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The Hopeful Capacity of Octopuses

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ABSTRACT
This work considers whether the experience of hope is solely within the purview of persons, or if invertebrates with complex nervous systems also have the capacity to hope. If one accepts that increasingly complex conscious experiences arise from successively more complex biological communication within a body, then any cognition or emotion may be experienced by a sufficiently complex organism. Hope is experienced both cognitively and emotionally. According to Snyder's Model of Hope Theory the cognitive experience can be divided into pathways thinking and future goal orientation, whereas the emotional experience is what arises from the interaction of cognitions and environmental pressures. Octopuses are often defined by their intelligence and the flexible way they pursue future goals. In 2021, their emotional life was brought to the forefront when they were identified as having sentience, or the conscious capacity for sensory and subjective experience. Because of their flexible goal-oriented thinking and the fullness of their emotional experience they have the biological complexity which gives them the capacity for experiencing hope. Therefore, humanity's moral circle should expand to treat them as moral patients, like other vulnerable populations. It is not the automatic tendency of humans to treat other organisms, especially invertebrates, as moral patients. Using social narratives to hold octopuses in moral patienthood that is reflective of the vibrancy of their lived experience may be used to extend the moral circle of humanity like it has done for other vulnerable populations.

KEYWORDS
Animal Consciousness, Moral Psychology, Hope, Emotions, Cephalopods, Ethics

INTRODUCTION

Octopuses[1] have risen in popular culture in the last decade as researchers and naturalists documented the vibrancy of their lived experience. They are aquatic invertebrates with experiences seemingly entirely foreign to those of humans. Yet to those who work with octopuses, their experiences allowed them to be "sensitized to the other; especially wild creatures" (Ehrlich and Reed 2020). They have been shown to be sentient and documentaries about their lives have won an Oscar (Ehrlich and Reed 2020), yet the fullness of their experience has yet to be delineated. Understanding their experiential life is the work of future experiments. Yet, philosophical questions may be used to consider the directions for those efforts. As such this paper will question, does an octopus have the capacity to have the relatively complex experience of hope? Part 1 considers the terminology used in relation to this question. Part 2 considers octopus sentience as well as their capacity and exhibition of hope. Part 3 concludes with implications that may follow from recognizing that octopuses do have the capacity to hope.

If one assumes that mind, consciousness, and emotions all have their basis in neurological and cellular processes, then increasingly complex organisms can have increasingly complex but similar experiences. This is similar to the idea of homologous and analogous structures in evolutionary biology. Bird and bat wings are homologous structures because they developed from forelimb structures in a common reptile ancestor. However, birds and insects have wings that are analogous because similar structures developed along completely separate evolutionary tracts. Therefore, even evolutionary disparate organisms, i.e., humans and octopuses, may have analogous experiences if their neurological structures have sufficient overlap.

Hope is a cognitive and emotional experience that is future oriented and based on the ability of an organism to identify a future preferred outcome that is different from the present and to consider a variety of ways in which the preferred outcome can be accomplished. In human psychological studies the emotional experience of hope rises with the cognitive experiences of an individual feeling able to accomplish a goal as well as their ability to identify alternative pathways in the face of barriers (Snyder 2002). Octopuses have an exceptional cognitive

1. The plural to octopus is octopuses, not octopi. Octopus is derived from the Greek word októpus. Thus, the plural is with an "es." The ending "i" is used for words derived from Latin.

capacity which allows them to identify numerous ways to accomplish a goal. While they are not self-aware, they do have personalities with a sufficient unity of experience and temporal understanding to satisfy the cognitive aspects of hope. Recently sufficient evidence was collected to designate octopuses as being sentient which means they are capable of having complex and differently valenced feelings (Birch et al. 2021). Their emotional life must be inferred from field reports and inductions from their handlers. Research on octopuses' experiential life is ongoing and increasing due to developments in neuroscience, cognition, and technological advances. Yet globally, octopuses are not recognized as within humanity's moral circle, in fact they are often disregarded and treated as only worthy of being eaten (Gritzer 2019). This may be due to their alien nature as aquatic invertebrates. It is uncomfortable to attribute moral patienthood to other animals, yet increasingly social mammals have been understood as being worthy of human moral considerations, e.g., dogs, whales, elephants, etc. Despite octopuses being scientifically recognized as sentient and it being widely distributed in the news cycle (Baker 2021; Hunt 2021; Pandey 2021; Tran 2021), legally they are still not protected, and morally few people consider the feelings of their calamari. Laws are often derived from the moral attitudes of their citizens; thus, it makes sense that legal protections are lacking because moral considerations for octopuses are also lacking.

