concern but were identified as being a stereotypic behaviour by 29%, 12%, and 6% of participants, respectively.

The results show that non-experts are willing to attribute mental experiences to various zoo-housed animals. Non-expert's level of concern and ability to identify concern is

[1] Stereotypic behaviour is a general term and can refer to any repetitive behaviour with an unknown cause (Mason & Rushen, 2006). In other words, it is an abnormal expression of behaviour in a repeated pattern that is expressed without being triggered by the initial stimulus.

influenced by various aspects of human perception. Participants had varying thresholds of concern towards the level of repetition and interpretation of the context of the behaviour. These varied responses emphasised the ambiguity of the stereotypic behaviour definition. This research methodology has the potential to advance existing theories by providing an extensive set of mental experiences and valences that can be used as a starting point for understanding non-experts' perceptions of animal behaviour. It promotes a more accurate and comprehensive approach to studying animal behaviour from a non-expert perspective, bridging the gap between expert and public perceptions. Zoos can involve visitors' perceptions, enhancing support and biodiversity preservation, which increases their social license to operate.

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We observe animals with great fascination,
But often lack the right interpretation,
Our biases may blur,
What their actions infer,
So their behaviour remains open to speculation

- ChatGPT [2]

[2] This limerick was generated by giving ChatGPT the prompt, “Please write a limerick about how researchers don't always know how non-experts perceive and interpret animal behaviour”.

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1 Literature Review

1.1 Modern Zoos

1.1.1 The Purpose of Modern Zoos

The World Association of Zoos and Aquariums (WAZA) is a global organisation dedicated to the care and conservation of animals and habitats worldwide. There are currently 281 institutional members accredited to WAZA, including seven within Australia and New Zealand (WAZA, n.d.). Zoos are essential to modern-day animal conservation, education, research, welfare, and entertainment (D'Cruze et al., 2019). Conservation is the main priority of the modern zoo (Scott, 2012). Zoos aid conservation by providing a safe (Conway, 1995) and controlled (Junhold & Oberwemmer, 2011) environment for endangered species where they can be closely monitored and cared for.

The protection of animals falls under the conservation umbrella, with zoos increasing attention, exposure and, therefore, species protection (Iwuchukwu et al., 2020). Education is another crucial aspect of modern zoos' purpose (Patrick et al., 2007). By educating visitors about the importance of biodiversity and the threats facing endangered species, zoos can help raise awareness and inspire people to take action (Packer & Ballantyne, 2010). Research in zoos can help broaden the understanding of how animals react to various aspects of captivity. Zoos also research animal behaviour, genetics, and other aspects of animal biology (Ryder & Feistner, 1995). This research can help to identify the threats facing endangered species and develop more effective conservation strategies. Modern zoos serve another purpose: to enhance the welfare of animals in captivity through an improved understanding of their experiences, facilitated by the progress made in animal science (D'Cruze et al., 2019). The final objective of modern zoos is entertainment, although this

may not be a widely advertised goal. The controversy surrounding the ethical nature of zoos is a primary concern for the public, researchers (Hutchins et al., 2016), and policymakers. The three E's (education, exhibition, and encounter) refer to a group of activities that society engages in. Zoos are a part of this group (National Animal Welfare Advisory Committee, 2021). The ethical concern is focused on exploitation, exhibition, and the use of animals for human entertainment. However, most zoo visitors attend zoos for entertainment or recreation (Bostock, 2003), which may be an indirect goal of modern zoos. Modern zoos, although promoting the welfare of animals, are, first and foremost, visitor attractions (Nekolný & Fialová, 2018). Understanding what attracts people to zoos while balancing and maintaining the welfare of animals will promote the social acceptability and continuation of zoos in modern society.

1.1.2 Zoo-Housed Animal Welfare

1.1.2.1 What is Animal Welfare?

Animal welfare is a concept constantly developing and evolving as we learn more about the experiences of animals. No explicit definition of welfare is used across the literature, indicating many different attitudes towards animal welfare (Carenzi & Verga, 2009).

In place of a definition, there are three orientations towards animal welfare. Which definition people subscribe to depends on their cultural, societal, and ethical values as well as personal knowledge and experience (Fraser et al., 1997). The biological function and natural living orientations may be the more obvious approaches to take in the context of animals housed in captivity and zoos; however, these orientations do not consider the

possibility that animals are still able to have negative experiences even when they are healthy and can perform behaviours seen in their 'natural' environment. The terms natural or normal are conceptually confusing, given that they are too vague and hold too many meanings in various contexts (Kilgour, 2012). The idea that animal behaviour terms are subjective is explored later in this thesis (see section 1.2). Therefore, the affective state orientation is the most appropriate approach in a zoo context. The affective state orientation places great importance on identifying and understanding the mental experiences of animals. It acknowledges that animals can have both positive and negative experiences (Mellor et al., 2020). I will use the affective state orientation toward animal welfare for this thesis. An animal has good welfare when they experience predominantly positive emotional states while minimising negative experiences when engaging with fellow animals, humans, and the surrounding environment (Green & Mellor, 2011). The affective state orientation relies on robust human inferences about the mental experiences of animals. Using this orientation, recognising animals' positive and negative mental experiences is crucial for assessing and improving welfare. Behaviour can be used as an externally observable means of inferring animal mental experiences (Beausoleil & Mellor, 2016).

1.1.2.2 Animal Welfare Problems within Zoos

While zoos play a role in conservation, breeding, protection, and rehabilitation, they are not without issues. One of the main concerns of non-experts and zoo visitors is animal welfare (Wickins-Dražilová, 2006).

One of the most significant welfare concerns raised about zoos is the issue of confined space. Many zoo-housed animals are confined to small, artificial habitats that do

not resemble their wild environments. This can negatively affect the animals' welfare and raises questions about the ethics of keeping animals in captivity (Stroud, 2007). These captive environments do not provide opportunities for exercise, social interaction, and mental stimulation (Stroud, 2007). This can lead to behavioural and health problems, resulting in mental experiences such as boredom, frustration, and anxiety (Mellor et al., 2020). Confinement can lead to negative mental experiences such as stiffness and muscle soreness/tension (Mellor et al., 2020). Other issues associated with confinement include overcrowding, poor physical fitness, lameness, constrained social interaction, and reduced defence and avoidance behaviours (Mellor et al., 2020). The behavioural restriction animals experience in confined spaces is a serious welfare concern (Mason & Rushen, 2006).

Large mammals such as elephants, lions, and giraffes are common species housed in zoos. In the wild, these species are known to roam vast distances daily. Elephants have been known to walk up to 50 miles a day (Hutchins, 2006). When this range is compared to the size of a large zoo enclosure, it is easy to see why certain behaviours may be restricted in captivity. Furthermore, the lack of space in zoos can prevent animals from engaging in behaviours found in wild populations (Clubb & Mason, 2007). For example, primates may be unable to swing from trees or forage for food, and aquatic animals may be unable to swim long distances or dive deep. Animals are highly motivated to perform some behaviours, and some captive environments stop animals from satisfying these motivations (Mason et al., 2007). Although many animal welfare problems exist within zoos, how the public and non-experts perceive these problems determines their social acceptability and can influence zoo mitigation strategies (Veasey, 2022).

1.2 Animal Behaviour: Characterisation, Mitigation, and Evaluation

1.2.1 Characterisation of Animal Behaviour Terms

Behaviour is an internal response of whole living organisms to internal or external stimuli (Levitis et al., 2009). There are numerous ways behaviour can be described to explain the differences between the behaviour's form, frequency, and context. This distinction can also be made between wild and captive populations. Typically, behaviours expressed in the wild are referred to as natural or normal behaviour. Normal behaviour is typically referred to as behaviour observed under unconstrained conditions (Lawrence et al., 2019). In other words, normal behaviour is benchmarked based on animals living freely (Hediger, 2013) or conditions that allow for a full range of behaviour.

On the other hand, natural behaviour is rarely defined in the literature (e.g., Parker et al., 2020), showing that researchers assume that natural is an intuitive term. However, in a practical sense, these terms are too vague and confusing to use without context (Kilgour, 2012). Therefore, there is a need to define and characterise the different types of animal behaviour.

Two animal welfare concerns within zoos have already been identified in this thesis: confined spaces and behavioural restriction. These issues could present as abnormal or stereotypic behaviours (Latham & Mason, 2010; Poirier & Bateson, 2017). Abnormal and stereotypic behaviour have numerous definitions in the literature. Animal behaviour is a complex and diverse subject, so it can be challenging to distinguish between the many different ways of categorising behaviour (Mason & Rushen, 2006). Understanding species-specific behaviour is vital for inferring what that behaviour might mean for the animal, its mental experiences, and what this means for its welfare.

1.2.1.1 Captive-Type and Wild-Type Behaviour

As previously addressed, there is a need to clearly distinguish between behaviours performed by wild populations versus those performed by captive populations. Currently, terms such as normal and natural can be used in too many different contexts, confusing their meaning. In this report, captive-type behaviour refers to any behaviour expressed by captive populations that differs in form from what might be expected in a wild population of the same species (Mason, 1991). This means captive-type behaviours are only found in captivity and would not be seen by wild populations. Captive-type behaviours include domesticated behaviours (Hansen Wheat et al., 2019); however, domestication has not occurred in most zoo-housed species. Captive-type behaviours include head banging, self-biting (Dorey et al., 2009), and bar biting (Williams et al., 2017). Captive-type behaviour also includes behaviours not seen in wild populations but are not abnormal (e.g., willingness to approach humans). This allows a distinction to be made between captive-type behaviour and behaviours that are simply abnormal.

In contrast, wild-type behaviour characterises behaviours that animals in a wild population would be expected to express. Wild-type behaviours include foraging, feeding, and social interactions (Veasey et al., 1996). Wild-type behaviour could more commonly be found in the literature as 'natural' or 'normal' behaviour. However, these terms are too vague and hold too many meanings in various contexts (Kilgour, 2012), hence the need to re-characterise them. In addition, it is confusing to understand 'abnormal-normal' behaviour for behaviours that are normal in form but become abnormal based on frequency, degree, or context. Abnormal wild-type behaviour is much more conceptually clear.

1.2.1.2 Abnormal Behaviours

Like 'normal' behaviour, abnormal behaviour can mean many different things in different contexts and may be defined differently depending on the context and background of the author (Mason, 1991). Abnormal behaviour historically includes all behaviours that differ in form (i.e., type), degree, frequency or context from that of the species norm or what is observed in the wild (Lutz, 2018). In ethology, abnormal behaviour refers to behaviours that deviate from the norm, either by being statistically rare in context or different from the behaviour of a given standard population (Mason, 1991). However, in clinical veterinary medicine and psychology, abnormal behaviour is used to help diagnose pathological illness or damage (Cooper & Mason, 1998). Regardless of its definition, abnormal behaviour can indicate illness, pain, or discomfort (Cooper & Mason, 1998), meaning any form of abnormal behaviour is used to infer negative mental experiences for the animal. Given the characterisation of captive-type and wild-type behaviour, abnormal behaviour refers to behaviour that differs in degree, frequency, or context from that of uninhibited wild populations (Fraser & Broom, 1997). In other words, it will refer to every aspect of behaviour other than the type of behaviour. This means some wild-type behaviours (e.g., grooming) can still be abnormal if they differ in degree, frequency or context from what would be expected from a well-functioning wild animal of the same species. Characterising abnormal in this way clearly distinguishes between abnormal, captive-type and wild-type behaviours.

1.2.1.3 Stereotypic Behaviour and Stereotypies

Stereotypic behaviour is commonly used interchangeably with stereotypy in the literature to refer to behaviours with superficial similarities but varying causes (Mason & Rushen, 2006). However, separating these terms may provide better conceptual clarity (Mason & Rushen, 2006). Stereotypic behaviour is a general term and can refer to any repetitive behaviour with an unknown cause (Mason & Rushen, 2006). In other words, it is an abnormal expression of behaviour in a repeated pattern that is expressed without being triggered by the initial stimulus. Stereotypic behaviours can be wild-type behaviour (e.g., repetitive grooming) or captive-type behaviour (e.g., head banging), and given their frequency, degree, and out-of-context nature would all be classified as abnormal behaviour.

Stereotypies, on the other hand, are a more specific subset of stereotypic behaviours. A stereotypy has three critical aspects: a fixed motor pattern, preservation of the behaviour, and functionless nature. Motor patterns refer to how the nervous system controls movement (Milani-Comparetti, 1970), and a fixed motor pattern involves little to no variation in the control of movement (i.e., the observable behaviour pattern is invariant). The preservation of behaviour refers to the persistence of activity without the appropriate trigger (Callahan et al., 2021) or the inability to cease a behaviour pattern once having started it (Gillen & Rubio, 2016). The final key aspect of stereotypy is the lack of a perceived purpose in performing the behaviour (Mason et al., 2007; Mason, 1991). Stereotypies are repetitive behaviours lacking purpose, with an unknown cause and a highly preserved and predictable motor pattern (Mason et al., 2007). This means that, unlike stereotypic behaviour, stereotypies do not involve behaviours with varying motor patterns (Mason et

al., 2007). Stereotypies are a subset of stereotypic behaviour and, therefore, are all abnormal and can be both captive and wild-type.

1.2.1.4 Abnormal Repetitive Behaviour

Abnormal repetitive behaviour (ARB) is a more recent and increasingly popular term coined by scientists. Researchers categorise ARBs into two main groups, one involving repeated goal-oriented behaviour (compulsive behaviour), and the other involving repetitive motor patterns (stereotypy) (Garner, 2008). In a broad sense, ARBs are behaviours exhibited by animals, which are invariant, inappropriate and seemingly devoid of any cause (Rose et al., 2017). There is little distinguishing difference between this definition and that of stereotypic behaviour, further emphasising the confusing nature of many animal behaviour terms.

1.2.2 The Importance of Characterising Animal Behaviour

Various animal behaviour terms are present in the literature, some are defined clearly, but most are highly variable, subjective, and impractical. To decipher and correctly infer the mental experiences of animals, their behaviour must be observed and understood in context (Beausoleil & Mellor, 2016). These definitions require a high level of species-specific knowledge and experience to categorise different behaviours. Non-experts possess a different level of understanding. Therefore, it is nearly impossible for them to identify different behaviours 'correctly'. The leap from observing behaviour to inferring what it

means for the animal is influenced, to a high degree, by human perception. This adds an extra layer of interpretation because non-experts perceive animal behaviour differently, and their responses need to be analysed and understood. In addition, to the behaviour terms being subject to perception and the terms overlapping and creating confusion, no methodology exists that allows researchers to assess the perception of non-experts towards animal behaviour.

Combining these factors increases confusion over how non-experts think about animal behaviour. The perception of non-experts carries significant weight, mainly due to the social license contract between non-experts and zoos (Douglas et al., 2022). Zoo visitors constitute a significant source of revenue for zoos and wield substantial influence through what they perceive as problematic. If non-experts perceive a behaviour as concerning, they may be more inclined to ascribe negative mental experiences to the animal performing that behaviour. This may impact the zoo's mitigation and intervention strategies towards welfare issues by changing priorities and emphasis on certain species or types of behaviour. Confusion over whether animals are having negative mental experiences would ultimately impact the zoo's social licence to operate. Non-experts hold immense power in bringing about change, so understanding their perceptions is paramount to zoo-based research.

1.2.3 Mitigation of Abnormal Behaviours: Enrichment

Despite efforts to improve living conditions for animals in captivity, many zoos still struggle to provide adequate space and social interactions for their animals. Many zoos are criticised for being too monotonous for animals, with a lack of diversity in their environment

and limited opportunities for stimulation (Mason, 2010). In the wild, animals can access various natural features and sensory experiences that keep them mentally and physically engaged. However, in many zoos, animals are confined to small enclosures with little variation in their surroundings (Maślak et al., 2016). Enrichment has long been a catch-all solution for most behavioural issues within zoos. Enrichment often involves identifying and offering animals environmental stimuli that provide them with opportunities for welfare enhancement in captivity (Swaisgood & Shepherdson, 2005).

Mitigation and intervention strategies for abnormal behaviour can only be used if concern towards the animal or behaviour is perceived first. From there, the behaviour and resulting mental experience must also be correctly inferred. Enrichment cannot be implemented correctly if no concern is perceived or the motivation underlying the behaviour is incorrectly identified. This means there is a risk that some abnormal behaviours expressed by zoo-housed animal will not be addressed. Correctly interpreting and identifying abnormal behaviours in zoo-housed animals should be a priority because mitigation strategies should directly address the abnormal behaviour and resulting mental experiences.

1.3 Social Licence to Operate in Zoos

Public opinion on housing animals in captivity has drastically shifted. This shift poses challenges to many zoos that confine animals (Boppré & Vane-Wright, 2019). While zoos may argue that their exhibits provide a unique opportunity for the public to see and learn about animals, critics argue that these benefits come at the expense of the animals' welfare (Shani & Pizam, 2008). By taking animals from their natural habitats, crucial opportunities

for foraging, social development, and natural behaviours are limited (Langenhof & Komdeur, 2018). Animal welfare advocates argue that zoos struggle to provide captive animals with the rich experiences found in the wild (Malamud, 1998). This raises the ethical issue of keeping animals in captivity for human entertainment (Mullan & Marvin, 1999). This is why the entertainment purpose of modern zoos is often not advertised or emphasised as much as the other objectives. Entertainment is the primary attraction of zoos and is why people visit (Bostock, 2003; D'Cruze et al., 2019). The proximity to captive wildlife, whether through direct or indirect means, enhances the appeal of a zoo to visitors (Anderson et al., 2003), thereby enhancing initial visits and encouraging repeat visits. When visitors come to zoos during their leisure time, they can choose which aspects of the zoo to engage with. Various factors shape visitor perception of zoos, such as animal exposure and interactions and preconceived notions about animal behaviours (Godinez & Fernandez, 2019). These elements can either promote or impede respect and appreciation for zoo-housed animals and the institutions that care for them. Visitors generate substantial revenue that can be utilised to fulfil the zoo's additional objectives (Hosey, 2005). However, some zoos may prioritise their financial interests over their conservation and educational goals, leading to concerns about the effectiveness of their programs and the allocation of resources (Minteer & Collins, 2013). Finally, the role of zoos in contributing to the conservation of species in their natural habitats is also the subject of debate. Some experts argue that the focus should be on preserving natural habitats and preventing the need for captive breeding and reintroduction programs (Rahbek, 1993). While many zoos are taking steps to address these issues, there is still much work to be done to ensure that the benefits of zoos outweigh their negative impacts on animal welfare and conservation efforts.

Organisations employ Social License to Operate (SLO) to gauge the public approval and legitimacy of their existence (Edwards & Trafford, 2016). The SLO is the underlying process through which a community grants approval to the industry to carry out its existing business activities (Hampton et al., 2020). The SLO for zoos is assessed based on the perception of the local community and stakeholders regarding the effectiveness of zoos in achieving their primary goals (Boutilier & Thomson, 2011). Therefore, it is imperative for zoos to actively participate in pertinent conservation initiatives, conduct research that focuses on conservation efforts, utilise advanced animal welfare practices, and launch impactful educational campaigns. These endeavours safeguard wildlife and foster a sense of inspiration among individuals (Hampton & Teh-White, 2018).