Hope is a central human experience. There is a vivacity to hope which allows one to endure. Many choices to end one's life occur because of a pervasive feeling of hopelessness in human beings. Because of its central nature to human experience, it may be uncomfortable to consider that other organisms may be capable of experiencing hope even in a less aware form. This is especially true for organisms which have yet to be widely considered in humanity's moral circle. Octopuses' capacity for experiencing hope indicates a complex and vibrant experiential life that requires their recognition as moral patients and challenges the understanding of any cognitive emotional experience being solely accessible by human consciousness.

PART 1: TERMS WITHIN THE EXPERIENTIAL CONTINUUM

Mind, consciousness, and emotions are not specific to human experience. They all arose progressively as organisms interacted with their environment.

Sensation is the primary aspect of experience, but an organism does not have to be conscious to experience sensation. It is what allows even single cellular organisms the ability to interact with their environment, seeking out food and avoiding things that may cause damage. Therefore, at its base, experience begins with sensation of the environment which either attracts or repels the organism (Ginsburg and Jablonka 2010; Godfrey-Smith 2016).

Mind is not something that exists outside of experience, but it is inextricably tied to the interaction of sensation of the environment with an organism's body. As an organism senses its environment, information is incorporated into the body of the organism allowing it to act more effectively within its environment. Mind describes this reactionary activity, from sensation, to incorporation, to action. Therefore, even single cellular organisms have rudimentary forms of minds. During the evolutionary process more complex minds develop as the needs of the organism's body increase. In a single cellular organism reaction is all that is necessary, but multicellular organisms need ways of communicating information which they gain from the environment to the other cells within their body. Therefore, intercellular signaling is required, meaning the mind of a multicellular organism would have to incorporate intrabody sensation as well as environmental information to allow the organism to interact effectively within its environment. This process increases to more rudimentary organisms, like worms, up to human beings, and can even be used to explain the collective intelligence of group interactions (Schermer 2022).

A useful metaphor for the mind is that of fire. Fire is the process of combustion in the visible spectrum of light. It exists as long as the chemical process of combustion occurs, but once it is finished the fire no longer exists. The same is true of mind. If sensation leads to activity within a body, then mind exists within the body.

Just because an organism has a mind does not mean that it has consciousness. Although, consciousness too exists on a spectrum. Consciousness is the awareness of a mind that it exists within an environment. Consciousness arises first through the ability of associative learning (Ginsburg and Jablonka 2010). Associative learning takes place when an organism can store information about past objects within memories which then can change their future interactions. It is more complex than mind since it requires the ability to store information about the world, whereas mind arises from the immediate sensory experiences within the world. As the associations within an organism become more complex, they can

take on a preferential quality leading to motivating the organism to seek or avoid objects based on past experience as opposed to only present experience which is the role of the mind. Thus, as species exhibit higher levels of consciousness, they can exhibit more complex preferences and temporal cognitions. These preferences and consistent ways of an organism interacting within the world are termed personality. The integration of all this learning leads to a progressive understanding of the organism as an agent within the world, and at its most complex leads to the self-aware consciousness exhibited by human beings.[2]

A useful simile to understand consciousness is that it is like an organism's discriminatory capacity for sound. The first experience of consciousness was akin to white noise (Ginsburg and Jablonka 2010; Godfrey-Smith 2016). Then as the associative capacities of organisms increased with evolution so too did their experience of consciousness. By applying the simile, human beings would be capable of experiencing the world as a complex symphony presented by the interaction of many instruments, whereas progressively less fully conscious organisms would have a steadily reduced ability to distinguish both the parts and the whole of the symphonic experience.

Emotions are mental states that occur because of neurophysiological changes within an organism. They serve the function of orienting the organism and adapting its behavior to succeed in its environment. They do this by inhibiting irrelevant behaviors and making relevant behaviors more likely. They have evolved along with cognition and are updated throughout a person's life as they interact with the world (Barrett 1998). In human beings it is the hormonal endocrine system interacting with the nervous system that produces emotional experience. As with mind and consciousness, emotions in humans are not fundamentally different from other organisms but differ in their complexity and their ability to be consciously experienced (Panksepp 2005; de Waal and Andrews 2022). In line with the functional view of emotions, an organism's emotional life increases with its progressively complex cognitive experience (Panksepp 2011). This happens because evolutionarily they both arise gradually aiding the species in successfully navigating their environment (Cosmides and Tooby 2000).

2. This view of consciousness does not attempt to give a neurobiological basis for the "hard problem" of consciousness (Chalmers 1995). It does however attempt to pinpoint the evolutionary process from which consciousness arose. How experience arises from neurobiological processes must continue to be debated within other papers.

From an evolutionary perspective, emotional states likely arose from more basic physiological sensations feelings. Examples of feelings are hunger, sexual desire, interest, fear, and joy, etc. The purpose of feelings is to orient an organism's behaviors to their environment based on homeostatic needs and environmental stressors. Because of their immediate importance they are necessarily consciously experienced. Emotions are capable of being experienced both consciously and subconsciously which leads to a more complex conscious experience. Additionally, emotions, unlike feelings, are used not only for subjective orientation, but also for social signaling of internal states. Therefore, an individual can feel anger, and the emotion of frustration when they try not to express their anger inappropriately. Additionally, this is why an organism can feel joy in relation to working towards a goal while experiencing the emotion of hope.

Two emotions in particular orient an organism towards perceived future circumstances, fear and hope. Fear is negatively valenced and is associated with perceived immediately present threats. In response to the threats the organism either chooses the actions of fight, flight, or freeze. Evolutionarily fear-based responses are most associated with behaviors which lead to the least physical pain for the organism. In modern times it is most commonly associated with preemptive avoidance behaviors (Sylvers et al. 2011). These behaviors are often reflexive; in line with characterization of fear as a basic emotion[3] (Ekman 1999; Ekman 2016). There is significant debate in the emotion literature concerning the labeling of emotional and affective states; however, the emotions which most researchers agree have a strong empirical basis are fear, anger, sadness, disgust, and happiness (Ekman 2016).

Hope is a positively valenced temporally motivating state which occurs after an individual identifies a preferred future goal and identifies ways to meet that goal. It has both a cognitive and an emotional component which are mutually reinforcing. The cognitive component is the identification of a preferred future. This differs from fear in that the preferred future outcome associated with fear is merely the absence of a currently threatening stimulus. Whereas the preferred future outcomes associated with hope can be propositional, reached through imagination[4].

3. A basic emotion essentially means that it is fundamental and ubiquitous to emotional experience.

4. What about "false hopes?" All hopes are orientations towards a preferred, and sometimes improbable outcome. The only difference between a hope that is labeled as false or one that is

Hope is associated with, but distinct from, subjective experiences such as optimism, self-esteem, self-efficacy, belief in problem solving abilities, and social support (Syder 2002; Hobfoll et al. 2003). In psychological literature, hope is most commonly measured by the Adult Hope Scale, which is a self-report measure. The scale differentiates hope into two factors, agency and pathways thinking (Snyder et al. 1991; Snyder 2002; Cheavens and Ritschel 2014). Agency is first the identification of a goal and second the subjective expectation that an individual can use pathways to accomplish that goal. Pathways thinking is the planning of how to accomplish a goal, and if necessary, the ability to consider and implement alternative routes to the goal. As the goal gets closer to being accomplished, an individual experiences positively valenced feelings and emotions like joy, happiness, or the emotional state of hope. If barriers arise in their attempts to accomplish a goal, they experience negatively valenced emotions, like anger, fear, or sadness. The cognitive trait of hope is the primary focus of hope research because it has temporal stability, as compared to the more variable emotional state of hope (Snyder 2002). Additionally, individuals who have high hope scores are more likely to navigate around barriers to their goals even when they are not experiencing the emotion of hope because of their propensity for pathways thinking (Snyder 2002; Cheavens and Ritschel 2014).