Additionally, zoos should prioritise understanding the opinions and perceptions of their visitors regarding their activities, as these factors may impact their operations. To survive amidst mounting social pressure, zoos must justify their operations and secure public approval. Understanding visitor and non-expert perceptions is crucial, as they influence zoo operations. By demonstrating social and environmental responsibility, zoos can earn and maintain public confidence, ensuring their continued existence (Boutilier & Thomson, 2011).

1.4 Human Perception of Animals

1.4.1 The Role and Importance of Perception

Perception is the process of interpreting and organising sensory information, formulating a substantial and meaningful understanding of the world (Lindsay & Norman,

2013). Perceptions, especially towards animals, matter because they can shape our thoughts, attitudes, and behaviours towards an individual or group (Sinclair et al., 2022). They can influence how we interpret and react to events and situations in our daily lives. Perceptions are rooted in our past experiences, beliefs, values, and cultural norms, which can manifest either positively or negatively (Weber, 2010). For instance, if a group is perceived as dangerous or threatening, people may avoid interacting with them or treat them unfairly. Conversely, if a group is perceived as friendly and welcoming, people may be more likely to engage with them and form positive relationships. Perceptions can also influence our thoughts and emotions, impacting our decision-making (Coleman & Hemsworth, 2014; Michie et al., 2011). If an issue is perceived as a significant problem, people are more likely to take action and address the problem. In summary, perceptions matter because they can influence our thoughts, emotions, attitudes, and behaviours towards a particular object, concept, or group of individuals. Therefore, it is important to be aware of our perceptions and consider how they may impact our interactions and decision-making (Williams & Noyes, 2007).

1.4.2 Elements Contributing to Human Perceptions of Animal Behaviour

One of the contributing elements to human perception of animal behaviour is the physical attributes of the animal and the baby schema effect. Humans have a remarkable sensitivity to detect specific animal features, significantly influencing their perceptions. Research has demonstrated that individuals are prone to associating positive traits, including intelligence, sociability, and emotional capacity, with animals possessing certain

physical characteristics (Sarwer et al., 2003). Animals with larger eyes, rounder faces, and features resembling those found in humans tend to evoke these positive attributions more readily (Lehmann et al., 2013). This phenomenon, commonly called the Baby Schema Effect, is believed to be an evolutionary adaptation ingrained in human psychology (Glocker et al., 2009). It is thought to facilitate nurturing behaviours and foster protective instincts towards infants and young offspring, thereby increasing their chances of survival and ensuring their well-being (Rilling & Young, 2014). Characteristics resembling those found in human infants trigger an innate caregiving response, reinforcing the positive perceptions and attributions towards these animals. The baby schema effect has been observed across various species and has implications for human-animal interactions (Lehmann et al., 2013). Animals displaying features associated with the Baby Schema Effect are likelier to elicit empathy, affection, and a desire to care for them. Understanding the influence of the Baby Schema Effect provides insights into human perceptions, biases, and preferences towards animals. It highlights the complex dynamic between evolutionary mechanisms, visual cues, and emotional responses that shape human-animal relationships (Borgi & Cirulli, 2016). Human-animal relationships are a priority from an ethical standpoint (Ward et al., 2018). How we perceive animals, their cognitive abilities, emotions, and intrinsic value significantly influence how we treat and interact with them (Serpell, 2004). By recognising these dynamics, we can develop strategies to promote empathy, responsible stewardship, and the welfare of animals in various contexts.

Another elements contributing to how humans perceive animal behaviour is familiarity. Familiarity with an animal significantly enhances positive perceptions towards it. When humans are familiar with an animal species, whether through personal interaction or exposure to media and cultural representations, it fosters a sense of comfort, trust, and

empathy (Greenall et al., 2022). Familiarity diminishes fear and uncertainty, allowing individuals to appreciate the animal's unique qualities and attributes (Airenti, 2015). Moreover, familiarity promotes an understanding of the animal's behaviour, interests, and ecological role, leading to increased appreciation and a desire to protect and conserve the species (Lim et al., 2022). Overall, familiarity engenders a positive perception by bridging the gap between humans and animals, fostering a deeper connection and empathy towards them.

Another key element that influences human perception of animal behaviour is anthropomorphism. The human perception of animal behaviour encompasses interpreting and understanding how animals act and interact with their environment (Beaver, 2010; Breed & Moore, 2016). It involves observing and analysing their actions, expressions, and communication methods and ascribing meaning and intention to their behaviours. Humans often relate to and empathise with animals through anthropomorphism, emotional resonance and familiarity with certain behaviours (Gómez-Leal et al., 2021; Mota-Rojas et al., 2021; Panksepp & Panksepp, 2013). This perception can shape or alter how animals are viewed significantly. The exhibition of human-like behaviour in animals elicits a favourable perception from humans due to various cognitive and emotional factors. Anthropomorphism, the tendency to attribute human characteristics to non-human entities (Torta et al., 2013), plays a significant role in this phenomenon. While it is widely accepted that animals exhibit individual differences, there is a concern that attributing personality to them may lead to an anthropomorphic perspective, distorting our understanding of animals as semi-human beings (Wemelsfelder, 2007). Furthermore, observing human-like behaviour in animals elicits various emotional responses, including joy, empathy, and amusement (de Waal, 2011). These emotional experiences arise from a sense of shared experiences and the

formation of a bond from human to animal. The resulting emotional connection further shapes our perception, fostering increased compassion and a desire to protect and care for the animal (Greenall et al., 2022). This cognitive resonance allows individuals to relate to the animals, leading to an elevated perception of their cognitive abilities and emotional capacity. Overall, the inclination of humans to view animals more favourably when they display human-like behaviour bridges the substantial divide separating them from nonhuman animals in terms of communication and cognition. As a result, humans ascribe human sentiments and thoughts to animals, establishing a perceived bond with them (Archer, 1997). These cognitive and emotional mechanisms collectively contribute to an elevated perception of animals as intelligent, unique beings deserving of care and attention. Understanding these aspects of human perception will help us appreciate how humans perceive animal behaviour along with the associated concern towards different behaviours.

1.4.3 Advanced Perception: Cognition, Mind Perception, and Valence

1.4.3.1 Perception of Animal Cognition

Research on human perception of animals has highlighted the complex and multifaceted nature of our attitudes towards different species (Batt, 2009). An important observation is that individuals tend to develop judgements and opinions about animals based on how they perceive the animals' cognitive abilities. When animals are perceived as more intelligent or similar to humans in their cognitive capacity, they tend to receive more significant 'moral consideration' from people (Piazza et al., 2014). Moral consideration refers to attributing intrinsic worth or importance to an entity (an animal in this case) (Owe

& Baum, 2021). This phenomenon suggests that attributing cognitive abilities significantly shapes human attitudes and behaviours towards animals. People may view animals with higher cognitive abilities as deserving of more rights, protections, and higher moral considerations, while those perceived as less intelligent may be given lower moral consideration (Waytz et al., 2010). It is essential to recognise that people perceive different cognitive abilities across and within species. The perception of intelligence is subjective and influenced by human cultural, societal, and personal factors (Weber, 2010), this can cause people to see different levels of cognition in the same animal. This would have a flow on effect to moral affordances which would alter the decisions made about animals (Williams & Noyes, 2007). Understanding the influence of perceived cognitive abilities on moral considerations is crucial for addressing issues related to animal welfare and promoting the ethical treatment of animals.

1.4.3.2 Mind Perception of Animals

Mind perception refers to attributing mental experiences, such as intentions and emotions, to oneself and others (Saracho, 2014). The term 'mind perception' encompasses the attribution and negation of various capacities to both human and nonhuman entities. This includes practices such as anthropomorphism, where human-like qualities are attributed to nonhuman entities, and dehumanisation, where human-like abilities are denied to nonhuman entities (Tzelios et al., 2022). Additionally, mind perception involves ascribing the capability of experiencing emotions to entities (Gray et al., 2012). The underlying properties influencing mind perception judgements have significant implications for real-world decision-making processes. Mind perception also plays a significant role in

our social interactions, influencing our understanding of others' behaviours and guiding our moral judgments (Jin & Peng, 2021). Moral judgment involves assessing a particular behaviour as either morally good or bad or as morally right or wrong (Jin & Peng, 2021). Enhancing our understanding of mind perception and the mental experience of others develops our ability to make better moral judgements (Fu et al., 2014).

Mind perception partly informs moral consideration and judgement where there is an intentional agent and a suffering moral patient (Gray et al., 2012). The intentional agent is responsible for causing harm or benefiting others, while the suffering moral patient is the recipient of that harm or benefit (Gray et al., 2012). Mind perception plays a crucial role in moral consideration, as it helps humans attribute mental experiences and intentions to both the agent and the patient. Moral judgements are subject to the perceived agency and experience of the moral patient (Gray et al., 2012). Agency is the capacity for intentional action (Monroe et al., 2012), while experience is the capacity to sense and feel (Waytz et al., 2010).

When it comes to animals, mind perception significantly impacts moral consideration and human behaviours towards animals. In many jurisdictions, some animals are considered sentient yet they are not afforded rights; rather, humans have responsibilities towards their care and protection (e.g., Animal Welfare Act, (NZ), 1999; Animal Welfare Act, (UK), 2006). Sentience is the capacity to have subjective (i.e., positive, or negative valence) mental experiences (Browning & Birch, 2022). The perception that an animal possesses a mind affords a moral obligation to prioritise its welfare (Bastian et al., 2012). Conversely, the perceived lack of mind justifies reduced concern for their welfare (Bastian et al., 2012)

The perception of animal minds is flexible, and animals are frequently attributed with mental experiences to facilitate our comprehension of their behaviour (Epley et al., 2008). One specific instance where mind perception may influence our comprehension of behaviour is the perception of welfare compromise. Animals displaying stereotypic behaviours may be experiencing a range of negative mental experiences (Mason, 1991). The perception of welfare compromise will influence our moral judgements regarding which animals need intervention or protection. For example, if we perceive animals as capable of suffering welfare compromise (i.e., some capacity for sentience), we are more likely to intervene and promote their welfare.

On the other hand, if we perceive animals as lacking mental experiences or emotions, we may be less inclined to consider their suffering morally significant. This directly influences the social acceptability of zoo operations as the perception of what mental experiences an animal is capable of is what raises the ethical questions of keeping animals in captivity. How the public perceives animals significantly shapes the market opportunities and long-term survival of the zoo industry (Hampton et al., 2020).

1.4.3.3 Valence

Directly measuring animal mental experiences is not currently possible (Boissy et al., 2007). Therefore, evaluating the mental experiences of animals has traditionally relied on measuring behavioural and physiological changes associated with the experiences being inferred (Mendl et al., 2009). Mental experiences are characterised by valence, perceived as positive or negative (Mendl et al., 2010). In non-human animals, valence is influenced significantly by reward and punishment, where reward increases the likelihood of the

behaviour occurring again (positive motivator), and punishment reduces that likelihood (negative motivator) (Mendl et al., 2010). Valence is an important concept when discussing the mental experiences of animals. Attributing valance to the mental experience of animals can deepen the understanding of what those experiences mean to the animal. The assumption is that positive valence is experienced as good, while negative valence is experienced as bad. Considering the valence of potential mental experiences in animals can also help increase our understanding of how people perceive these mental experiences and reduce the assumptions made by researchers.

1.4.4 Methodological Approaches for Measuring Human Perceptions

Non-experts, also known as laypeople, are individuals possessing a lower level of knowledge compared to experts within a particular industry (Gottschling et al., 2020). It is rare for individuals without a background in science or those new to animal ownership to engage in formal observational studies (Tami & Gallagher, 2009). This means that there is a gap in both the prevalence of non-expert related animal behaviour studies but also a lack of methodology suited to doing this type of research. This thesis will aim to be among the few to assess non-experts perception of animal behaviour.

To understand how non-experts perceive animal behaviour, it is common to use research methods that evaluate their perceptions. The main techniques for assessing and interpreting human perceptions are surveys and questionnaires. Surveys are widely used to collect systematic data and gain insights from specific populations. They involve pre-defined questions to gather information (Phillips, 2017), aiming to describe or identify relationships

between variables (Pinsonneault & Kraemer, 1993). Internet or online surveys offer an efficient and scalable alternative to traditional survey methods and also allows people to remain completely anonymous (Alessi & Martin, 2010). Surveys pose a significant challenge in terms of the accuracy in evaluating the perceptions of responses (Sato, 2009). Errors in the interpretation of survey results are unavoidable. Even the most methodically thought out surveys will be subject to personal and professional bias (Deming, 1944). Therefore, to gain reliable and accurate data, additional considerations must be used to understand the responses fully.

1.4.5 Behavioural Rating Scales: Use by Caretakers and Owners

Scientists have devised rating scales to measure the behavioural characteristics of various animal species. However, these scales are undertaken by animal caretakers and owners with extensive first-hand knowledge of the animals. Their deep familiarity with the animals enables them to provide valuable insights into their behaviour and contribute to refining the measurement tools (Wemelsfelder, 2007). A holistic approach to animal behaviour is more suitable to non-experts as it recognises that behaviour goes beyond mere physical actions. Behaviour is evaluated within a larger framework and assumes a mental dimension, conveying a form of 'body language' that provides insight into the animal's subjective experience at a given moment (Wemelsfelder, 2007). This perspective acknowledges that behaviour is not solely about observable movements but encompasses a richer understanding of the animal's internal state. This means that through careful observation of animals and the quality of their expressions, we can better understand their overall welfare (Wemelsfelder, 2007). This shows that behaviour goes beyond visible actions

and understanding the mental experiences of animals is what prompts us to optimise their welfare. It also shows that this type of approach to animals behaviour will help to understand people's perception in greater depth.

1.4.6 Methodological Approaches for Evaluating Animal Behaviour

There are numerous ways of assessing animal behaviour in both a practical and a research setting. The chosen method depends on the goal or purpose of gathering the information. In some cases, researchers or animal carers will want to observe behaviours to interpret the underlying mental experience of animals (e.g., Ahloy-Dallaire et al., 2018; de Oliveira & Keeling, 2018). In other cases, it might be more important to understand if people can correctly interpret animal behaviours (e.g., Morris et al., 2012; Tami & Gallagher, 2009). Observation is the main method for directly assessing an animal's behaviour (Lendvai et al., 2015). However, there are other methods for assessing the behaviour of animals that focus more on the perceived mental experiences of animals, namely Qualitative Behavioural Assessment.

1.4.6.1 Problems with Evaluating Animal Behaviour

One reason that behaviour can sometimes be hard to identify is that the definition of behavioural terms can appear similar, leading to confusion in identifying them. An example is stereotypic behaviour, stereotypies and compulsive behaviour, all including the term 'repetitive' in their definition (Garner, 2005; Luescher, 2003; Mason & Rushen, 2006). These

definitions are highly subjective, and it is easy to see how observed behaviour may meet the criteria for multiple behaviour definitions.

Another reason inferences from behaviour can be challenging, especially for non-experts, is the difficulty of correctly identifying some behaviour based solely on observation. Observing behaviour without considering other external and internal factors may lead to incorrect assumptions about what that behaviour means for the animal's mental experiences. A classic example is how yawning in primates is interpreted by people (Karere et al., 2009). Yawning due to fatigue might look the same as that caused by anxiety but the two behaviours have very different implications for the animal's inferred mental experiences. In addition to the internal and external context of the behaviour, the species-specific context is also important to consider. Different species may have differing behavioural motivations and norms, meaning generalisations cannot be made across all animals. Elephants, for example, only require a few hours of sleep (Tobler, 1992), while Koalas spend almost all day sleeping (Martin & Handasyde, 1999). This shows that abnormal behaviour for one species might appear normal for another.

The context in which the behaviour form is expressed must also be considered when identifying behaviours. This means behaviours with an adaptive advantage in the wild may become troublesome in a captive setting. For instance, adaptive behaviours such as migration become maladaptive in captive or other environments where the behaviour cannot be fulfilled. This also includes behaviours such as infanticide (Learmonth, 2019), in which animal infants in the wild are killed to increase the fitness or survival of the population (Hrdy, 2008). These behaviours are wild-type and are not abnormal for animals to perform. However, the inability to express these behaviours, or expressing them in a captive setting, may lead to negative mental experiences and potentially reduced overall

welfare. The welfare compromise associated with expressing adaptive wild-type behaviour in captive settings cannot be understood by single observation alone.

Similarly, abnormal and stereotypic or compulsive behaviours may resemble wild-type behaviours if not understood in context. This would include behaviour such as stereotypical grooming (Phillips et al., 2017), which is wild-type in its form but could be considered abnormal given the level of repetition, frequency of occurrence or situation in which it is performed. This again shows that observation or recording of individual behaviours alone is problematic for inferring the mental experiences of animals.

1.4.6.2 Qualitative Behavioural Assessment

Historically, the most scientific and precise methods for assessing animal behaviour were based on observing and recording individual behaviours at a specific point in time (Beausoleil & Mellor, 2011). However, to make inferences about the animal's mental experience while performing certain behaviours, researchers must make subjective decisions about what that behaviour might mean for the animal. In most cases, behaviour is not directly valuable in understanding whether animals have good or bad welfare. The primary concern is the animal's mental experience, which can lead to inferences about the status of the animal's welfare (de Waal, 2011). In most cases, an animal's mental experience influences complex behaviours (Nematipour et al., 2022).

Wemelsfelder et al. (2000) developed a methodology for evaluating an animal's behavioural repertoire and its relationship to mental experiences. This methodology, called Qualitative Behaviour Assessment (QBA), is a whole-animal approach to behavioural assessment. Wemelsfelder proposes that using qualitative terms has a more robust

empirical foundation than researchers currently recognise. QBA is a method of inferring the mental experiences of an animal via behaviour assessment. It takes the approach that observers can interpret an animal's behavioural expression and resulting mental experience using qualitative descriptors (Rutherford et al., 2012). One of the main advantages of QBA is that it includes subtle details of posture, attitude and movements of animals that go undetected by other means of behaviour analysis (Jones et al., 2022). Therefore, QBA provides a model for generating reliable insights into the subjective experiences of animals.

QBA uses two steps for gathering information. After observing an animal's behaviour, the first step requires assessors to generate a list of descriptive terms in their own words. This step follows a food and consumer science methodology called Free-Choice Profiling (FCP) (Arnold & Williams, 1986). Assessors are not restricted by the number of terms they write or how they describe the behaviour (Wemelsfelder et al., 2000). FCP allows assessors to choose their own terminology, and the analysis of terms will reflect their perceptions. FCP is therefore gathering a perception of what the observer thinks about the animal. The descriptive terms can then be used to score animals quantitatively (Wemelsfelder et al., 2000). The second step of QBA uses a visual analogue scale (Wemelsfelder et al., 2001). Assessors are asked to rate each of the terms they came up with on a scale to determine a degree of intensity. Measurements are then taken from the minimum point where the mark intercepts the scale (de Boyer des Roches et al., 2018). These measurements are then used for statistical analysis.