Considering the complexity of cognition and emotional richness that is required to experience hope, it has only been associated with human beings. Basic emotions and feelings have been identified in other organisms, but many complex states, like hope, have been considered to be special to personhood. This likely has to do with the agential quality of hope. Other organisms are not recognized as moral agents, although human beings do regularly assign agency

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not is whether it is considered even remotely possible, and whether it is eventually accomplished. To an outside observer the success of the actions legitimizes the methods that were used; meaning a hope that was originally labeled "false" would be retrospectively understood as not "false" if the goal was accomplished. On the other hand, a hope that ends in the ultimate failure of the individual is retrospectively understood as a "false hope." Until the retrospective analysis of the hope happens it cannot meaningfully be labeled as a "false hope."

Delusional hopes which are not based in reality, like those of individuals experiencing episodes of psychosis, may be the best example of a "false hope." However, individuals who experience extreme delusions often have low scores on the Adult Hope Scale, indicating they experience the emotion of hope rarely. This probably has to do with being unable to actualize their goals or imagine alternative pathways towards their completion (Snyder 2002).

to animals when they seem to make a forward-looking plan and carry it out to completion. For example, a pet getting onto the counter and stealing treats.

Additionally, the emotional experience of hope appears to be vital to continuing one's life. Without it one finds the emotional state of despair, which if it continues for long enough, can lead to the wish to end one's life. "The sense of the unmanageable, of helplessness, of invasive negativity about the future is, in fact, one of the most consistent warning signs of suicide" (Jamison 1999, 94). As a morbid irony, after an individual makes it a goal to kill themselves, and decides on the pathway to accomplish that goal, they often exhibit a lifted mood and more energy for about 10 days before the attempt[5] (Snyder 2002). This vital aspect of hope to human consciousness is likely one of the reasons that it has not been viewed as something that is experienced by other organisms, even ones with intellectually or emotionally complex lives.

There is something personal about hope to our conceptions of being human. Thus, the challenge lies in accepting that human experience of the mind, consciousness, and emotion exist on a continuum with other animals, and that all "uniquely human" experiences might also be experienced by a sufficiently complex organism, including hope. Octopuses may be such an organism. They have complex intellectual lives and are capable of establishing future goals while using multiple pathways to accomplish their goals in the face of barriers. Additionally, they have been recognized as sentient which requires the ability to feel both positively and negatively valenced emotions (Birch et al. 2021). Therefore, on the surface, it appears that they have the capacity to experience the motivating state of hope and its emotional counterpart. Considering the importance attributed to hope within human consciousness it is necessary to consider this in more detail.

PART 2: CAPACITIES OF OCTOPUSES

Octopuses are highly intelligent creatures that not only learn, but also play (Montgomery 2015). Unlike humans who have a definitively centralized mind, they have a dispersed mind in which the arms seem to have significant autonomy[6].

5. Thus, supporting the idea that the emotional experience of hope relates to the cognitive experiences of agency and pathways thinking.

6. In fact, 60% of the neurons within their body are in their arms, and 40% are within their central brain.

The metaphor of a conductor with a jazz band is useful when considering the interaction of the octopus's central and distal neuronal structures (Chiel and Beer 1997; Godfrey-Smith 2016, 105). Despite the dispersed nature of its mind, memories are stored within the central brain. Learning which occurs with one arm is capable of being utilized with a different arm (Mather 2021b). Additionally, the front two arms are most commonly used for reaching tasks, and all arms are capable of being used in a visually directed fashion which requires a top-down signaling approach (Mather 2021a). Therefore, while the mind of an octopus is more dispersed than that of a human it is a singular organism that acts upon the world not as nine different minds, but as one central mind which has eight largely autonomous partners.

Therefore, a reasonable question is, do octopuses even have the cytoarchitecture[7] to experience hope? Hope is correlated with activation of the medial orbitofrontal cortex (Wang et al. 2017). The frontal cortex is the seat of executive function and personality and has been identified as the primary cortex differentiating human cognition from the cognition of other organisms (Semendeferi et al. 1997). However, the Cambridge Declaration on Consciousness, concluded that a frontal cortex is not necessary for consciousness, therefore organisms with no frontal cortex, e.g., birds and octopuses, still possessed the neural architecture necessary for complex cognitive affective experience (Low et al. 2012)[8]. Thus, it is reasonable to consider whether it is possible for organisms, like octopuses, to have the experience of hope despite not having a frontal cortex.