Numerous studies using QBA as a method for behaviour analysis have found it to be reliable, repeatable and a good representation of the animal's physical behaviour (e.g., Napolitano et al., 2008; Rousing & Wemelsfelder, 2006; Walker et al., 2010). QBA showed high agreement among observers regardless of their professional background and with no

prior training with animal behaviour (Wemelsfelder et al., 2001). In addition, the FCP aspect of QBA allows observers to develop descriptive terms that make sense to them. FCP allows assessors to develop the experiences and descriptive terms on their own accord, and a particular opinion or way of thinking is not forced upon them (Wemelsfelder, 2007). However, some aspects of Wemelsfelder's (2000), QBA technique would rely on expert knowledge and interpretation of species-specific behaviours to generate or develop the corpus of terms (e.g., Duijvesteijn et al., 2014; Patel et al., 2019). For this reason, it has yet to be used in a non-expert zoo-specific setting.

2 Research Overview

2.1 Characterisation of Topic

Despite the benefits that zoos bring to the conservation of different species, the individual cost to animals is a cause for concern (Safina, 2018). There is a constant balance between trying to protect the species as a whole while also considering the potential welfare compromise of the animals involved.

One of zoos' most prolific animal welfare issues is the prevalence of stereotypic behaviour. Stereotypic behaviour refers to repetitive behaviours, fixed in a form with an unknown underlying cause (Mason & Rushen, 2006). Although the definition of stereotypic behaviour and other animal behaviour terms is somewhat defined in the literature, the poor practical application of these terms quickly becomes apparent. The definition of many behaviour terms is subjective and vague and can make them challenging to identify. In addition, it is hard for a non-expert to grasp the different meanings of behaviour terminology. Therefore, it is almost impossible to interpret how they perceive animals. The perception of non-experts holds great significance in this context, especially considering the social license and societal approval between non-experts and zoos (Douglas et al., 2022). Zoo visitors provide a significant source of income, and their opinions hold great influence. As previously mentioned, zoo patrons expect to see a certain level of care, and regardless of whether their perception is right or wrong, they can bring about an immense amount of change. Therefore, understanding their perceptions towards zoo- housed animals is vital to bring about meaningful change.

Perception influences our level of care towards animals and our ability and willingness to perceive concern. Mind perception influences our interactions and moral

judgements towards animals, guiding our understanding of behaviour and what is morally right and wrong. Some people are willing to recognise animals as sentient, attributing them with minds and subjective experiences, which creates a moral obligation for their well-being. Conversely, perceiving animals without cognitive awareness justifies reduced concern for their welfare. The perception of animal minds is flexible, and we often attribute mental experience to animals to comprehend their behaviour. For instance, when animals display abnormal behaviours, the perception of welfare compromise influences our moral judgements regarding intervention and protection. Understanding how humans perceive animals and their behaviour is essential to animal welfare research.

Humans are the ultimate decision-makers over animals, dictating everything from their diet to habitat and even their capacity to exercise agency and perform highly motivated behaviours (Edelblutte et al., 2023). Human perceptions rely heavily on how much an individual knows about the animal, their previous experience with animals and likely what they were brought up to think about animals (Hecht et al., 2012). Due to the major significance that human perceptions hold in animal-related research, we must gain a reliable understanding of what these perceptions mean. How we perceive animals directly impacts the social acceptance of zoos, as it raises ethical questions about keeping animals in captivity. The public's perception of animals shapes the zoo industry's long-term sustainability.

It is easy to assume that asking people their perceptions results in them reflecting their values and experiences onto animals. It would also be easy to assume that, in some cases, people's perceptions of animal behaviour are wrong. However, discounting human perceptions is not the solution, especially in the animal sciences (Wemelsfelder, 2007). It could be argued that any behavioural observation, even the oldest and most empirical

forms, is subject to some degree of human perception. The practical use of behaviour assessment relies on species-specific frameworks created by industry experts and carried out by animal experts or caretakers well-versed in these animal behaviour (Wemelsfelder, 2007). Given the variety of species, this methodology is hard to carry into the zoo space. It would be near impossible to implement species-specific behaviour assessments on every single zoo-housed species across the globe (Jones et al., 2022). In addition, it would require a high level of knowledge and experience by the observer to be accurate. It may not be the most appropriate form for assessing non-experts' perceptions. Therefore, a different methodology is needed to assess how people perceive the mental experience of animals, including those displaying behaviour. Wemelsfelder et al. (2000) developed a methodology for evaluating animal behaviour and its relationship to mental experiences. This methodology, called Qualitative Behaviour Assessment (QBA), is a whole-animal approach to behavioural assessment.

QBA will be the basis for the methodology in this thesis, although it will be modified in certain aspects to increase understanding of non-expert's perception. The measurement of perceptions usually relies on methodologies such as surveys and questionnaires (Batt, 2009; Reade & Waran, 1996), which can be hard to apply in a zoo context, given the vast array of species (Jones et al., 2022). This thesis will combine Qualitative Behaviour Assessment (QBA) with general human perception methodology. This methodology will help understand the dimensions of experience that people perceive amongst different zoo species and the ability of people to identify abnormal behaviours.

2.2 Thesis Objectives, Aims, and Study Outline

It is the objective of this thesis to broaden the current understanding of how non-experts describe the behaviour of zoo-housed animals as well as the perceptions these people have towards various types of animal behaviour. The first aim is to develop a set of terms and the associated valences commonly used by non-experts to describe animal behaviour. This is to lay the foundation for reliable terminology that can be used in the future for qualitative animal-related research. The second aim is to validate the methodology for generating reliable terminology to describe animal behaviour. The third aim is to ascertain how concerned non-experts are with various types of stereotypic behaviour in different species. The fourth and final aim is to discern non-experts' ability to identify various types of stereotypic behaviour in different zoo-housed species.

Study 1 will require participants to watch six videos from a larger group of 12. Each video will depict a different animal displaying a particular type of behaviour. The animal and type of behaviour will vary between videos. Participants can respond in their own words with as many descriptive terms as they want. Each video will prompt them to focus on the animal's mental experience. After watching the videos, participants will attribute a valence to each descriptive term they wrote. They can choose from positive, neutral, or negative valence. The most popular descriptive terms from this study will be carried forward and used in Study 2.

Study 2 will ask a different set of participants to watch six of the same 12 animal videos. This time, they will be required to rank the top ten most popular descriptive terms from Study 1 on a scale of 0-10, with zero meaning extremely unlikely and ten meaning extremely likely. They will be required to do this for each video. After watching each video,

they will be asked if any of the videos they watched concerned them. They will then be given the definition of stereotypic behaviour and asked if they thought any video represented stereotypic behaviour.

3 Study 1 Methods

In this study, I assessed the most frequently used terms non-experts use to describe animal behaviour. In addition, my aim was to determine the associated valance ascribed? to each descriptive term to establish the intent and consistency behind how the terms were used. Combining these two outputs, I composed a comprehensive set of common terms non-experts use to describe animal behaviour. As previously discussed, no commonly used methodology is used specifically for assessing non-experts' perceptions of animal behaviour. Therefore, the study design of this thesis uses animal behaviour and human perception measurements. The main structure of this study follows that of an online survey questionnaire in which pre-defined questions aim to gather information or identify relationships between variables (Phillips, 2017; Pinsonneault & Kraemer, 1993). The format of the survey questions follows that of Qualitative Behaviour Assessment (QBA) (Wemelsfelder et al., 2000) in which assessors are asked to generate a list of descriptive terms in their own words. This type of response is used in QBA and called Free-Choice Profiling (FCP), in which descriptive terms can be used to score animals quantitatively (Wemelsfelder et al., 2000). FCP gives assessors the freedom to choose their own terminology, and the analysis of terms will reflect their perceptions.

The second part of this study involves participants attributing a valence to each descriptive term. Mental experiences have valence, they can be perceived as either positive or negative (Mendl et al., 2010); therefore, it is essential to include this step to help gain a better understanding of human perceptions. There are various ways to attribute valance to human perceptions in a research sense. Some studies ask assessors to define their selected mental experiences (Wemelsfelder et al., 2001). Directly asking participants to attribute a

valence to each descriptive term they wrote helps us understand how they conceptualise it. This will confirm how they use the word and improve our understanding our their perception. The variables used in this study are the type of animal, degree of captivity and presence or absence of stereotypic behaviour. In addition, the response variable will be the descriptive terms written by participants along with the associated valence.

3.1 Ethics Statement

The project was evaluated by peer review and qualified as a low risk study under the Massey University Code of Ethical Conduct (see Appendix A for the full ethics statement). One of the potential ethical issues we considered was the distressing nature of some stereotypic behaviours observed in animals. No videos depicting animals being harmed by humans or themselves were included in this study. It was deemed that locomotory and oral stereotypic behaviour would portray the type of behaviour we wanted to show while not being distressing to witness. Participants could also close their browsers if they wished to stop participating. In addition, this study is not concerned with comparing demographic groups. This means that although the demographic data was reported by the recruitment platform, individuals remain anonymous and not be linked to their answers.

3.2 Participants

One hundred people (65 females, 34 males, 1 no response) were recruited through the online Prolific website (Prolific, n.d.) to participate in the 12-minute study. Participants ranged between 19 and 65 years of age (M = 36; SD = 10.89). Those who completed the study were paid approximately NZD$ 3.00 in their country's currency. Participation was restricted to people at least 18 years of age located in New Zealand and Australia (n = 25), the United Kingdom (n = 25), the United States of America and Canada (n = 25), and South Africa (n = 25) (see Appendix B for a summary of demographic sex and age). I did not aim to select a representative sample of any particular group. Participants were recruited from these four regions as they are primarily English-speaking and do not represent a single nationality.

3.3 Study Design

This study employed a novel approach to Qualitative Behavioural Assessment (QBA) by enlisting non-expert participants to observe animal behaviours and articulate their experiences through descriptive language. A storyboard, including the layout of the page, button placement, and timing of progression was created and used as the template to design the study. This study was co-designed using an online platform to create a custom layout and presentation (see Figures 1 and 2 for examples of the study layout). The functional study was then uploaded to Prolific for assess to participants. Each participant viewed 6 video clips depicting various animal behaviours, some likely reflecting stereotypic behaviour. They were then asked to generate words that captured their impressions of what

the animal was experiencing. Subsequently, participants quantitatively classified the valence of the words they provided. This approach allowed us to identify a corpus of common terms non-experts perceive in animals and the relative welfare relevance of the terms. The study design integrates qualitative descriptions with quantitative valence ratings, shedding light on the subjective interpretation of behaviours by individuals without specialised expertise.

Participants were allowed to write as many descriptor terms as they felt accurately described the animal in the video. Participants were free to use the same or new terminology when describing the behaviour in each video. Participants were asked to watch a series of short videos depicting various types of animal behaviour. A prompt for each video stopped participants from simply describing the animal's behaviour (e.g., climbing, eating, resting). Previous QBA studies have made use of terms such as "behavioural expression" and "emotional expression" to prompt participants to use emotive language (Arena et al., 2017, 2019). Participants in this study are considered non-experts, so a more layperson-friendly phrase needs to be developed. It was determined that using "feelings and experiences" as the prompt in this study would be the most clear-cut way to convey the type of language we hoped to generate. The prompt "Describe what this animal is feeling or experiencing" was placed above each video, and a similar phrase was used on the instructional page. The video continued to play on a loop, and participants could continue to write descriptive terms before clicking on the next video in their own time. After watching all the videos, participants were asked to attribute a valance to each of the terms they wrote by simply choosing between clicking a positive, neutral or negative button.

3.4 Materials

Twelve videos of animals displaying different types of behaviour in varying degrees of captive settings were used in Study 1. The videos were found on YouTube and were distributed beyond the study (see Appendix C for links to all videos). To ensure each video was of similar length, videos were edited to run for 25-40 seconds. This also allowed the video to be viewed in its entirety before the participants progressed to the next video. A variety of species, behaviour and environmental setting needed to be captured in the videos in order to generate a broad collection of mental experiences. At least one video of a mammal, reptile, amphibian, fish, bird and insect species was used. A range of wild-type and captive-type behaviours in various levels of captive and wild setting was also used as criteria for collecting the videos. Video quality was also important and the video needed to be at least Full High Definition (FHD) of 1920 × 1080 pixels. A breakdown of animal, behaviour type and captivity level are summarised in Table 1. The selected videos were placed into one of two groups, a wild-type behaviour group (bee, frog, chimpanzee, otter, parrot, snake, tiger, zebra) and a stereotypic behaviour group (elephant, giraffe, polar bear, shark). Each participant viewed six of the 12 videos. The six videos were selected such that four were randomly selected from the group of eight wild-type videos and two were randomly selected from the group of four stereotypic videos. This ensured that each participant viewed a similar ratio of wild-type and stereotypic videos.

Table 1. List of animal videos including the type of animal, the behaviour and the degree of captivity depicted in each.

Animal	Behaviour	Captivity Degree
Bee (*Apis*)	Wild-type foraging	Wild
Otter (*Lutrinae*)	Wild-type grooming	Wild
Parrot (*Psittaciformes*)	Wild-type eating	Wild
Snake (*Serpentes*)	Wild-type hunting/exploration	Wild
Frog (*Rana*)	Wild-type idle buccal pumping	Captive pet
Chimpanzee (*Pan troglodytes)*	Wild-type climbing	Captive zoo
Tiger (*Panthera tigris)*	Wild-type flehmens response	Captive reserve
Zebra *(Equus quagga)*	Wild-type idle/foraging	Captive zoo
Elephant *(Loxodonta)*	Stereotypic swaying	Captive zoo
Polar bear *(Ursus maritimus)*	Stereotypic pacing	Captive zoo
Giraffe *(Giraffa)*	Stereotypic tongue weaving	Captive reserve
Shark *(Selachimorpha)*	Stereotypic twirling	Captive aquarium

The first video would automatically start playing once the participant had agreed to participate. It would continue to play on a loop either until the participant decided to click forward or the maximum time (3 minutes) on each page expired. The heading above the video changed from "Video 1" to "Replaying Video 1" once the video had begun to loop. This was to indicate to participants when the video was over and they were re-watching it. Directly under the video, a prompt "2-5 Terms" was placed to remind participants that they only needed to enter a few terms for each video. Underneath the video, a box saying "Enter

your terms here" prompts the participant to enter their descriptive terms. Each time the participant pressed the enter key, their term appeared at the bottom of the screen to show the number of terms a participant had already used.

3.5 Procedures

Participant consent was gained twice first via the Prolific system in which participants consent via the registration page and again by clicking a consent button after reading the study outline. The questionnaire was designed to allow participants to respond to the videos in their own words with no limit on the number of words or characters. Figure 1 shows what the screen of a participant looked like during a typical response to a video.

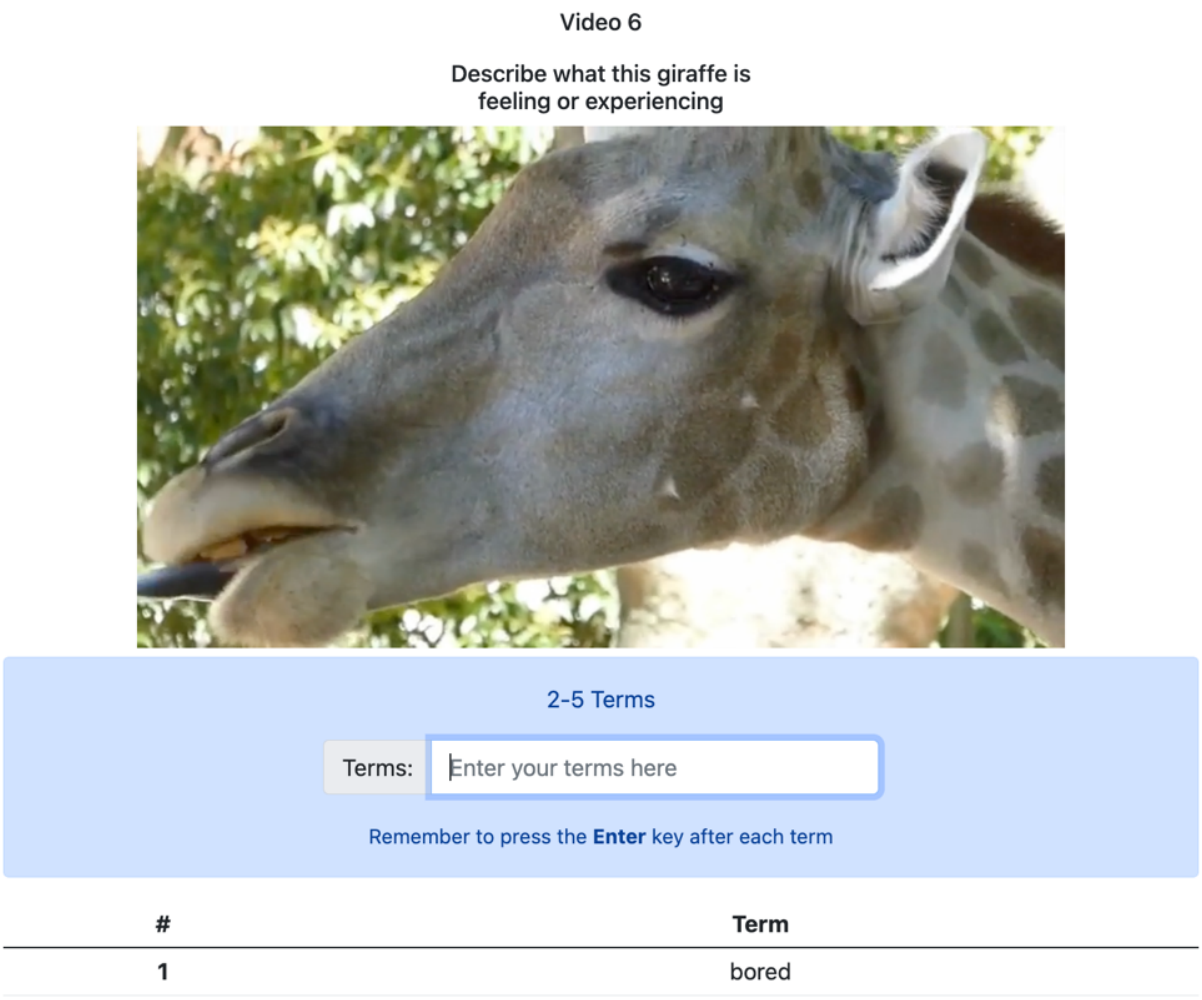

Figure 1. Image depicting a participant's screen in part 1 of the questionnaire

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After each participant wrote descriptive terms for each of the six videos, they were directed to the second part of the study. Participants were then presented with the terms they had typed and asked to select the valence for each term (see Figure 2). Each term the participant had entered for the videos appeared on screen one at a time. A new term would only be shown once the participant chose either positive, neutral or negative valence. If a participant used the same term over multiple videos, it would only be shown once to avoid participants changing their minds and creating excess data showing the same information.