Cognitive Capacity- Pathways Thinking

Octopuses are capable of using their sight to locate prey within a jar and use flexible learning to open the lid by twisting (Anderson and Mather 2010). It takes them time to learn this skill, and some must be shown how to do it first by watching a handler do it. This type of manipulation is not one that would be found in the wild; therefore, octopuses must be able to incorporate novel information which is not evolutionarily relevant into mental representations to access later.

Despite being predators, octopuses are regularly prey as well. As such, octopuses are exceptionally patient in the face of danger, and will stay still while

7. Groupings of neurons which together form central nervous system structures.

8. The authors of the declaration were "prominent cognitive neuroscientists, neuropharmacologists, neurophysiologists, neuroanatomists and computational neuroscientists" (Low et al. 2012).

camouflaged for long periods, or remain in their dens when in the presence of a predator. If the predator follows them, they shoot ink leaving a blast of ink behind. One octopus used all these methods to escape a pyjama shark. When that did not work it tried a different tactic. It collected many different seashells and rocks with its tentacles from the ocean floor to make a shield ball. This shield ball was a type of compound object that the octopus employed at multiple points during its life. The pyjama shark kept attacking despite the shield ball, so the octopus tried yet another strategy. It dropped its defensive posture and ultimately ended up riding on the back of the shark (Ehrlich and Reed 2020). The octopus utilized many different pathways towards its goal of not being eaten by the shark. This use of pathways thinking in response to danger is especially adaptive considering the solitary life that octopuses lead. They do not have social groups to keep watch while they are distracted thus their flexible responsiveness to danger is high (Mather 2019b).

Octopuses exhibit pathways thinking when playing as well. This was seen in the wild when an octopus was chasing a school of fish and swatting at them. It made the school of fish move but the octopus did not seem to be trying to eat them, it was merely enjoying exploring its agency with them (Ehrlich and Reed 2020). It is easiest to see octopuses play in captivity. Their high intelligence requires that they are stimulated, otherwise they become agitated and often try to escape (Montgomery 2015). If they are effectively stimulated by being given novel objects and by being handled by their caretakers, then they show significantly greater adjustment (Montgomery 2015).

Octopuses that are given novel objects first try to bring the objects to their mouth. Then they proceed to go through four further identified stages of play with the object (Kuba et al. 2014). First, they explore the object with their arms. Then they pass it between two arms continuously or push and pull the object, or they pull the object along with them. The third and fourth stage of play has to do with the frequency of engaging with the object and the variability of interactions with it. This is an example of pathways thinking because the octopus has a goal of understanding a novel object and then finds multiple ways to engage with that object that are not solely related to its immediate use. As has been shown, pathways thinking is something that octopuses use in all aspects of their lives.

Cognitive Capacity- Distinctive Personalities and the Temporal Experience of Goals

Octopuses not only have complex intellectual and emotional lives, but also a personality attached to it. This is in line with the understanding that mind and consciousness arise from the interaction of an organism's body with its environment and internal states. It is important not to anthropomorphize organisms and attach personalities to something which is just responding reflexively (Godfrey-Smith 2016; Dennett 2019). Yet it does not appear to be that this is the case with octopuses. Personality is a set of consistent behaviors, cognitions, and emotional patterns. Considering the intellectual capacity of the octopus mind, their consistent behaviors, and their emotional expressiveness, it seems necessary to conclude that they do in fact have personalities.

In captivity octopuses use sight to distinguish handlers they prefer from handlers they do not (Montgomery 2015, 52). They make it known when they do not like handlers by spraying them with their siphon. This categorization happens quickly since they were able to discriminate between two unfamiliar handlers who were dressed the same, but either gave them food, or a slight pain instead with increasing certainty over two-weeks (Anderson et al. 2010). As well, octopuses accomplish routine tasks, like where they prefer to penetrate a clam shell with their beak, in individually different but consistent ways reflective of different thinking styles, i.e., personalities (Mather 2008). Their wide variability in personality has even led the Seattle Aquarium to develop a personality test for the octopuses in their care (Montgomery 2015, 52-53). Godfrey-Smith sums up the experimental literature well with the observation, "One message of octopus experiments is that there is a great deal of individual variability" (2016, 54).