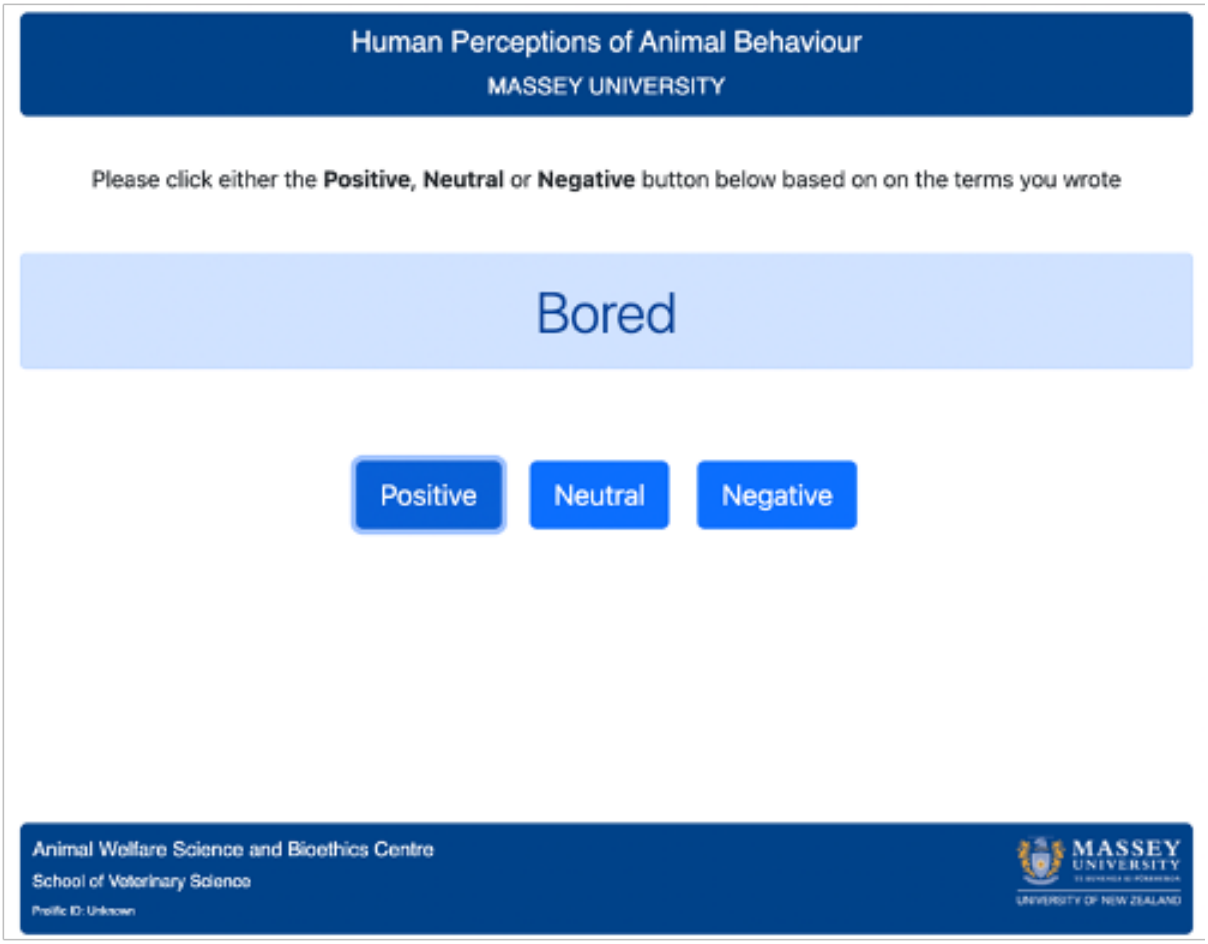

Figure 2. Image depicting a participant's screen in part 2 of the questionnaire.

3.6 Data Refinement

Given the large number of descriptive terms collated, the terms needed to be refined to reduce inaccurate and duplicate information. The scope of this study was limited to terms that met the criteria of a feeling or experience. In order to objectively score each term two researchers took part in the coding process and reduce the potential bias. The raw unedited list of terms was given to each researcher with only minor spelling corrections made (as per Appendix D). To separate the terms that met the criteria of a 'feeling' or

'experience,' the two researchers coded each term with either a '1' or '0'. A score of 1 meant that the response met the criteria for being a feeling or experience the animal can have, while a 0 meant that the term did not meet these criteria. In the case of the two coders disagreeing, the primary researcher's response was taken and either included or excluded from further analysis. The instructional page asked participants to press the 'Enter' key after each term to ensure they were recorded as a single response. In cases where multiple terms were entered in at the time (e.g., "Happy" and "Relaxed"), each term was separated and used as an individual term. To condense the results further, similar terms were grouped. Each unique term was included in the cell description for transparency.

3.7 Study 1 Results

3.7.1 Descriptive Terms

Participants generated 732 terms to describe the 12 videos. The full data set for this study can be accessed online (Gibbs, 2023). Despite numerous prompts throughout the study, some participants did not describe the feelings or experiences of the animals. There were numerous instances where participants simply described the behaviour rather than commenting on mental experiences. Some examples of this occurring include responses such as hunting, agile and climbing. In addition, there were also many instances where participants wrote similar terms that were obviously related. Examples of this include happy and happiness, bored and boredom, anxiety, anxious and anxiousness. It was decided that to get a more representative overview of the terms, these similar terms would be grouped.

Two researchers evaluated whether the terms adequately described feelings or experiences (coded as 1) or not (coded as 0). The two coders achieved 95% agreement, while only 5% of terms needed to be re-evaluated by the primary researcher. After the coding process, the terms attributable to a feeling or experience were further condensed to group synonymous terms (e.g., anxious was grouped with anxiety and anxiousness) . After the refinement process, the 732 terms were reduced to 220 unique feelings and experiences.

The unique terms were then sorted in order based on frequency (see Table 3). Together, the top 20 terms comprised 56% of the total frequency of feelings and experience terms generated by participants in the study. The most commonly used term was hunger or hungry, with 82 participants including it in their response for at least one of the six videos they watched.

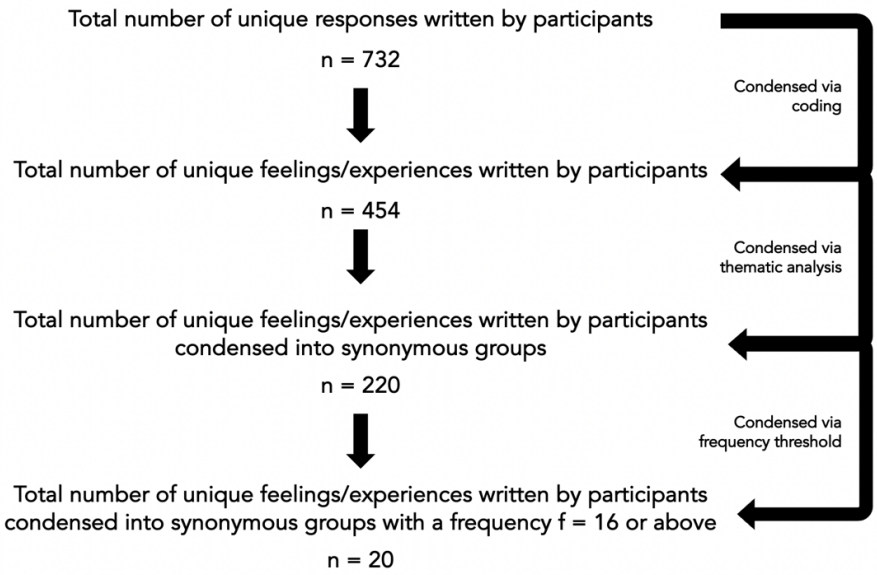

Figure 3. Diagram depicting the process of refining terms from Study 1.

3.7.2 Valence

My next objective was to characterise the valence of the top 20 terms to better identify descriptors that we can use for the Study 2. Valence is highly subjective; therefore, knowing how each participant characterises the terms they wrote is important. Each term had a resulting frequency (n) based on the number of participants who classified that term as either positive, neutral or negative. There were 388 positive terms, 130 neutral terms and 214 negative terms. The frequency of how many times each term was categorised into each valence category (n) was divided by the total number of times that term was written by all participants (f) and calculated to give a percentage. Each term had a positive, neutral and negative percentage representing how participants classified each (see Figure 5). Two terms were consistently classified in the same valence category. The frustrated group of terms were always classified as negative, while the enjoyment terms were always classified as positive. No terms were universally neutral within the top 20. The hunger, curiosity, focused

and alert groups showed the highest levels of neutral classification (43%, 40%, 39% and 81% respectively). This was often closely split with either a high positive or high negative percentage as well, indicating a high level of dispute about the potential valence experienced by the animal. Both hunger and alert were the only terms with more than 5% in all three valence categories indicating that these terms are the most ambiguous to participants.

Table 2. Top 20 feeling and experience terms generated by participants ordered by frequency (f).

		Positive (n=388)		Neutral (n=130)		Negative (n=214)	
Term (Group of terms)	**f**	**%**	***n***	**%**	***n***	**%**	***n***
Hunger, Hungry	82	9	7	43	35	**49**	40
Happy, Happiness, Happy (by the wagging of its tail)	76	**97**	74	3	2	0	0
Bored, Boredom	62	0	0	18	11	**82**	51
Curiosity, Curious (Zebra)	57	**60**	34	40	23	0	0
Playful, Playfulness	44	**93**	41	7	3	0	0
Content, Contented, Contentedness, Contentment	43	**77**	33	21	9	2	1
Relaxation, Relaxed (it looks)	36	**94**	34	6	2	0	0
Calm, Calmness	35	**71**	25	29	10	0	0
Jolly, Joy, Joyful, Joyous	33	**97**	32	3	1	0	0
Loneliness, Lonely	33	3	1	9	3	**88**	29
Excited, Excitement	27	**96**	26	4	1	0	0
Frustrate, Frustrated, Frustration	27	0	0	0	0	**100**	27
Anxiety, Anxious, Anxiousness	26	0	0	4	1	**96**	25
Enjoy, Enjoyable, Enjoying, Enjoyment	26	**100**	26	0	0	0	0
Confused, Confusion	25	0	0	24	6	**76**	19
Satisfied, Satisfy, Satisfaction (with food)	25	**96**	24	4	1	0	0
Sad, Sadness	22	0	0	5	1	**95**	21
Free, Freedom (to move)	19	**95**	18	5	1	0	0
Focus, Focused	18	**61**	11	39	7	0	0
Alert, Alertness (to surroundings)	16	13	2	**81**	13	6	1

Note. Bolded numbers indicate the valence category with the highest percentage for each term. (i.e., specifies which valence category the term has the highest associated percentage with).

3.8 Summary of Study 1

The aim of Study 1 was to develop a set of terms and the associated valences commonly used by non-experts to describe the mental experiences of animals. This helps gain unbiased insight into what mental experience the participant is willing to attribute to each animal. Participants were asked to choose a valence that best suited each descriptive term they wrote. Valence refers to whether a mental experience is positive or negative quality for the animal (Mendl et al., 2010). This allowed further insight into the perception of participants and reduced the assumptions researchers would have to make about what the mental experience meant to each participant.

At the conclusion of Study 1, a series of 20 terms with a response frequency of 16 or above was tabulated including the associated positive, neutral and negative percentages for each term or group of terms. Some terms showed a significant weighting in a single valence category however there were a few instances in which the categorisation of the term was more ambiguous. A second study will be used to help to quantify the mental experiences of animals and test the valence outcomes of Study 1. In addition, the second study would continue to follow the methodology of QBA in which the qualitative nature of each term would be turned into quantitative data via the use of a visual analogue scale and principal component analysis. A second study would also allow for further analysis and direct questioning regarding the stereotypic behaviour videos.

4 Study 2 Methods

In this study, I used the terms generated in Study 1 to evaluate the perceived mental experiences had by animals. I also used Study 2 to validate the methodology developed in Study 1 of this thesis to generate reliable terminology to describe animal behaviour. I also aimed to ascertain how concerned non-experts are about zoo-housed animal behaviour and discern the ability of non-experts to identify various types of stereotypic behaviour in different species. The objective of this study was to broaden the current understanding of how non-experts perceive animal behaviour and the instances in which they can identify stereotypic behaviour and perceive concern about the behaviour. As in Study 1, this study closely follows the Qualitative Behavioural Assessment (QBA) methodology. To align with QBA methods already developed, the qualitative terms generated in Study 1 are represented quantitatively via a visual analogue scale. Although a traditional visual analogue scale in which participants tick a point along a scale (e.g., Fleming et al., 2015; Jarvis et al., 2021; Rousing & Wemelsfelder, 2006) was not used in this study, a set of sliding scales for each term was used. Sliding scales serve the same purpose as a visual analogue scale, transforming qualitative data into quantitative data but are more user-friendly and easier to incorporate into an online study. Each scale allowed participants to select a number from zero to ten. Zero was included in the scale for participants who believed the term did not apply to the video they watched.

4.1 Ethics Statement

The project was evaluated by peer review and qualified as a low-risk study under the Massey University Code of Ethical Conduct (see Appendix A for the full ethics statement). One of the main ethical issues we considered was the distressing nature of some stereotypic behaviours depicted in the videos. It was deemed by industry experts and this research team that no videos depicting animals being harmed by humans or themselves would be included in this study. It was deemed that locomotory and oral stereotypic behaviour would portray the type of behaviour we wanted to show while not being distressing to witness. Participants could also close their browsers if they wished to stop participating. In addition, this study is not concerned with comparing the demographic groups. This means that although the demographic data will be reported, individuals will remain anonymous and will not be linked to their answers.

4.2 Participants

One hundred people (52 females, 48 males) were recruited through the online Prolific website (Prolific, n.d.) to participate in the 12-minute study. Participants ranged between 20 and 70 years of age (M = 35; SD = 11.6). Those who completed the study were paid approximately NZD$ 3.00 in their country's currency. Participation was restricted to people at least 18 years of age located in New Zealand and Australia (n = 25), the United Kingdom (n = 25), the United States of America and Canada (n = 25), and South Africa (n = 25) (see Appendix B for a summary of demographic sex and age). I did not aim to select a representative sample of any particular group. Participants were recruited from these four regions as they are primarily English-speaking and do not represent a single nationality.

4.3 Study Design

This Study followed the generalised format of Qualitative Behavioural Assessment (QBA) but with the novel approach of using non-expert participants to observe animal behaviours. In this quantitative study, I sought to understand people's impressions of animal experiences and identify the sentiment underlying the ratings. I then identified common factors underlying the ratings. I applied these ratings to identify participants' sentiments toward each video while simultaneously ascertaining if they were concerned with and could identify stereotypic behaviours. A storyboard, including the layout of the page, button placement, and timing of progression was created and used as the template to design the study. This study was co-designed using an online platform to create a custom layout and presentation (see Figures 4, 5, and 6 for examples of the study layout). The functional study was then uploaded to Prolific for assess to participants.

4.4 Animal Experience Ratings

The top 20 most frequently responded terms from Study 1 are tabulated in Table 3. Ten positive, neutral, and negative terms were used for Study 2 to represent better the different mental experiences participants attribute to animals. The top four terms with over 80% of participants classifying them as positive were "Happy", "Playful", "Relaxed", and "Joyful". The top two terms with over 40% of participants rating them as neutral were "Hunger" and "Curious". The top four terms with over 80% of participants classifying them as negative were "Bored", "Lonely", "Frustrated", and "Anxious". These terms were brought forward for use in Study 2. See Table 3 for the classification of all the top 20 terms. When

more than four terms met the positive, neutral, or negative criteria, the top four with the highest response frequency were taken. Ambiguous terms refer to terms that did not meet the positive, neutral, or negative criteria. The inclusion/exclusion criteria for classifying terms obtained from Study 1 are summarised below.

Positive term:

- The percentage of participants classifying the term as positive must be greater than 80%, while less than 5% of participants classify the term as negative.

Neutral term:

- The percentage of participants classifying the term as neutral must be 40% or greater.

Negative term:

- The percentage of participants classifying the term as negative must be greater than 80%, while less than 5% of participants classify the term as positive.

Ambiguous term:

- A term that does not meet the positive, neutral, or negative criteria.

Table 3. Top 20 terms and percentage (%) valence by most frequently (f) responded term, according to a positive, neutral, negative or ambiguous classification. Data from 100 participants collected during a Prolific questionnaire survey in November 2022.

		Positive (n=388)		Neutral (n=130)		Negative (n=214)	
Term (Group of terms)	**f**	**n**	**%**	**n**	**%**	**n**	**%**
Positive Terms							
Happy, Happiness, Happy (by the wagging of its tail)	76	74	97	2	3	0	0
Playful, Playfulness	44	41	93	3	7	0	0
Relaxation, Relaxed (it looks)	36	34	94	2	6	0	0
Jolly, Joy, Joyful, Joyous	33	32	97	1	3	0	0
Excited, Excitement	27	26	96	1	4	0	0
Enjoy, Enjoyable, Enjoying, Enjoyment	26	26	100	0	0	0	0
Satisfied, Satisfy, Satisfaction (with food)	25	24	96	1	4	0	0
Free, Freedom (to move)	19	18	95	1	5	0	0
Neutral Terms							
Hunger, Hungry	82	7	9	35	43	40	49
Curiosity, Curious (Zebra)	57	34	60	23	40	0	0
Alert, Alertness (to surroundings)	16	2	13	13	81	1	6
Negative Terms							
Bored, Boredom	62	0	0	11	18	51	82
Loneliness, Lonely	33	1	3	3	9	29	88
Frustrate, Frustrated, Frustration	27	0	0	0	0	27	100
Anxiety, Anxious, Anxiousness	26	0	0	1	4	25	96
Sad, Sadness	22	0	0	1	5	21	95
Ambiguous Terms							
Content, Contented, Contentedness, Contentment	43	33	77	9	21	1	2
Calm, Calmness	35	25	71	10	29	0	0
Confused, Confusion	25	0	0	6	24	19	76
Focus, Focused	18	11	61	7	39	0	0

Note. Words in brackets refer to an instance in which participants response included the word before the bracket but with followed it up with an additional description, (e.g., "Freedom (to move)" means at least one participant wrote "Freedom" and at least one participant wrote "Freedom to move" as their response).

4.5 Materials

Participants were shown a subset of six videos from the same 12 videos used in Study 1. The videos were found on YouTube and were not distributed beyond the study (see Appendix C for links to the video). As in Study 1, the six videos were generated randomly and in a random order for each participant. Out of the six videos, four videos were randomly generated from the group of eight wild-type videos. Two of the videos were generated randomly from the group of four stereotypic videos. This ensured that a participant did not watch all four stereotypic videos or all wild-type behaviour videos.

4.6 Procedures

Participants were first shown an information page that described participants' rights and interests. Once consenting to the study, they were taken to an instructional page that clearly outlined what each participant would be required to do. The videos would automatically start playing once the participant had agreed to participate. It would continue to play on a loop either until the participant decided to click forward or the maximum time (3 minutes) on each page expired. The heading above the video changed from “Video 1” to “Replaying Video 1” once the video had begun to loop. This was to indicate to participants when the video was over, and they were re-watching it. After watching each video for 20 seconds, participants were prompted to answer, “How likely do you think it is that this (animal name) is feeling or experiencing the following terms?” using a series of sliding scales. A score from zero to ten could be recorded, with zero meaning extremely unlikely and ten meaning extremely likely. Figure 3 shows how participants could physically move

each sliding scale and see their response for each of the 10 terms. Participants had to activate each sliding scale by clicking on it, even if they wanted to respond with a zero score. This was to ensure each participant consciously chose to select zero and avoid any ambiguity with a non-response. Participants would answer in the same way for all six videos they saw. Each participant saw a random group of six videos, and each video displayed the sliding scales in a different order to avoid bias. Once participants activated each sliding scale, they could progress to the next video or automatically progress after three minutes.

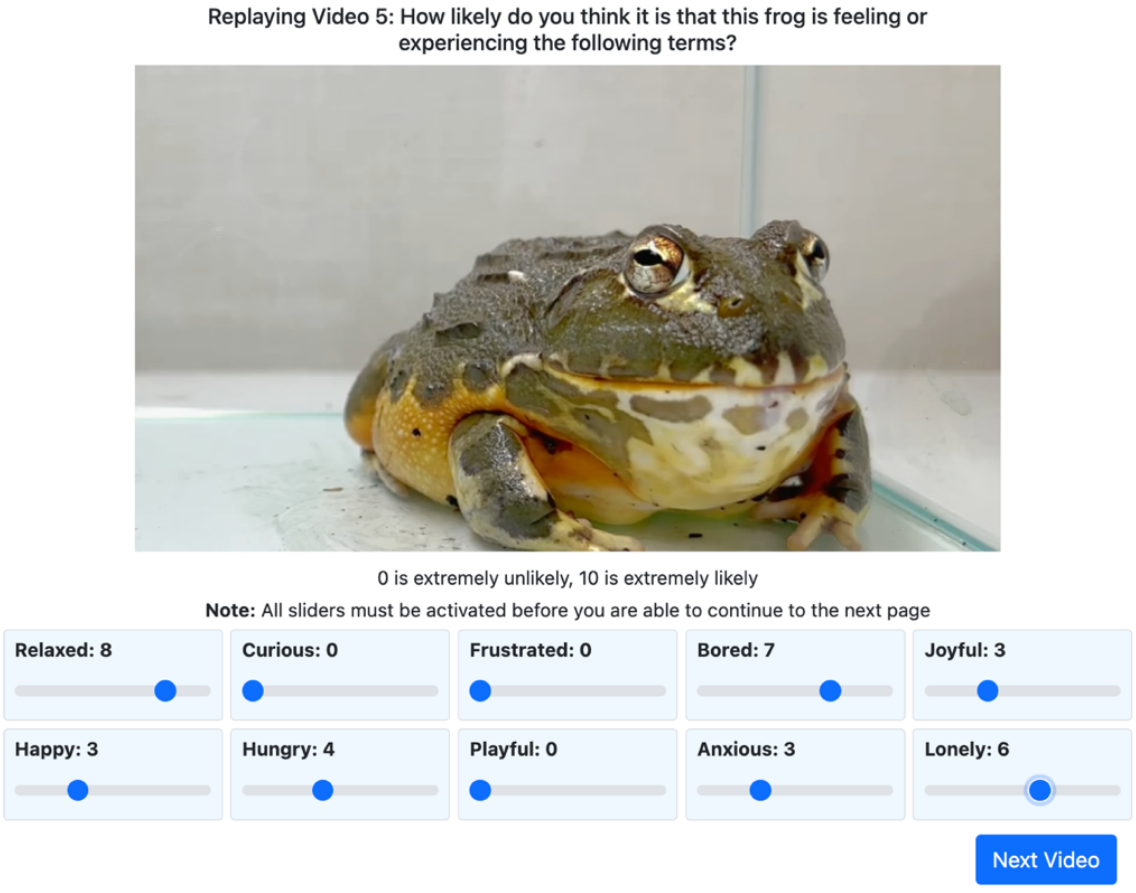

Figure 4. Image of Study 2, part 1 depicting what a typical response to one of the 6 animal videos would look like.

After watching each of the six videos, participants were introduced to part two of the study. Part two involved participants answering two separate questions. Figure 4 & 5 shows how each question page was laid out. Images of each of the six videos the participants saw appeared underneath the question prompt. An instructional page explained that participants must “click on the image(s) you think best answer the question you were asked”. A bolded red border appeared around the image once a participant had clicked it to indicate it had been selected. A ‘next ‘button allowed them to progress after they had selected at least one image, and they were automatically moved forward after 1 minute on the page. After completing the second question, participants were taken to a conclusion page where they were given access to further reading on the subject and given an opportunity to provide feedback on the study.

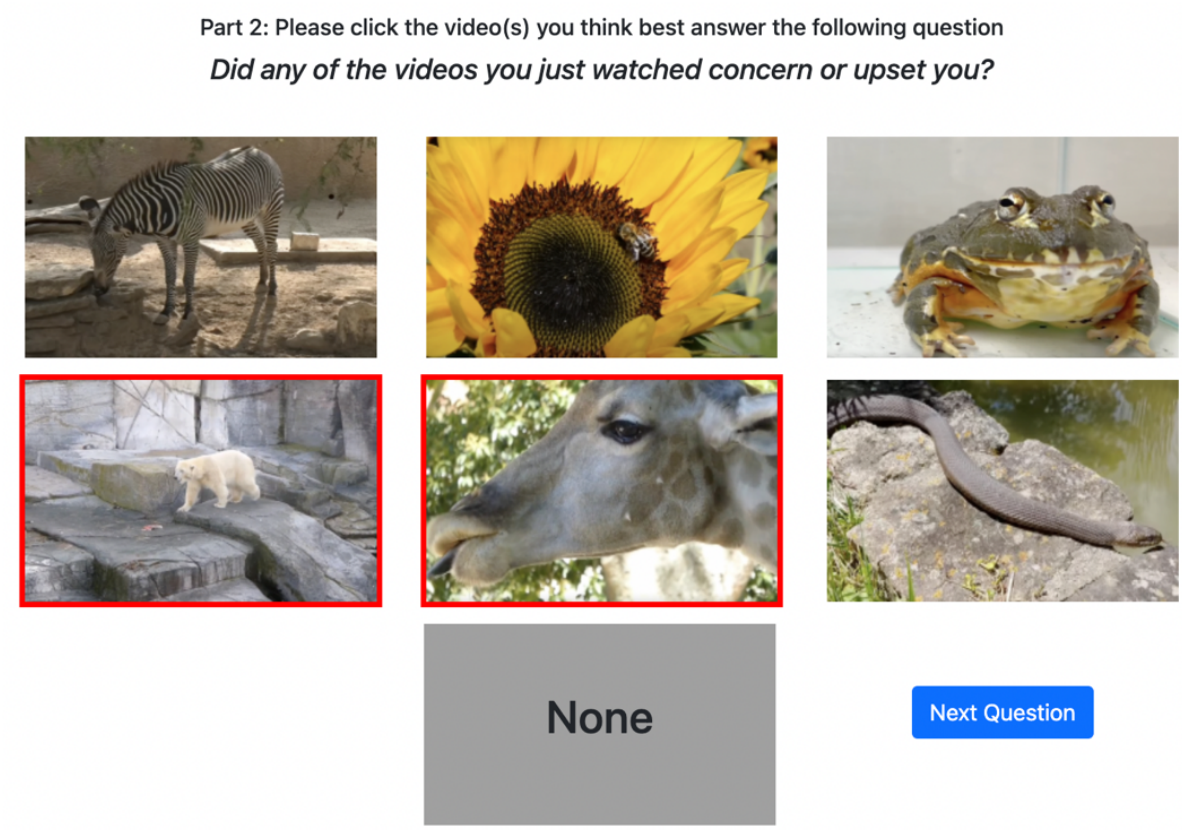

Figure 5. Image of Part 2 of Study 2, depicting the first question asked to participants.

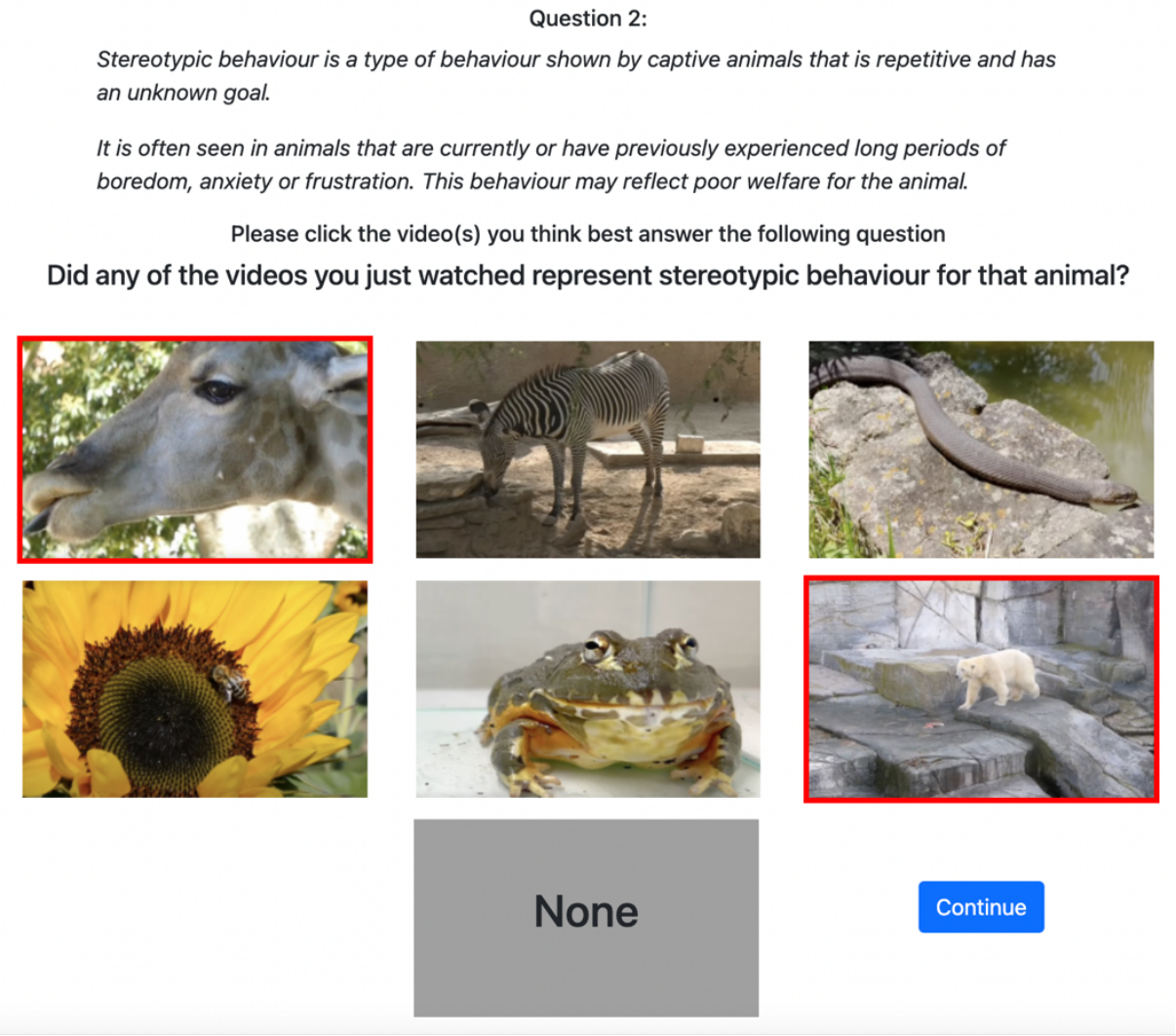

Figure 6. Image of Part 2 of Study 2, depicting the second question asked to participants.

4.7 Data Refinement and Analysis

The data collected from this study was transformed and exported into Microsoft Excel Version 16.66.1. The principal component analysis was carried out in jamovi Version 2.3.21.0. Study questions were analysed in Microsoft Excel. The outputs were compiled and presented in the results section.

4.7.1 Principal Component Analysis

The data collected from Study 2 on Prolific needed to be transformed into a format that would not only be compatible with the jamovi software but also in a format that would allow a principal component analysis (PCA) to be completed. A PCA involves the reduction of dimensions in large data sets. It does this by transforming a large set of variables into a smaller one, while still retaining most of the information from the large set. Various statistical decisions need to be made prior to carrying out a PCA. These decisions affect the process of a PCA and will produce different results. Rotation refers to a method that further analyses initial PCA results to make the pattern of loadings clearer (Brown, 2009). Oblique rotation was chosen in this study, given that the factors are assumed to be correlated (Brown, 2009).

4.7.2 Study Questions

Responses from both questions were tabulated as frequencies for each video. Two frequencies for each video were generated based on which participants thought the behaviour in the video was concerning and which participants thought the behaviour represented stereotypic behaviour. These frequencies were then divided by the total number of participants who watched that video (e.g., the number of people who thought the elephant video was concerning or stereotypic was divided by the total number of people who watched the elephant video). These resulting percentages were recorded alongside the frequencies (see Table 5), and a bar graph was generated to show these results visually (see Figure 10).

4.7 Results Study 2

4.7.1 Principal Component Analysis

The full data set for this study can be accessed online (Gibbs, 2023). A principal component factor analysis was conducted on the 10 items with oblique rotation (direct oblimin). Initially, the PCA was run including all 10 terms or items. Upon checking the Kaiser-Mayer-Olkin (KMO) assumption hunger was seen to have a very low score of 0.41. A score of 0.5 is considered to be barely acceptable (Field, 2013) so the decision was made to remove hunger as an item. The resulting KMO scores were well above the acceptable level. Once the PCA had been run the number of factors to be retained needed to be confirmed. One method for determining the number of factors to be retained is via a scree plot (Figure 7). The point of inflection on this scree plot would justify retaining either 2 or 3 factors (Cattell, 1966). However, given that the third factor did not have an eigenvalue above 1 and the sample size of this study was relatively small only two factors were retained (Field, 2013). This means that the remaining 9 items were loaded on two factors. After further analysis of which items were positively loading onto which factor it was determined that factor 1 represented ‘positive’ and factor 2 represented ‘negative’.

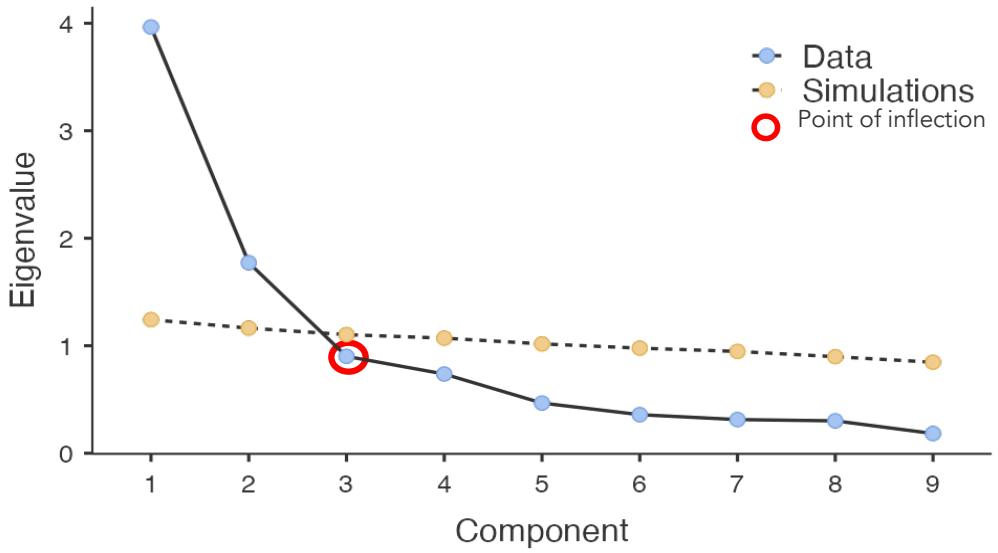

Figure 8. Scree plot showing the point of inflection.

The Kaiser-Mayer-Olkin measure verified the sampling adequacy for the analysis, KMO = 0.820, and all KMO values for individual items were greater than 0.784, well above the acceptable limit of 0.5 (Field, 2013). An initial analysis was run to obtain eigenvalues for each factor in the data. The scree plot would justify retaining either 2 or 3 factors due to the point of inflection (Cattell, 1966). See Appendix E for initial eigenvalues, Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy. Two factors were retained due to the small sample size, as well as the third factor not having an eigenvalue above 1. Two factors had eigenvalues over Kaiser's criterion of 1 (Table 9) and, in combination, explained 63.74% of the variance. A Pearson correlation coefficient was computed to assess the linear relationship between positive (component 1) and negative (component 2). There was a negative correlation between the two variables, r(598) =

-.31, p = <.001. Table 9 shows the factor loadings after rotation. The items that cluster on the same factor suggest that factor 1 represents 'positivity' and factor 2 represents 'negativity'. See Appendix F for summary descriptives by term and animal video.

Table 4. Summary of exploratory factor analysis results (n=100) for the two principal components (PC1 and PC2). Collected during a Prolific questionnaire survey in November 2022.

	Component		
	Rotated Factor Loadings		
Item	**Positive (PC1)**	**Negative (PC2)**	**Communality**
Joyful	**0.9009**	0.00465	**0.809**
Playful	**0.858**	0.11081	**0.681**
Happy	**0.8544**	-0.09709	**0.798**
Relaxed	**0.6161**	-0.27842	0.578
Curious	**0.5222**	0.19452	**0.239**
Lonely	0.0796	**0.83132**	**0.651**
Bored	0.0472	**0.79855**	**0.613**
Frustrated	-0.1043	**0.79795**	**0.707**
Anxious	-0.0674	**0.78728**	**0.662**
Eigenvalue	3.965	1.773	
% of variance	44.05	19.69	
α	0.814	0.827	

Note. 'oblimin' rotation was used

4.7.2 Comparison of Components

The average positive component and average negative component scores for each animal video were also calculated in jamovi. These scores were then plotted onto a graph and represented visually (Figure 8) (see Appendix G for descriptives of each animal video by positive and negative value). The videos are represented by icons showing the animals that were the focus of each video. Red circles indicate the videos showing stereotypic behaviour. The polar bear video was classified as the most negative out of all the videos. This is shown by the polar bear having the highest negative value.

In contrast to this, the otter video was the video that was classified as the most positive, indicated by the highest positive score. The videos featuring the shark, tiger, and zebra were classified with nearly equal measures of positivity and negativity. The tiger, zebra and frog videos did not depict stereotypic behaviour but were classified by participants as being more negative than the stereotypic shark and giraffe videos.