Like humans, octopuses have both avoidance goals and desire goals. An example of an avoidance goal is learning to avoid a negative stimulus. Octopuses are able to learn where they experienced a negative stimulus, e.g., pain, and then avoid that situation in the future. This requires the event to be encoded into the octopus's long-term memory and then retrieved at a later date (Birch et al. 2021). Additionally, octopuses have been known to be upset with lights inside and outside their tank, so they shoot water with their siphon to break the lights, thus turning it off (Godfrey-Smith 2016).

Desire goals are also commonly experienced by octopuses. For example, an octopus waited for its handlers to leave for the night, then escaped from its

tank, walked three feet, and went into another tank which housed the flounders. After eating a fish, it would leave the flounder tank and traverse back into its own tank. It did this regularly until it was caught by a handler who arrived early one day (Montgomery 2015; Corpuz 2016). This required future planning, and consideration of entities which were not currently in presence, i.e., its handlers. Leaving the cage and moving into the other tank after people had left for the night required future planning. This cannot be explained by a reflexive response to being hungry because the octopus was fed regularly, and it only left its tank after everyone had left for the night. The octopus had a goal, eating the flounder, which it consistently waited to enact until after it would not be seen moving by its caretakers.

Octopuses have personalities and consider goals in a temporal fashion, but are they self-aware? One of the most common first steps to answering the question of agentic self-awareness is to see whether the organism has self-recognition. The most common test to analyze whether an animal has self-recognition is the mirror test. Octopuses do not pass the mirror test, but questions have been raised as to whether the mirror test is valid for all organisms including those whose vision is not their primary sense (Kohda et al. 2019). Even though octopus visual sensation is effective it is possible that they self-recognize using chemical sensation (Mather 2021a). This is supported by a chemical recognition mechanism that was identified as the reason octopus arms do not become attached to each other, and why octopuses do not treat their amputated limbs as food (Nesher et al. 2014). Research in this area is still ongoing, but it must be acknowledged that there is as of yet no compelling evidence for selfhood in octopuses (Birch et al. 2020). This aspect will be discussed in relation to the experience of hope in Part 3 of this paper.

Emotional Capacity- Sentience and Experiential Reports

Birch and colleagues reviewed over 300 scientific studies and found evidence for the emotional experience of octopuses among other invertebrates (2021). From this study all cephalopods were concluded to be sentient[9]. They concluded

9. The recognition of sentience requires certain countries to give the organisms more importance when considering them in future legal discussions. In 2021 the U.K. recognized the sentience of cephalopods and decapods, e.g., crabs and lobsters. The U.S. has not recognized their scientifically recognized status legally, although "boiling lobsters alive without stunning was already illegal in the U.S." (Baker 2021). Despite being recognized as sentient, within the U.K.

that there is sufficient evidence for a high confidence that cephalopods experience the feelings of pain, pleasure, hunger, thirst, warmth, joy, comfort, and excitement (Birch et al. 2021). As evidence for their emotional experience octopuses often turn a dark red color with skin folding into horns appearing when they are feeling aggressive (Godfrey-Smith 2016, 117; Montgomery 2015, 119-120). They further have been shown to signal this aggression to other conspecifics by making themselves tall and spreading their webs (Scheel et al. 2017). Additionally, octopuses at the Steinhart Aquarium in California get frustrated and act out when they are bored. So, the handlers regularly stimulate them and provide them with novel experiences and objects to keep them content and stop them from acting out (Newitz 2015). Octopuses have the ability for a wide array of feelings which are the precursors to emotional experience (Birch et al. 2021). Emotional expression is still being explored scientifically; however, experiential reports indicate a complex emotional life that influences octopuses' behavioral activity.