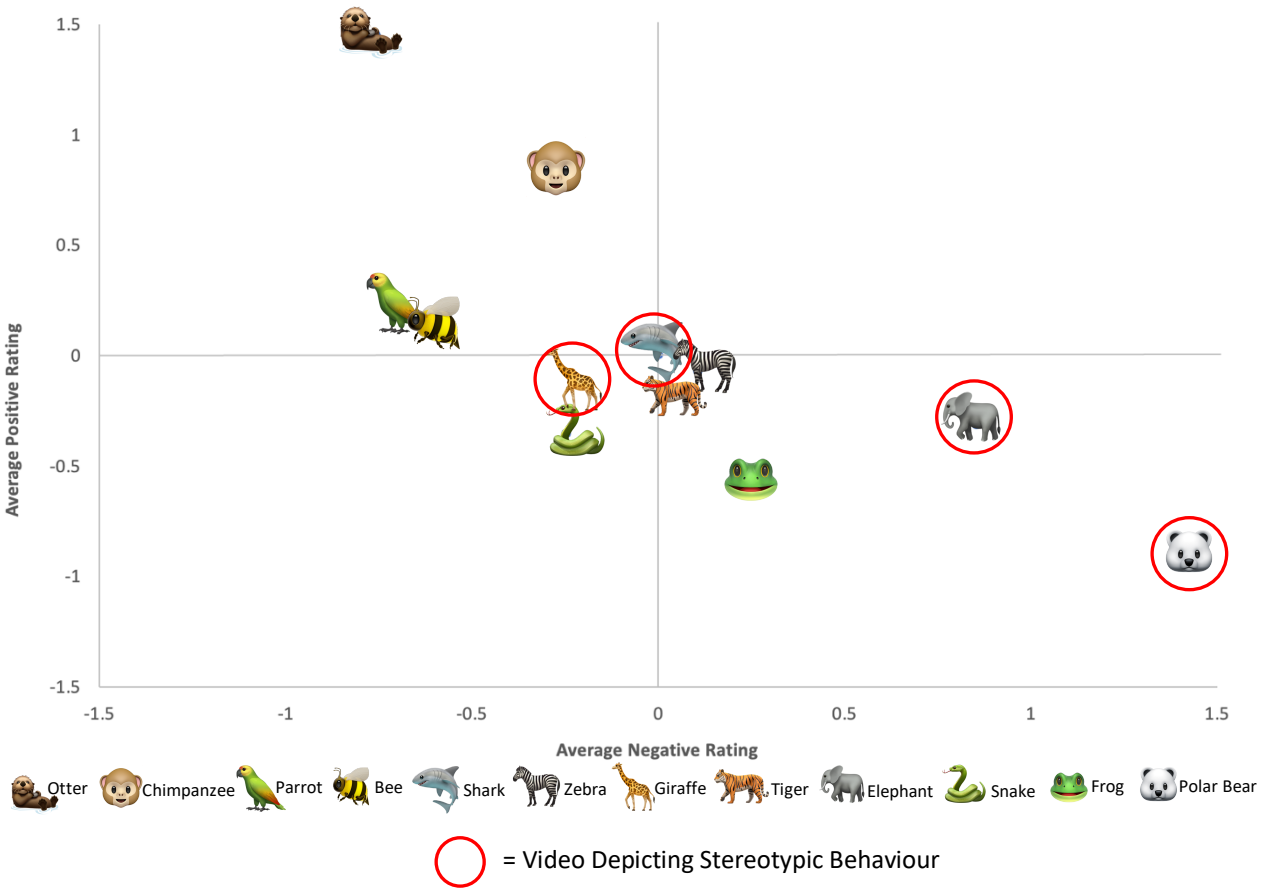

Figure 9. Distribution of the 12 animal videos based on the average positive (PC1) and average negative (PC2) score. Data from 100 participants collected during a Prolific questionnaire survey in March 2023.

4.7.3 Concerning and Stereotypic Behaviour Video Classifications

The total number of participants who watched each video is noted by n in Table 10. The number of participants who classified the video as concerning (% Concern) and possibly representing stereotypic behaviour (% Stereotypic behaviour) was divided by the total number of participants who watched the video (n). This gave a percentage concern and percentage thought to be stereotypic behaviour for each animal video. Table 10 is ordered based on the highest percentage of participants who watched the video thinking it

represents stereotypic behaviour. The polar bear has the highest level of concern and was thought to be stereotypic behaviour by the most participants. Participants ranked the snake video as least likely to represent stereotypic behaviour, but the video did raise some concern with participants (5% compared to 18%). The otter, bee and parrot videos raised no concern with participants, but these videos were classified as stereotypic behaviour by 29%, 12%, and 6% of participants, respectively. Only 2% of participants thought that none of the videos represented stereotypic behaviour, while 32% found no concern with the videos. Figure 9 visually depicts the percentage concern and percentage thought to be stereotypic (as per Table 10). Figure 9 shows that in all cases, bar the snake or choosing "none" of the videos, the percentage of participants who watched the video thought the behaviour might represent stereotypic behaviour is much higher than the percentage of perceived concern for the same video.

Table 5. Table depicting the proportion of participants who watched each video and whether they showed concern towards the video and whether they thought the video showed stereotypic behaviour.

Video	n	% Concern	% Stereotypic Behaviour
Polar bear	**48**	**65%**	**81%**
Elephant	**50**	**44%**	**80%**
Shark	**60**	**20%**	**57%**
Frog	48	25%	40%
Zebra	53	21%	38%
Giraffe	**42**	**7%**	**31%**
Otter	41	0%	29%
Tiger	58	12%	28%
Chimpanzee	54	2%	15%
Bee	42	0%	12%
Parrot	49	0%	6%
Snake	55	18%	5%
None	100	32%	2%

Note. 'None' refers to the option each participant had to choose none of the videos

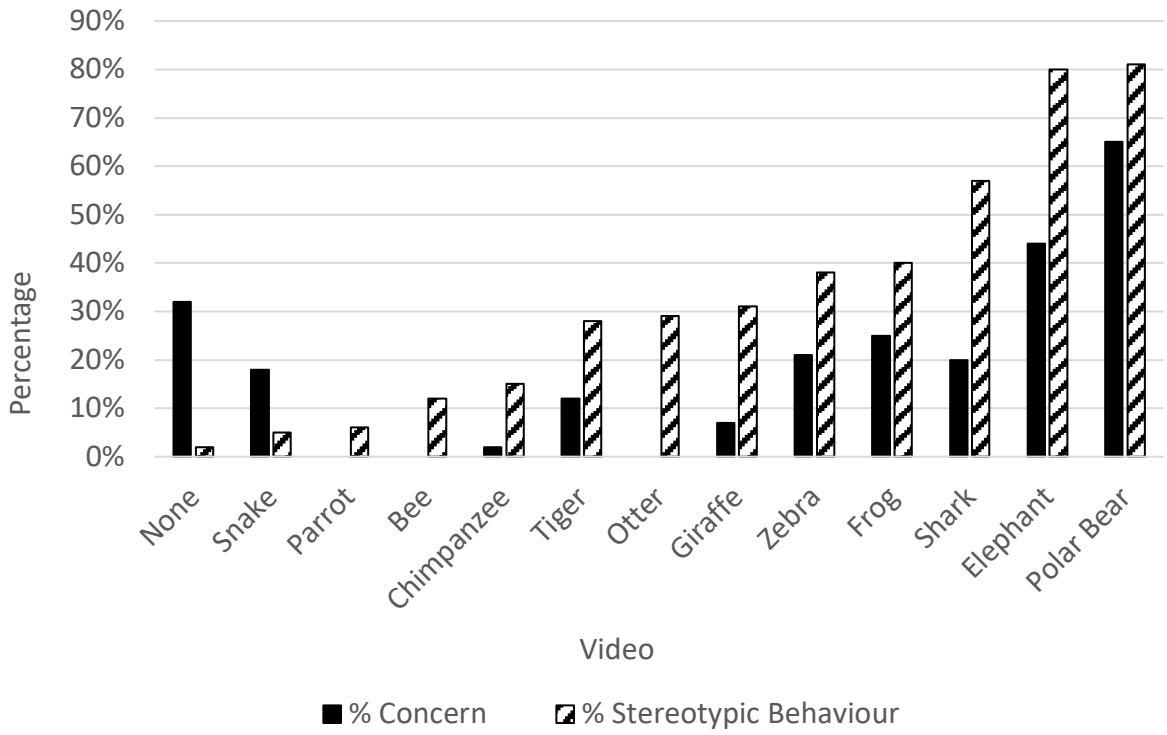

Figure 10. Graph showing the percentage of participants who watched the video who perceived concern and thought the video depicted stereotypic behaviour. Data from 100 participants collected during a Prolific questionnaire survey in March 2023.

Note. 'None' refers to the option each participant had to choose none of the videos

5 Discussion

5.1 Evaluating Terms and Valences Used by Non-Experts to Describe Animal Behaviour

The first aim of this thesis was to develop a set of terms and the associated valences commonly used by non-experts to describe the mental experiences corresponding to various types of behaviour in zoo-housed animals. There is no direct methodology currently available to gauge non-experts' perceptions of animal behaviour. Approaches to measuring perception rely on surveys and questionnaires, requiring interpretation of responses. Additionally, non-experts' limited knowledge and experience hinder their involvement in animal behaviour studies (Tami & Gallagher, 2009). To address this, I devised a methodology amalgamating two established methods.

Aim 1 was achieved via the generation of terms in Study 1 and confirmation of valences in Study 2. This approach involved crafting an online survey mirroring Qualitative Behavioural Assessment (QBA) format to extract terms from non-experts describing animal mental experiences. A table of the top 20 most commonly responded terms non-experts use to describe the mental experiences of animals and the associated valence was developed (see Table 3). Only 10 terms were brought forward and used in Study 2; therefore, confirmation cannot be made that all the top 20 terms had consistent valences. The 10 terms could be applied to future research as they relate to a spectrum of animals and behaviours.

5.1.1 Evaluation of the Generated Descriptive Terms

The outcome of Study 1, presented in Table 3, shows participants' perceptions of mental experience terms and their associated valences within the context of animal behaviour. There was the highest prevalence of positive terms written by participants (n=388) compared to the neutral and negative terms. Notably, the prevalence of terms like "Happy", "Playful", and "Relaxed" shows that non-experts can identify and are willing to attribute positive mental experiences to animals. This is concurrent with current research, which shows that people can share positive feelings and empathy towards animals (Young et al., 2018). People experience heightened positive empathy for those they have strong connections with, prompting action when they think it can create a positive impact. From a sustainability perspective, zoos could centre their efforts on helping visitors understand what contributes to the happiness of these animals (Young et al., 2018).

"Hunger" and "Curious" were the only two neutral terms within the top 20, with 40% or more participants considering these terms neutral. These two terms were brought forward and used in Study 2 as 'neutral' options. When used in the principal component analysis (PCA) during Study 2, hunger did not load on either component 1 (positivity) or component 2 (negativity), indicating that participants did not think about hunger in the same way they did other terms. In addition, due to a low Kaiser-Mayer-Olkin (KMO) value, the term Hunger did not meet the criteria to be included in the Study 2 analysis (Field, 2013). Therefore, hunger was removed from further analysis, leaving nine items.

Hunger can be considered a "survival-related" mental experience given that the associated behaviour maintains internal body function essential to the animal's survival (Mellor et al., 2020). The other nine terms are "situation-related" mental experiences

associated with responses to animals interacting with external stimuli such as the environment, other animals, and people (Mellor et al., 2020). This, along with the influence of culture on human perceptions, could explain why hunger did not fit the PCA model. Most participants in the study were located in higher-income countries and may not have negative connotations associated with hunger, (i.e., these participants may be more likely to have constant access to food meaning they do not experience hunger in a negative way).

In Study 2, "Curious" emerged as a neutral term similar to Study 1, but without the complexity observed with "Hunger." Despite having a lower factor loading (0.5222), it surpassed the required threshold (0.512) for inclusion. "Curious" exhibited a significant positive loading score on the positive component and a smaller positive loading on the negative component, although this was not statistically relevant. Participants initially saw it as neutral, but its alignment with the positive component and its classification as a "situation-related" mental experience (Mellor et al., 2020), suggests a good fit in the PCA model. Study 2 results indicate that "Curious" likely carries a more positive connotation than initially shown in Study 1, highlighted by its higher loading on the positive component. Overall, neutral terms may not fit the classical definition of welfare-relevant mental experiences; where valence (positive or negative) is considered necessary to influence animal welfare (Browning & Birch, 2022; Mendl et al., 2010). Future research may consider excluding neutral terms from analysis or not allowing participants the option to choose neutral as a valence.

Terms such as “Bored”, “Lonely”, “Frustrated”, and “Anxious” were all categorised by participants as being negative mental experiences. These mental experiences evoke a sense of isolation and dissatisfaction. This observation is particularly pertinent as it suggests a shared understanding among participants regarding the aversive nature of these mental

experiences. Non-expert's perception of animals is likely influenced based on knowing how these animals behave and interact in the wild. For instance, animals such as elephants, often seen in herds in the wild, would automatically elicit negative feelings in visitors if they saw an elephant isolated (Young et al., 2018). Juxtaposed with this, negative feelings towards animals (e.g., hatred or fear directed at snakes) are associated with reduced concern for their welfare (Serpell, 2004). This could explain discrepancies between negative mental experiences written by participants for a particular video and a low level of concern for the same video (see Appendix H, and Table 11).

The findings underscore the diverse and nuanced ways participants attribute valences to various animal mental experiences. Only two terms within the top 20 showed 100% consistency in the reported valence (“Frustration” and “Enjoyment”). Most terms showed significant percentages across at least two valence categories (e.g., “Bored”, “Curious”, “Content”, and “Calm”). These insights contribute to a deeper comprehension of the interplay between the interpretation (via human perception) and the mental experiences of animals, inviting further exploration into the intricacies of animal behaviour perception.

5.2 Validating Methodology for Reliable Animal Behaviour Terminology

The second aim of this thesis was to validate the methodology for generating reliable terminology non-experts use to describe animal behaviour. In Study 2, I measure non-expert's perceptions of the mental experiences of animals. The data from Study 1 was validated via the quantitative methods of Study 2. In Study 1, I identified the top ten terms meeting criteria for Study 2 analysis; four positive, four negative, and two neutral terms. A

principal component analysis (PCA) condensed items into two key components: positivity and negativity. Aim 2 was successfully achieved by aligning valences for the terms established in Study 1 with those in Study 2. For example, participants in both studies recognised happiness as a positive mental experience. The results of Study 2 reaffirmed that this methodology is reliable for generating and understanding non-expert perceptions of animal behaviour.

5.2.1 Effectiveness of Free-Choice Profiling

In Study 1 Free-Choice profiling (FCP) was used to gain an unbiased response from non-experts towards the behaviours they were watching. Some QBA studies use pre-established lists of terms and ask participants to only use words from the list (eg., Duijvesteijn et al., 2014). This limits the ability to infer perception, given that responses recorded in this way are biased and based more on expert knowledge. In addition, if participants were given the terms, they may have felt inclined to answer a certain way, or that none of the terms reflect what they see. Pre-set scales could lead to biased assessments, while freedom to create terms allows for uninhibited observation, enabling the investigation of shared approaches among observers (Wemelsfelder et al., 2000). The videos used for Study 1 and Study 2 showed various animals, environments and behaviours, meaning the impact of species, environment and behaviour bias is reduced and that the output of terms is the most frequently used term to describe many animals in different contexts. This was done to try and gain the broadest understanding of how non-experts perceive animal behaviour. The top 20 terms give a comprehensive list that can be used in future research. The list of terms also gives researchers, and industry experts a starting

point for the types of mental experiences non-experts are willing to attribute to animals. The top 20 terms are mostly linked to situation-related mental experiences (Mellor et al., 2020). Exploring the integration of survival-related oriented terms in subsequent analyses could be an insightful next step.

5.2.2 Effectiveness of Attributing a Valence to Each Term

In addition to Free-Choice Profiling, participants were asked to attribute valence to the generated terms. Evaluating the valence of terms went beyond typical QBA practice but was vital in this case. Like other behaviour observation methods, QBA mainly uses industry experts to observe and record behaviours (Duijvesteijn et al., 2014; Patel et al., 2019). This means that interpreting the descriptive terms they wrote is less necessary because it would be expected that, in most instances, they are correctly interpreting the behaviour they witness. Adding in the valence step removes the assumptions that would otherwise have to be made about how non-experts perceive the descriptive terms. Valence is subjective, varying between individuals (Kuppens et al., 2013). Therefore, making assumptions about what people mean when describing animals makes it easy to misrepresent people's perceptions. Participants' experiences of emotions like boredom or loneliness may differ. By having participants attribute valences to terms, assumptions about their descriptions are avoided. These terms and associated valences are valuable for future qualitative animal-related studies, and given that the valence of each term is known, researchers can be more confident in their conclusions.

5.2.3 Effectiveness of Methodology

The results of Study 2 helped validate the results we found in Study 1 by confirming how participants viewed each descriptive term. Study 1 results gave us an initial idea about the valence participants attribute to each term, and Study 2 results confirmed most of these findings. In Study 2, all 8 terms, except for the two neutral ones, were associated with the component they were perceived to represent from Study 1. For instance, in Study 1, participants predominantly linked "Happy" with positivity, and in Study 2, "Happy" similarly loaded onto the positive component. It was beneficial to validate the use of the terms on a completely new group of participants. This was to confirm whether the perceptions of Study 1 participants were reflective of the whole population. It also shows that if needed, Study 1 alone would be at least a somewhat reliable way to assess non-experts' perceptions towards animal behaviour. The two follow-up questions were an additional step compared to what Qualitative Behaviour Assessment (QBA) usually does. This was done as the identification of stereotypic behaviour was needed for Study 2. These questions would not be needed if only a general perception needed to be gathered. To make sense of how non-experts were thinking about this behaviour and to remove any assumptions about their responses, participants were asked which videos they thought showed stereotypic behaviour. This, along with asking if any of the videos concerned them, allows more specific conclusions about what they thought about the animals to be drawn. If we did not ask these questions, conclusions would need to be drawn from the descriptive terms alone. Assumptions would need to be made that negative mental experiences mean concern or the presence of abnormal behaviour when this might not always be the case. This additional step was essential and beneficial in answering the aims of this thesis. Researchers using this

methodology for future studies can likely be confident about what participants mean and understand their perceptions in greater detail.

5.3 Evaluation of Concern and Identification of Stereotypic Behaviour [3]

The first question asked to participants during Study 2 was whether they thought any videos were concerning. This question was asked first to gain the participants' initial reaction and allow them a point of reflection. This question also relates to the third aim of ascertaining if non-experts are concerned with various types of stereotypic behaviour in different zoo-housed species. This aim was somewhat achieved as participants did perceive a significant level of concern towards some of the stereotypic behaviour videos, but not all. The video that raised the most concern with participants was the polar bear video, with 65% of participants rating it as concerning. Two other stereotypic behaviour videos (shark and giraffe) raised significantly less concern with participants. The shark video was considered concerning by 20% of participants, while the giraffe concerned only 7%. The animal videos that raised the least concern with participants were the otter, bee, and parrot videos. All of these videos were considered concerning by 0% of participants.