These emotional states can be further inferred by octopus dreaming. Octopuses like other cephalopods seem to sleep and even dream[10] (Godfrey-Smith 2016, 133-135). Octopuses rest for a long period of time with a neutral gray color to their skin, which is their sleep stage. Then after some time they begin to change color suddenly, with a pattern very similar to human sleep stages (Malinowski et al. 2021). Consistent with the idea of an emotional life, their skin changes color in similar ways as their skin does when they are awake, i.e., darker red colors with horned skin show more small agitated movements and lighter more gray colors with smooth skin show less agitated movements. The issue of knowing whether an animal is sleeping and does in fact dream is similar in difficulty to whether an animal has consciousness. However, from the experiential evidence researchers conclude it is highly likely that they do dream, but it has yet to be empirically supported beyond a doubt (Godfrey-Smith 2016, 133-135; Nature by PBS 2019; Malinowski et al. 2021).

It is impossible to experience the cognitive emotional life of another organism. Famously, Nagel showed there was no way to understand the consciousness of a bat (1974). However, this inability to experience the consciousness of another extends to other human beings as well. Therefore, all assumptions of consciousness

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they can still be "sold to untrained handlers, transported in ice-cold water, boiled alive without stunning them and other extreme slaughter methods" (Baker 2021).

10. For an example of this, watch "Octopus Dreaming" (Nature by PBS 2019).

must be made with a cognitive leap; a belief that through collecting behavioral evidence that consciousness can be inferred with a degree of certainty. The sentience designation and behavioral evidence support the idea that octopuses have vibrant emotional lives.

PART 3: OCTOPUS HOPES

While it may be intuitively appealing, it would be a mistake to say that hope is a uniquely human emotion. As has been argued, consciousness comes about gradually, and many animals experience emotional states (Ginsburg and Jablonka 2010; de Waal and Andrews 2022). Therefore, any sufficiently complex organism can experience the motivational and emotional state of hope.

Octopuses are organisms that followed an entirely distinct evolutionary path to human beings. From a shared ancestor of a flatworm both humans and octopuses developed complex neuronal organizations and highly similar visual sensory mechanisms. While their mind is more decentralized, they still have top-down and bottom-up capabilities including, learning, memory, and emotional life. Both empirical and subjective evidence point to the fact that octopuses have distinct personalities and preferential attitudes. More research is needed to understand the extent of octopus consciousness, but they live vivid sensory lives and exhibit complex behaviors which are indicative of intelligent and emotional cognition.

Octopuses are capable of pathways thinking to achieve one's goals and are motivated to accomplish novel future goals in line with their personalities as opposed to a reflexive unconscious way of attaining goals. Since they also feel emotions, it logically follows that while engaging with a future oriented agentic task they could feel a sense of hope that they will accomplish the task. Therefore, octopuses have the capacity to experience the motivating state and emotion of hope while interacting with the world.

Hope has widely been considered to be a uniquely human experience as it is a desire for one's future self. But it ultimately arises from the cellular interactions within human bodies and brains. It may be uncomfortable to think that similar to the analogous structures of a bird and insect wing, neurological complexity leads to the capacity for similar cognitive and emotional experiences between humans and octopuses, especially one as complex and vital as hope. Since octopuses are not self-aware, they will not experience hope in the vital way that humans do, where

living without it is often the reason for suicide. However, self-awareness merely augments the experiential fullness of hope. A cognitive emotional experience can be felt without being understood by the organism experiencing them. Therefore, while octopuses' hopes for their future are likely more rudimentary in nature than humans, e.g., focused on more interesting experiences or preferred foods, they still have the capacity to have desires for their future selves and thus experience hope.

One might suggest that it is impossible to say whether an octopus experiences hope. Considering the fact that they are invertebrates and have a less centralized nervous system they may be too different to humans to experience an emotion like hope. The sentience report showing they can feel many emotions including joy and fear, as well as the ability to develop connections with their caretakers indicates that they share at least some similar experiences with humans (Birch et al. 2021; Montgomery 2015). Ultimately it is impossible for any individual to say that another person experiences hope, yet we believe that they do. This is because of a recognition of the capacity of another human being to feel the experience which we have labeled hope. Human beings are not fundamentally different than other organisms, which is why we are, for example, able to derive conclusions about the efficacy of medicines from animal testing. If our capacities are not fundamentally different from animals', except in terms of increased complexity, then any animal with sufficient capacity of experience should be able to have similar experience. What octopuses naturally lack is spoken language, longer lifespans, and an automatic propensity for social groupings. Therefore, it would not be safe to assume that they had the capacity to feel a social emotion, e.g., shame. Hope is not exclusively a social emotion; in fact, it often originates individually. Since octopuses have the capacity for hope, and capacity, as it is with humans, is the strongest evidence for the experience of hope, then it should be concluded that octopuses do experience hope.

Extending Moral Circles- Moral Patienthood of Octopuses

It may be uncomfortable for people to consider that another organism can experience hope, especially one as seemingly different from us as an octopus. In part, this is because it is easier for humans to empathize with other social mammals because they act similarly and share similar physical characteristics (Mather 2019a). This bias leads to increased attention in media and research attention

being given to mammal species who only make up .2% of total species worldwide and especially invertebrates being discounted in moral considerations (Mather 2019a). Invertebrates make up 90% of global species, but their experiential life is discounted despite it having a wide range of complexity (Horvath et al. 2013). Octopuses, and cephalopods in general, have a vibrant experiential life. Thus, it is a mistake to conclude from this bias that social mammals hold a monopoly on conscious experience and moral consideration.

This suggests that we should afford octopuses more moral rights. They cannot be seen as traditional moral agents because that would require that they understand our societally developed morals. Additionally, their lack of self-awareness does not allow them to be seen as full moral agents. But it is morally required to hold space for them as moral patients. A moral patient is one that is given rights which recognize the responsibility of other moral agents to treat them with concern for their wellbeing. The capacity for hope helps show the need for holding moral space for octopuses because it is an example of a complex motivational and emotional state as opposed to a more basic emotional experience identified when attributing sentience. At present octopuses, like all invertebrates, are not a part of humanity's moral consideration unless the individual's moral circle includes all animals, like Jainists or vegans (Anderson 2019). Octopuses share the capacity to hope with human beings, though their experience of it is likely very different. In time as humans become more comfortable attributing complex cognitive emotional experiences to other species it is likely that many other species will also be found to have the capacity to experience hope. The conditions which must be met are, the organism is capable of cognitive flexibility in achieving future goals and is capable of experiencing emotions. An organism's self-awareness likely increases the vital nature of hope that is experienced by human beings, but less aware organisms can still have the emotional experience of hope arise from its cognitive mechanisms. Octopuses should be treated as moral patients in a way that is reflective of their conscious experience.

Vulnerable populations who have reduced agency, or are unable to act as moral agents, are commonly treated as moral patients, e.g., people in vegetative cognitive states or children. Children are an especially helpful parallel when considering octopuses. They have many cognitive and emotional capacities that develop as they age. It is only through interaction with other more expert individuals, especially parents, that they are then able to put words to their

cognitive and emotional experiences. Therefore, they too experience the emotion of hope in more rudimentary forms until, as they develop, it begins to take on a vital, and often subconscious aspect in their lives. Their capacity for complex experience and human identity makes it easy to hold them as moral patients. Yet a similar capacity for experience also exists within many organisms, including octopuses.

Increased demand for octopuses, and declining levels in the wild have led to the development of octopus farms, which are on track to be fully operational within a few years (Marshall 2021). Only recently octopuses were put on the list of sentient animals according to U.K. law (Baker 2021). Globally they are given very few legal considerations like this. In fact, they are commonly enjoyed fried, i.e. calamari, boiled, or even eaten alive (Gritzer 2019). To hold them in moral patienthood that is reflective of the vibrancy of their experience requires maintaining their individual identities when they cannot. Narratives must be told which allow insight into their lives. This can be done through Oscar winning documentaries, field notes, empirical research, and philosophical scholarship (Ehrlich and Reed 2020; Montgomery 2015; Godfrey-Smith 2016; Mather 2019b; Birch et al. 2021). Social narratives lead to identity constructions that help hold an entity within one's moral circle (Nelson 2002). It is imperative that the experiential life of all organisms, including octopuses, continues to be mapped. Human moral considerations should be updated along with the empirical data and philosophical conclusions. Octopuses have a complex conscious experience which includes the capacity to hope. Octopuses should be treated as moral patients and given legal considerations which reflect the richness of their mind, consciousness, and emotions.

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