The fourth aim of this thesis was to explore if non-experts could identify various types of stereotypic behaviour in different zoo-housed species. This was done by giving participants the literature definition of stereotypic behaviour and asking them to select the videos they believed depicted animals displaying this type of behaviour. This aim, like aim 3,

[3] Note: Any reference to the percentage of participants rating or classifying a video in the following sections refers to the percentage of participants who watched the video, not the total number of participants in the study.

was only somewhat achieved as participants could identify some, but not all, of the stereotypic behaviours. The polar bear showing stereotypic pacing was the animal video most recognisable to participants as representing stereotypic behaviour, with 81% of participants identifying it. In addition, the elephant displaying stereotypic swaying was also a highly recognisable behaviour, with 80% of participants identifying it as a stereotypic behaviour. Only just over half of the participants (57%) could recognise the shark displaying repetitive twirling motions as potentially being a stereotypic behaviour. However, this is a large decrease from the percentage of people who recognised the polar bear and elephant behaviours. The least recognised stereotypic behaviour was the giraffe displaying oral stereotypic behaviour. Only 31% of participants were able to identify this behaviour as potentially being stereotypic. In addition, the wild-type behaviours displayed in the frog and the zebra videos had a higher percentage, 40% and 38%, respectively, of participants rating them as stereotypic compared to the giraffe video. The ability of participants to identify a behaviour as potentially resembling stereotypic behaviour and the fact that participants perceived concern in some instances but not others could be due to several factors outlined below.

5.3.1 Influence of Human Perception on Stereotypic Behaviour

5.3.1.1 Influences of the Elements Contributing to Human Perception

Human perception significantly influences the study's aims to determine if non-experts are concerned about stereotypic behaviour in zoo-housed species. Humans evaluate animals based on their cognitive frameworks, emotions, and cultural biases. This inherently affects how non-experts perceive and interpret animal behaviour. People associate positive qualities like intelligence and sociability with animals having specific physical traits (Sarwer

et al., 2003). For instance, sharks and giraffes lack features that evoke positive perceptions, such as big eyes and round faces. This might explain why the animals displaying stereotypic behaviour and featuring these traits raised more concern and were more accurately identified (e.g., polar bear and elephant) than the animals displaying stereotypic behaviour but without the 'attractive' physical traits (e.g., shark and giraffe). In addition, the polar bear and elephant video may have invoked more empathy via the Baby Schema effect (Lehmann et al., 2013; Prguda & Neumann, 2014). Physical attractiveness and Baby Schema traits increase empathy, and these characteristics could also increase a willingness to attribute positive mental experiences. Cuteness may equate to an increased perception of positive behaviour, which could explain the low concern for the otter and chimpanzee videos (Jack & Carroll, 2022).

In addition to physical attributes, familiarity with mental experiences associated with different behaviours would also increase non-experts' ability to perceive concern and identify stereotypic behaviour correctly. Pacing and swaying are behaviours humans would typically associate with anxiety or fear (Doumas et al., 2018; Niknamian, 2019), making it easy to attribute these feelings to animals displaying the same behaviour. In addition, these behaviours are large locomotory behaviours that are easy to identify, given their full-body nature. Marine and oral stereotypic behaviour could be more challenging for non-experts to identify, given their diverse nature and lack of personal experience with the behaviour (Johnson et al., 2009; Roshier et al., 2008). Familiarity also helps people understand the animal's behaviour (Lim et al., 2022) and the resulting mental experiences associated to that behaviour.

Similarly to familiarity with the behaviour, human-like behaviour is relatable to humans, increasing anthropomorphism and eliciting a favourable response (Torta et al.,

2013). Pacing and swaying are behaviours humans typically link with anxiety or fear (Doumas et al., 2018; Niknamian, 2019), making it instinctive for non-experts to attribute the same feelings to animals displaying similar behaviour. Participants may have been less willing to anthropomorphise and attribute mental experiences towards behaviours displayed by animals from marine environments. Unfamiliar behaviours such as buccal pumping in the frog and grazing in the zebra also make it hard to link these behaviours with personal experiences. In addition, human-like behaviour can increase feelings of joy and amusement (de Waal, 2011). Hence, watching the chimpanzee climb raised little concern among participants as this may have evoked positive childhood memories with participants.

5.3.1.2 Influence of Advanced Perception

Perceiving a high level of cognition in animals can influence the ability to identify their behaviour accurately. It may lead to bias towards interpreting behaviours as more complex and intentional than they are or undermining complex feelings if cognition is perceived to be low (Mameli & Bortolotti, 2006). Animals in these studies perceived to have high levels of cognition could be mammals such as the polar bear and elephant (Callahan et al., 2021). This would explain why participants were happy to consider these animals capable of performing stereotypic behaviour. Mammals are perceived to have more cognitive abilities than Fish, Reptiles, Amphibians and Invertebrates (Eddy et al., 1993).

The perception of higher cognitive ability could result in an increased perception of complex mental experiences, such as the ones associated with stereotypic behaviour (Mason & Rushen, 2006). This reasoning could also explain why fewer participants identified the shark video as stereotypic. The shark may have been perceived to have less cognitive ability and, therefore, incapable of having the mental experiences associated with

stereotypic behaviour. Cultural, societal and personal factors greatly influence this perception (Weber, 2010), hence the variation in participants' willingness to perceive cognition. Animals with more cognitive capacity tend to receive greater moral consideration (Piazza et al., 2014). This higher level of perceived cognition results in people viewing these animals as deserving more protection (Waytz et al., 2010).

Mind perception and the components that make up mind perception significantly influence non-expert perception. The perceived level of cognition is the first step in attributing a mind to an animal. The higher the perceived level of cognition, the higher the degree of mind perception. In addition, the greater the perceived mind, the greater the moral capacity and complex mental experiences animals are perceived to be capable of (Piazza et al., 2014). Bastian et al. (2012), found that mammals such as elephants, monkeys, and lions (similar to tigers) were seen to have the highest perceived mind. In contrast, animals such as frogs and sharks were seen to have much less of a mind. This reasoning could explain why complex behaviours such as stereotypic behaviour were attributed to animals with a greater mind. In contrast, the shark was perceived not to have displayed stereotypic behaviour because they may have been perceived to have a lower mind level. Mind perception is complex, multifaceted, and personal, making breaking down each participant's perception of each animal nearly impossible. Trends can be seen in the way non-experts thought about animals.

The greater the level of perceived mind, the more moral judgement is afforded to that animal. Moral perception influences our understanding of behaviour and guides our moral judgement (Jin & Peng, 2021). Other aspects that influence our perception, such as physical characteristics, cognition and familiarity, will influence how we see the animal. As an extension of this, certain behaviours can be perceived as morally good or bad and

morally right or wrong (Jin & Peng, 2021). This means that concern for abnormal behaviour is likely influenced significantly by what people think about the animal. The perception of a mind increases the willingness to attribute mental experiences to animals, which, in turn, increases the moral judgement of which animals require intervention or protection. This can influence the level of concern participants may have had towards certain animals making people less inclined to consider their suffering morally significant (Bastian et al., 2012). This capacity to have subjective mental experiences (i.e., sentience) is the basis of human protections afforded to animals in many jurisdictions (eg., Animal Welfare Act, (NZ), 1999; Animal Welfare Act, (UK), 2006).

5.3.1.3 Anomalies in the Data Relating to Human Perception

Given that the explored literature encompasses diverse dimensions like animal cognition, anthropomorphism, physical traits, familiarity, and the animal mind. When certain trends diverge from established literature, another facet of perception might explain the anomalies. For instance, sharks, lacking attractive physical traits (Jack & Carroll, 2022), being less familiar to people (Johnson et al., 2009), and historically perceived to have less mind (Bastian et al., 2012), would seemingly elicit reduced empathy. However, participants identifying the shark video as stereotypic and perceiving concern challenges conventional perception research. Even so, this could be explained by contextual factors, such as the captive setting depicted in the video (Finlay et al., 1988). Anomalies arising from one aspect of perception finding resolution in another is a recurring theme in this thesis.

A notable observation from both studies is that identifying stereotypic behaviour doesn't directly correlate with levels of concern. To prevent bias, participants were initially asked about their concern before being provided the definition and information that linked

stereotypic behaviour to poor welfare. However, in all cases bar the snake video, a lower percentage of participants identified the videos as stereotypic than those who expressed concern. Strikingly, despite varying concern levels, all videos had at least 5% of participants acknowledging their potential for being stereotypic. This suggests that the behaviour alone was not prompting participant concern. The subjective and vague definition of stereotypic behaviour and participants' inclination to categorise all repetitive behaviours as stereotypic likely contribute to this trend. It would have been interesting to inquire whether participants' concern levels shifted after learning about stereotypic behaviour and its implications for animal welfare.

5.3.2 Influence of Environmental Complexity and Enrichment

The complexity and 'naturalness' of the environment an animal is housed in can influence the way the animal is perceived (Fraser et al., 1997). Many zoos house animals in small enclosures with little variation (Maślak et al., 2016). The background environment and the features of the video may have influenced participant perception and, therefore, the ability to recognise the stereotypic behaviour (Godinez & Fernandez, 2019). The giraffe video showed only the head of the giraffe, giving participants little other contextual information to draw on. The giraffe's environment and the context of whether any food was present were also unknown. The lack of contextual information given to participants in this video may have influenced their ability to recognise the behaviour as stereotypic.

Captive or zoo environments are typically seen as less favourable than naturalistic or wild habitats (Finlay et al., 1988). Animals inhabiting naturalistic environments may also be perceived to have more naturalistic behaviours and better welfare (Fraser et al., 1997). The external environment of the frog video may have also played a role in the perception of the

behaviour. The barren and restricted space the frog was in could have negatively impacted how this behaviour was perceived. Participants could have drawn conclusions based on the environmental conditions the frog was in and assumed that the frog's wild-type behaviour must also reflect something negative. Similarly to that of the frog, the environment the zebra was housed in may have also contributed to the misidentification of the wild-type behaviour. The zebra was shown in a captive, most likely, zoo setting with a concrete wall and artificial structures visible. Fàbregas et al. (2012), found that 78% of people believe that a naturalistic enclosure provides suitable requirements for inhabitants, while only 40% believed that non-naturalistic enclosures met the same level of suitability. This may have meant that more participants were likely to attribute negative feelings, assuming the zebra is not living in a naturalistic setting.

In addition, some videos gave participants a broader context to draw on. The otter, tiger, bee, parrot and snake videos were all free of artificial objects in the background, and it was clear that these animals were not in a captive setting. These videos depicted animals in a wild setting, which may have influenced the participants' perceptions. The fact that all of these videos were captured in a wild setting may have reduced participants' willingness to perceive concern. It could be that a wild animal is perceived as ‘free’ and therefore did not concern participants (Fraser et al., 1997). Other videos showing wild-type behaviours but in a captive setting, such as the frog and zebra, raised much more concern with participants. In this instance, it was clear that these animals were held in captive environments, and that alone, regardless of their behaviour, could have raised concern with participants. These perceptions align with the sentiments underlying the natural living orientation towards animal welfare (Fraser et al., 1997). In this orientation, an animal’s welfare is perceived to be good when animals can carry out natural behaviours in a natural environment (Webster

et al., 2015). Non-experts often gravitate towards the natural living orientation due to its alignment with the intuitive belief that animals' well-being is linked to their ability to engage in innate behaviours within their native surroundings. This resonance with common perceptions highlights the appeal of prioritising animal welfare through facilitating natural behaviours and environments.

5.4 Practical Implications for Zoos and Social Licence to Operate

Understanding how non-experts perceive animal behaviour can help zoos enhance visitor experiences by tailoring exhibits and educational programs to resonate with visitors. The ability of non-experts to attribute negative mental experiences to animals shows that they understand the capacity for animals to suffer in some capacity and that this suffering matters. Zoos need to be aware of the compromised welfare perceived by non-experts. Knowing which behaviour non-experts perceive concern in will highlight which behaviour requires the most mitigation for zoos to maintain their social license to operate. While public perceptions play a role in shaping social license to operate (SLO), it's important to acknowledge that these perceptions can sometimes be misinformed or inaccurate. Non-exerts are not always drawing the correct conclusions about the mental states of animals and this has been evident throughout this thesis (e.g., the high concern towards the zebra and frog but lower concern for giraffe and shark). The perpetuation of misunderstandings through SLO raises questions about whether it is truly beneficial for zoos to base their interventions solely on what the public deems concerning. Nonetheless, understanding the public's perception will help to shape the management and the prioritisation of animal

welfare mitigation strategies (Cobb et al., 2020). Non-expert perception has already been a powerful motivator for change as their perceptions of animal welfare played a major role in reshaping the modern zoo (Webber et al., 2022). Moreover, understanding their perceptions can inform ethical considerations surrounding zoos and wildlife conservation. In animal behaviour research, considering public perceptions can lead to more relevant and practical outcomes. Balancing public sentiments with well-founded scientific understanding is crucial to ensure that interventions genuinely align with the best interests of animals in zoo settings.

In addition, understanding public concerns and perceptions can help zoos enhance animal welfare practices, ensuring captive animals have enriching experiences that align with public expectations (Cobb et al., 2020). By incorporating visitor and non-expert perceptions into zoo programs, exhibits, and educational materials, zoos can tailor their conservation and educational efforts to effectively communicate the importance of biodiversity preservation and garner public support. Gaining public approval and legitimacy through SLO is crucial for zoos' continued existence. Therefore, actively participating in conservation initiatives, researching conservation efforts, and prioritising animal welfare and education can help zoos secure public confidence and support. Addressing ethical concerns and implementing strategies prioritising animal welfare and conservation objectives are essential to address public perceptions and maintain relevance. Animal welfare is a developing field, and ensuring zoos maintain and apply new knowledge will increase their sustainability and use of animals in the future (Cobb et al., 2021). By promoting conservation efforts and educating the public about wildlife and environmental preservation, zoos can inspire individuals to take action and support broader conservation initiatives.

Overall, zoos need to understand non-experts' perceptions of zoo-housed animals as they could represent fee-paying visitors to the zoo. Non-experts hold significant influence over how zoos operate and what their priorities are (Hampton et al., 2020). Ensuring visitors have a positive experience will increase the revenue of repeat visits and willingness to contribute to conservation efforts (Anderson et al., 2003). In the face of increasing social scrutiny, zoos must validate their existence and gain public acceptance. Recognising the significance of visitor and non-expert perceptions becomes paramount as they directly impact zoo management. Exhibiting social and environmental accountability, zoos can cultivate trust among the public, securing their continued presence in society (Boutilier & Thomson, 2011).

5.5 Limitations

One of this thesis's main limitations was using animal videos rather than live animals for behavioural observations. Video recordings have some benefits for animal research, including the reduced impact a human presence would have on animal behaviour (Giersberg & Meijboom, 2022). However, given the contextual information needed to correctly interpret behaviour, allowing participants to watch live animals and describe the mental experiences of animals would provide a much deeper understanding of their perception. Watching video footage limits the conclusions people can draw, given the lack of contextual and environmental factors that they can draw on (Giersberg & Meijboom, 2022). This may impact their perceptions, and their perception of some behaviours may change significantly if they are privy to a wider context. Another issue with the videos used in this thesis was their short nature. Each video only ranged from 20 to 40 seconds and played on a

continuous loop. Participants were told once the video had started replaying, but the behaviours could easily be misconstrued to be more repetitive than they were. In addition, it did not allow participants to see the animals in other contexts or compare the focus behaviour to other types of behaviour. The perceived level of repetition was a key aspect of this research, and although unavoidable, altering how repetitive the behaviour looked could have unfavourable skewed participants' perceptions. This could have significantly changed how they described the behaviour and accounted for some wild-type behaviours being more negative than they would otherwise be perceived.

The methodology used in both studies of this thesis follows a similar structure to Qualitative Behaviour Assessment (QBA). One of the main aspects of QBA is the general procrustes analysis (GPA), which is done at the conclusion of generating terms (Napolitano et al., 2009; Rutherford et al., 2012; Wemelsfelder et al., 2001). GPA is a statistical analysis used to find a consensus between observer assessment patterns and determine the agreement (Wemelsfelder et al., 2000). GPA was not done in this thesis, which is a potential limitation given that it allows for a conclusion to be made about the population as a whole. I decided against using GPA in this thesis because evaluating the demographic breakdown and agreement between participants was not a primary aim. This thesis had four aims, the first being to develop a set of terms commonly used by non-experts to describe animal behaviour. This meant the focus was more on the patterns and trends between the terms, not between participants. A principal component analysis (PCA) was done instead, allowing trends from the generated terms to be extrapolated.

Another limitation involved the demographics of study participants. A selection of 100 participants was split between four different geographical locations (Australia and New Zealand, Canada and the United States of America, the United Kingdom, and South Africa).

These locations were chosen as they are primarily English-speaking countries and encompass a large geographical area. However, the results from this thesis do not represent a worldwide population and future research into the perceptions of people residing in different countries would be beneficial. It can be assumed that people from non-English speaking countries with different cultural and religious beliefs would hold different perceptions towards the behaviours of animals (Greenall et al., 2022; Weber, 2010).

One of the biggest limitations of Study 1 in this thesis is that most of the statistical analyses were done by hand. This significantly increases the likelihood of human error and bias in the results. Two separate researchers coded the descriptive terms based on what was deemed to be a mental experience an animal could have. Although the two people involved in coding the terms showed 95% agreeance, it is possible that different researchers would have produced different results. The tabulation of frequencies for both the descriptive terms and associated valences was also done by hand, which is again subject to human error. If tabulated incorrectly, these frequencies could have altered the order of the most commonly responded terms and potentially changed the terms brought forward and used in Study 2. The methodology used in this thesis could have also benefited from a larger sample size. Principal component analysis relies heavily on the accuracy of loading scores, which can be influenced by sample size. A larger ratio of subjects to items increases the reliability of outcomes and decreases the likelihood of certain errors (Osborne & Costello, 2019). Although the sample size used in this thesis was big enough to maintain reliability, a bigger sample size would have only validated it further (Field, 2013).

Another limitation of this thesis is that it was the first study looking into non-expert perceptions of animal behaviour, specifically at stereotypic behaviour and using QBA. This meant there were no restrictions on animal species, environment or type of behaviour. The

purpose was to gain a broad and general understanding of the type of mental experiences non-experts use to characterise different behaviours. However, this does mean that many factors can explain the study's outcomes. This limits what conclusions can be accurately drawn as anomalies in one outcome can be easily explained by something else. Future studies would benefit from focusing on a single species, behaviour type or captive setting in order to see more obvious patterns in the data collected.

5.6 Strengths

I successfully tested a reliable and accurate methodology for measuring non-experts' perceptions of animal behaviour in a zoo setting. Qualitative Behavioural Assessment (QBA) studies used in a zoo setting to this date are limited. Most QBA studies involve farm or domesticated species (e.g., Andreasen et al., 2013; Minero et al., 2016; Rutherford et al., 2012). Previous studies using QBA have typically only used industry experts such as farmers, keepers or animal scientists to generate terms using the Free-Choice Profiling technique (e.g., Patel et al., 2019). In addition, most studies using non-experts or laypeople give them a pre-determined list of terms to use (e.g., Duijvesteijn et al., 2014).

Industry professionals create these pre-determined lists, limiting the understanding of non-experts' initial unbiased perception. Sometimes, the QBA methodology includes both a pre-determined list and knowledgeable assessors (e.g., Skovlund et al., 2023). The methodology used in this thesis uses non-experts and Free-Choice Profiling to better understand their perception of certain animal behaviours. In addition, each participant was asked to determine a valence for each descriptive term they wrote, further increasing our ability to analyse and decipher their perception. The follow-up questions after Study 2 are

also a step further than previous QBA research has taken. These follow-up questions forced participants to consider the terms they used to describe each animal critically and consider the behaviour in context. The follow-up questions helped us understand their perceptions of different animal behaviours. This was because we did not need to assume if they found behaviours concerning based on the attributed valence they gave each term. Direct conclusions could be taken from which videos they said concerned them and which they recognised to represent stereotypic behaviour. This methodology developed a set of terms generated by non-experts that can be used in future research. The broad nature of the animal species, environment type and behaviour displayed mean that these terms would be appropriate to use in various scenarios. It also means that researchers wanting to use a pre-determined list of terms for QBA, can now use terms generated by non-experts and be confident in knowing what they represent.

5.7 Future Directions

The research conducted in this thesis was exploratory in nature. Understanding human perception of animal behaviour, especially non-expert perception of stereotypic behaviour in zoo-housed species, is a largely untouched area of research. The aim of Study 1 was to develop a set of terms used by non-experts to describe animal behaviour. The objective was for this set of terms to be able to be used in future qualitative animal-related research. Future research using the ten most commonly responded terms for species-specific behaviours or analysis of how the environment changes perceptions would be a great next step. Study 2 confirmed that the associated valences from Study 1 were held by

participants in Study 2, meaning that we can more reliably assume what non-experts mean when using these terms. It would be interesting to isolate stereotypic behaviour and directly compare different species to ascertain if participants were biased regarding which animals they perceived the most concerning. In addition, considering a single species displaying a variety of behaviours would eliminate species bias and see whether their perception of behaviour changes when watching an animal of the same species perform a variety of behaviours. To understand how the priorities of keepers may differ from zoo visitors, a comparison could be made between the perceptions of stereotypic behaviour in non-experts compared to zoo keepers. Taking the top 10 terms and using them as a pre-determined set for use with non-experts is also possible. Finally, experimenting with whether similar terms and the same valences are generated with a different subset of animals, such as companion animals or production animals, or a different participant demographic group would also be an interesting comparison to make.

5.8 Conclusion

The four aims of this thesis were all achieved. For aim 1, I developed a comprehensive set of terms and associated valences commonly used by non-experts to describe animal behaviour. This list of terms lays a strong foundation for future qualitative animal-related research, providing reliable and standardised terminology. For aim 2, I validated a methodology for generating reliable terminology to describe animal behaviour. The methodology's effectiveness has been confirmed by implementing Free-Choice Profiling and attributing valences to each term, ensuring unbiased responses and a deeper understanding of non-experts' perceptions. The third aim was to gauge the level of concern

non-experts holds towards various types of stereotypic behaviour exhibited by different species. By examining the data, valuable insights have been gained, shedding light on the emotional response and empathy non-experts have towards these behaviours. Lastly, the fourth aim was to assess non-experts' ability to identify different types of stereotypic behaviour in various species. The findings from this aim have provided valuable information about the accuracy and proficiency of non-experts in recognising such behaviours, further enriching our understanding of public perception in this domain.

Overall, this thesis contributes to our understanding of non-experts' perceptions of animal behaviour by developing a reliable methodology that can inform animal welfare practices aimed at retaining social license to operate. These findings can serve as valuable resources for future research and guide zoos, conservation organisations, and educators in effectively communicating the significance of animal behaviour and its impact on animal welfare.

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Appendix A

Information Sheet and Ethics Statement Used in Study 1 and Study 2

Human Perceptions of Animal Behaviour
MASSEY UNIVERSITY

Participant Rights and Interests

Risks of Participation
There are no known physical, psychological, economic or social risks associated with your participation in this study. Additionally, your participation is voluntary, you can refuse to answer any questions, you may also close your browser at any point during the study.

Benefits of Participation
There are no direct individual benefits to you. A general benefit is that you will add to our knowledge of the research subject.

Payments
You will receive payment for your participation through the Prolific system.

Withdrawal from participation
Your participation in this study should be completely voluntary. If you choose to participate, you have the right to withdraw at any time during the study without penalty or prejudice from the researchers. You are not obligated to answer any questions that you find objectionable. In the event that you do withdraw from this study, the information you have already provided will be kept in a confidential manner.

Privacy & Confidentiality
Your responses will be completely anonymous; you will be shown a random selection of videos and your personal identity will not be linked to your data. During data collection, the data will be accessible only by the project team. Once the data have been analysed, we will ensure that we remove from the data set any information that might inadvertently include any identifying information. We will then make this non-identifiable data available to other researchers and might post it to an online repository (e.g., a website such as the Open Science Framework) for reproducibility purposes. The data will remain in the repository indefinitely.

Research output

The results of this study may be presented, in the aggregate, for academic purposes at conferences, lectures, etc., and may be published in academic journals. Your responses will not be identifiable in any of these research outputs. If you would like a report of the final results, please contact any of the investigators (details below) in one year.

Further information about the project

If you would like further information about the project, please do not hesitate to contact us through the Prolific messaging link.

This research project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researchers named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researchers, please contact Professor Craig Johnson, Director (Research Ethics), telephone +64 06 356 9099, extn 85271 or email humanethics@massey.ac.nz.

☐ Having read the information above, do you consent to participate in this study?

Next

Animal Welfare Science and Bioethics Centre
School of Veterinary Science
Prolific ID: Unknown

MASSEY UNIVERSITY
UNIVERSITY OF NEW ZEALAND

Appendix B

Summary of Demographic Data Collected During Prolific Questionnaire Surveys

Table B1. Number (n) of Study 1 participants and percentage (%) in each country of residence by sex. Data from 100 participants collected during a Prolific questionnaire survey in November 2022.

Country of residence	Male (n=34)		Female (n=65)		Total (n=99)	
	n	%	n	%	n	%
Australia/New Zealand	11	44	14	56	25	25
United Kingdom	6	24	19	76	25	25
United States of America/Canada*	12	48	12	48	24	24
South Africa	5	20	20	80	25	25

** One participant from the United States of America chose "prefer not to say"*

Table B2. Number (n) mean (μ) and standard deviation (σ) of the age of participants who took part in Prolific questionnaire survey in November 2022.

		Age of participant	
Country of residence	n	μ	σ
Australia/New Zealand	25	37	10.11
United Kingdom	25	38	10.94
United States of America/Canada	25	37	10.77
South Africa	25	31	10.99
All countries	**100**	**36**	**10.89**

Table B3. Number (n) of Study 1 participants and percentage (%) in each country of residence by sex. Data from 100 participants collected during a Prolific questionnaire survey in March 2023.

Country of residence	Male (n=48)		Female (n=52)		Total (n=100)	
	n	%	n	%	n	%
Australia/New Zealand	17	35	8	15	25	25
United Kingdom	12	25	13	25	25	25
United States of America/Canada	12	25	13	25	25	25
South Africa	7	15	18	35	25	25

Table B4. Number (n) mean (μ) and standard deviation (σ) of the age of participants who took part in Prolific questionnaire survey in March 2023.

		Age of participant	
Country of residence	n	μ	σ
Australia/New Zealand	25	38	11.6
United Kingdom	25	36	10.6
United States of America/Canada	25	39	12.4
South Africa	25	29	9.5
All countries	**100**	**35**	**11.6**

Appendix C

List of YouTube Videos and the Associated Links

Video 1 – Polar Bear Pacing Stereotypic Behaviour

Paul Rose. (2018, March 19). *Polar Bear Stereotypic pacing* [Video]. YouTube. https://www.youtube.com/watch?v=l5MvOaKuQf0

Video 2 – Otter Grooming Behaviour

Random Currents. (2017, June 14). *Sea Otter Grooming* [Video]. YouTube. https://www.youtube.com/watch?v=oIns89Gk_Ag

Video 3 – Chimpanzee Climbing a Tree

Dallas Zoo. (2015, August 14). *Dallas Zoo's Young Chimp Makes Impressive Tree Climb* [Video]. YouTube. https://www.youtube.com/watch?v=1wHWQ6v_8v8

Video 4 – Frog Buccal Pumping (Idle Breathing)

Frog Time. (2022, March 13). *Result of Praying Mantis Stepping on Frog* [Video]. YouTube. https://www.youtube.com/watch?v=JFwJIrhHVEA

Video 5 – Zebra Grazing

Gracelove-Animals. (2022, September 16). *Gravy's Zebras, Jamila, Duni and Alex, then Kahlfani shows up summer 2022* [Video]. YouTube. *https://www.youtube.com/watch?v=EexX2HRebeI*

Video 6 – Tiger Flehmen Response

Christine Lucas. (2015, May 18). *Tiger Flehmen Response* [Video]. YouTube. https://www.youtube.com/watch?v=7f8IKtqF5dQ

Video 7 – Elephant Swaying Stereotypic Behaviour

Paul Rose. (2019, September 9). *Elephant Stereotypic Behaviour (for animal behaviour practical)* [Video]. YouTube. https://www.youtube.com/watch?v=xvQnrsyV6RY&t=290s

Video 8 – Bird Eating

Parrot Media. (2021, September 6). *Ringneck Parrot Eating Lady's Finger* [Video]. YouTube. https://www.youtube.com/watch?v=UED4emzYQpU

Video 9 – Snake Foraging/Exploring

Quinkana. (2021, August 11). *Slithering Water Snake* [Video]. YouTube. https://www.youtube.com/watch?v=tOw4ynj8Rwc

Video 10 – Giraffe Oral Stereotypic Behaviour

Paul Rose. (2017, Jul 29*). Giraffe oral stereotypic behaviour* [Video]. YouTube. https://www.youtube.com/watch?v=iwm3J2zhyQw

Appendix D

Table of corrected spelling mistakes of terms generated by participants in Study 1

Appendix D. Table showing the spelling mistakes made by participants and the resulting correction. From a Prolific questionnaire survey in November 2022.

Term Participant wrote	Term after spelling was corrected
Frighened	Frightened
Enslodure	Enclosure
Frusted	Frustrated
Flastrate	Frustrated
Jot	Joy
Joygul	Joyful
Playin	Playing
Solumn	Solemn
Streesed	Stressed

Appendix E

Supplementary Tables for Principal Component Analysis

Table E1. Initial Eigenvalues of Principal Component Analysis: Explained Variance by Principal Components.

Initial Eigenvalues			
Component	**Eigenvalue**	**% of Variance**	**Cumulative %**
1	**3.965**	**44.05**	**44.1**
2	**1.773**	**19.69**	**63.7**
3	0.901	10.02	73.8
4	0.737	8.19	82
5	0.467	5.19	87.1
6	0.359	3.99	91.1
7	0.313	3.48	94.6
8	0.302	3.35	98
9	0.184	2.04	100

Table E2. Coefficient and p-value of Bartlett's Test of Sphericity for the Principal Component Analysis.

Bartlett's Test of Sphericity		
χ^2	**df**	**p**
2559	36	**< .001**

Table E3. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy for Principal Component Analysis.

KMO Measure of Sampling Adequacy	
	MSA
Overall	**0.82**
Relaxed	**0.894**
Playful	**0.865**
Lonely	**0.79**
Joyful	**0.787**
Happy	**0.813**
Frustrated	**0.819**
Curious	**0.834**
Bored	**0.784**
Anxious	**0.818**

Appendix F

Summary Statistics by Each Term and Animal Video

Appendix F. Descriptives of Principal Component Analysis: Number, Mean, and Standard Deviation by Term and Animal Video.

Descriptives

	Video	Anxious	Bored	Curious	Frustrated	Happy	Joyful	Lonely	Playful	Relaxed
N	Otter	41	41	41	41	41	41	41	41	41
	Polar Bear	48	48	48	48	48	48	48	48	48
	Snake	55	55	55	55	55	55	55	55	55
	Shark	60	60	60	60	60	60	60	60	60
	Bee	42	42	42	42	42	42	42	42	42
	Chimpanzee	54	54	54	54	54	54	54	54	54
	Elephant	50	50	50	50	50	50	50	50	50
	Frog	48	48	48	48	48	48	48	48	48
	Parrot	49	49	49	49	49	49	49	49	49
	Zebra	53	53	53	53	53	53	53	53	53
	Giraffe	42	42	42	42	42	42	42	42	42
	Tiger	58	58	58	58	58	58	58	58	58
Mean	Otter	0.659	1.12	2.61	0.61	7.88	7.15	1.12	8.61	7
	Polar Bear	6.35	5.83	2.92	6.73	1.06	0.646	5.83	1.52	0.729
	Snake	2.4	1.85	6.13	1.55	2.15	1.4	1.91	1.16	3.47
	Shark	2.87	3.33	3.37	2.87	3.13	2.73	1.47	4.48	3.52
	Bee	1.43	0.881	4.52	1.26	4.81	3.48	0.976	1.95	4.05
	Chimpanzee	1.43	2.74	6.44	0.889	5.13	4.35	2.33	5.94	5.41
	Elephant	4.24	6.06	2.26	3.36	2.32	1.64	6.02	3.74	2.54
	Frog	2.63	4.56	1.6	2.79	1.88	1.46	4.23	0.979	4.25
	Parrot	1.24	0.918	3.45	1.02	5.2	3.57	0.878	2.27	5.63
	Zebra	1.81	4.38	4.26	1.85	3.32	2.4	4.32	1.85	4.58
	Giraffe	1.76	3.6	2.48	1.57	3.55	2.4	2.57	2.17	5.24
	Tiger	2.28	3	4.69	3.17	2.84	2.09	2.52	2.76	3.52
Standard deviation	Otter	1.46	1.91	2.68	1.43	2.8	3.02	1.79	2.15	2.99
	Polar Bear	2.99	3.01	2.83	3.02	1.51	1.18	3.28	1.95	1.53
	Snake	2.94	2.58	3.09	2.15	2.24	1.92	2.84	1.56	3.09
	Shark	3.12	3.46	2.93	3.32	3.23	2.97	2.39	3.74	2.98
	Bee	2.44	1.7	3.15	1.93	3.16	2.99	1.42	2.92	2.92

Chimpanzee	2.12	2.88	2.92	1.49	2.89	3.08	2.71	3.27	2.8
Elephant	3.07	3.24	2.58	2.81	2.54	1.98	3.2	3.29	2.58
Frog	2.84	3.1	2.16	2.99	1.86	1.65	3.36	1.41	3.32
Parrot	1.68	1.75	2.99	1.45	2.78	2.99	1.17	2.34	3.01
Zebra	2.2	3.38	2.88	2.33	2.78	2.43	3.46	2.1	3.05
Giraffe	2.61	3.36	2.51	2.09	2.51	2.73	2.72	2.51	2.85
Tiger	2.42	2.94	2.95	3.14	2.57	2.47	2.96	3.05	3.37

Appendix G

Summary Statistics of Each Animal Video by Positive and Negative Value

Appendix G. Descriptions of Principal Component Analysis: Mean and Standard Deviation of Each Animal Video by Positive and Negative Value.

Descriptives			
	Video	**Positive**	**Negative**
Mean	Otter	1.45	-0.757
	Polar Bear	-0.848	1.41
	Snake	-0.352	-0.246
	Shark	0.00535	-1.39e−4
	Bee	0.114	-0.605
	Chimpanzee	0.809	-0.28
	Elephant	-0.312	0.855
	Frog	-0.56	0.23
	Parrot	0.229	-0.724
	Zebra	-0.0694	0.107
	Giraffe	-0.102	-0.222
	Tiger	-0.155	0.0492
Standard deviation	Otter	0.906	0.517
	Polar Bear	0.531	0.841
	Snake	0.686	0.801
	Shark	1.1	1.02
	Bee	0.869	0.634
	Chimpanzee	1	0.689
	Elephant	0.833	1
	Frog	0.548	0.946
	Parrot	0.83	0.483
	Zebra	0.779	0.895
	Giraffe	0.731	0.808
	Tiger	0.932	0.809

Appendix H

Descriptive Terms Sorted Based on Animal

Appendix H. Table depicting the top 10 feeling and experience terms generated by participants sorted by frequency (f) for each animal video.

Elephant		Giraffe		Polar Bear		Shark		Bee		Frog	
Term	**f**	**Term**	**f**	**Term**	**f**	**Term**	**f**	**Term**	**f**	**Term**	**f**
Bored	25	Hunger	17	Bored	15	Playful	15	Busy	14	Bored	15
Confused	8	Calm	10	Lonely	14	Bored	12	Happy	12	Hunger	15
Lonely	8	Relaxed	8	Anxious	13	Confused	11	Excited	8	Content	8
Frustrated	7	Content	7	Frustrated	11	Trapped	9	Focused	8	Calm	7
Playful	7	Thirsty	7	Troubled	11	Free	8	Content	7	Lonely	7
Sad	6	Bored	6	Restless	8	Happy	7	Hunger	7	Relaxed	7
Happy	5	Satisfied	6	Confusion	6	Curious	6	Determination	4	Sad	5
Relaxed	4	Happy	5	Sad	6	Anxious	5	Joy	4	Anxious	4
Restless	4	Alert	4	Hunger	5	Excited	4	Satisfied	4	Tired	4
Tired	4	Peaceful	4	Stressed	5	Frustrated	4	Concentration	3	Alert	3

Chimpanzee		Otter		Parrot		Snake		Tiger		Zebra	
Term	**f**	**Term**	**f**	**Term**	**f**	**Term**	**f**	**Term**	**f**	**Term**	**f**
Curious	16	Playful	29	Hunger	32	Hunger	18	Hunger	17	Hunger	30
Playful	15	Happy	24	Happy	21	Curious	16	Curious	15	Happy	10
Adventurous	8	Joy	14	Content	14	Warm	6	Happy	7	Content	8
Determined	8	Enjoyment	9	Satisfied	13	Alert	4	Bored	5	Curious	8
Fun	7	Fun	8	Curious	12	Calm	4	Relaxed	5	Relaxed	7
Happy	6	Content	7	Alert	9	Excited	4	Angry	4	Bored	6
Energetic	5	Excited	7	Enjoyment	8	Happy	4	Content	4	Interested	5
Excited	5	Relaxed	6	Relaxed	7	Looking	4	Disgust	4	Thirsty	5
Content	4	Satisfied	4	Interested	6	Relaxed	4	Enjoyment	4	Calm	4
Joy	4	Free	3	Calm	5	Eager	3	Frustrated	4	Lonely	4