Between the Species

What it's like, or not like, to Bee

ABSTRACT

In his recent work, David DeGrazia (2020) explores the possibility of insect sentience, focusing on bees as a case study. He advances a novel evolutionary approach, arguing that, from an evolutionary perspective, it's more likely that bees are sentient than insentient., insofar as bees (allegedly) would have a selective advantage if they are motivated—in the form of feeling—to achieve their aims. His argument assumes two questionable claims: (1) if X is a selective advantage for an organism, then the organism likely has X, and (2) conscious creatures would have a selective advantage if they are sentient. I challenge both claims, and consequently call into question DeGrazia's claim that we have an evolutionary-based reason to attribute sentience to bees (and other insects).

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Introduction

The question of whether insects are sentient or conscious is of increasing interest in a number areas of research, including philosophy, insect neurobiology and behavior, artificial intelligence and robotics, and evolution (Adamo 2016). While sentience refers to the capacity to feel pain or pleasure, consciousness refers to subjective awareness. Theoretically, consciousness is possible without the capacity to experience pain, insofar as it's possible for creatures to have states of awareness, but not the capacity to feel pain or pleasure (DeGrazia 2020; Klein and Barron 2016; Fischer 2016). The basic idea is that all creatures who are sentient are conscious, but not all conscious creatures are sentient.[1]

In general, there are three competing positions regarding insect sentience: (1) insects are sentient (and thus conscious), (2) insects are, at the very least, conscious (and perhaps insentient), or (3) insects are neither conscious nor sentient. A growing number of insect neurobiologists and behaviorists endorse some version of the second position, insisting that, at the very least, insects may have subjective awareness or experience, i.e., insects may have the most basic form of consciousness. Klein and Barron (2016), for instance, claim that human consciousness stems not from our neocortex, but from our midbrain, which is a simple structure that synthesizes sensory data in a way that enables us to navigate the world. Because "insect brain supports functions analogous to those of the vertebrate

[1] Relatedly, Ned Block (1955) draws a distinction between phenomenal consciousness, which is related to the capacity for sensory experiences, and access consciousness, which is related to the capacity for reasoning and direct control of action. According to Block, it's possible that creatures have access consciousness and not phenomenal consciousness.

midbrain," there's good reason to think that insects, too, are conscious (Klein and Barron 2016).[2]

In his recent work, David DeGrazia (2020) explores the possibility of insect sentience, focusing on bees as a case study. Drawing on the work of Klein and Barron, he argues that bees are conscious, while acknowledging that this doesn't entail that they are sentient (and thus it doesn't entail that bees have interests or moral status).[3] Consciousness, according to DeGrazia, refers to mere awareness, and thus it is more basic than sentience, which refers to awareness that involves feeling. So, bees might have awareness (i.e., consciousness), but not the capacity for feeling (i.e., sentience).

In determining if bees are sentient or merely conscious creatures who lack the capacity to feeling, DeGrazia advances a novel evolutionary approach to the question of insect sentience. In particular, he considers whether it is more likely, from an evolutionary perspective, that bees are (1) conscious and insentient or (2) conscious and sentient. He ultimately concludes that, from an evolutionary perspective, the latter is more likely. His conclusion stems from his claim that bees would have a selective advantage if they are motivated—in the form of feeling—to achieve their aims.

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[2] But as Alamo (2016) points out, Klein and Barron's position is grounded in a very narrow account of consciousness that reduces consciousness to some kind of information processing and excludes attributes that are traditionally associated with consciousness, such as self-awareness.

[3] On DeGrazia's view, the capacity to feel (i.e., sentience) is a prerequisite for having interests.

To motivate his argument, DeGrazia turns to a discussion of robotics, inviting readers to consider two different possible kinds of conscious robots.[4]

> (1) A robot that "not only has built-in aims," but also "cares about, or desires, their achievement such that the robot tends to feel frustrated at the frustration of its aims and to feel satisfied at the satisfaction of its aims" (29). That is, a sentient robot.
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> (2) A robot that "possesses not only built-in aims but also a type of consciousness that processes information about its environment (senses), about its own location and state (self-awareness), about its previous actions and their consequences for its system (memory)," but doesn't care about or desire anything, including achieving its aims (28). I.e., an insentient conscious robot.

DeGrazia argues that the first kind of robot—the sentient robot—would be "more proficient at avoiding destruction and performing its tasks" simply because it has the motivation—in the form of feeling—to achieve its aims and perform its tasks. According to DeGrazia, the same can be said for bees: they would be more proficient at performing their tasks and achieving their aims if they have the motivation—in the form of feeling—to accomplish their tasks and achieve these aims. As he argues:

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[4] As Adamo (2016) points out, on Klein and Barron's account of consciousness, some modern robots will turn out to be conscious. Presumably, DeGrazia agrees.

> If they [bees] are conscious and have certain action tendencies or general aims built into them through natural selection, and if they don't care whether they can achieve them, then a better biological model could emerge through random mutations in which creatures have the same abilities but care about achieving their aims—that is, have desires that tend to keep them and their hive mates alive and available for reproduction. (29)

There are two claims implied by DeGrazia's argument that merit further discussion.

1. If X is a selective advantage for an organism, then the organism likely has X.

2. Conscious creatures would have a selective advantage if they are sentient.

In what follows, I challenge both claims, and consequently call into question DeGrazia's claim that we have an evolutionary-based reason to attribute sentience to bees (and other insects).

Claim 1: If X is a selective advantage for an organism, then the organism likely has X.

DeGrazia moves quickly from the widely shared assumption that sentience provides animals with a selective advantage to the claim that bees must have it.[5] This line of reasoning seems to imply that simply because you can think of a property that

[5] Sentience is said to be a selective advantage for animals insofar as it enables them to make adaptive behavioral choices (Sneddon et al. 2014).

would give an organism a selective advantage, you can infer that it probably actually has that property. But that is obviously false. After all, the capacity to launch from the ground might give bats a selective advantage, but, still, bats don't have this capacity. Likewise, even if bees would be better at their "jobs" if they cared about achieving their aims, it doesn't follow that it's likely that this "better biological model" of caring about aims emerged through random mutations. Just as bats do not produce enough lift to launch from the ground even if this capacity would give them a selective advantage, bees may lack the physiological and neurological structures that are required for sentience (e.g., a large number of large sized neurons), even if this would give them a selective advantage.

So, perhaps bees are insentient because having the best selective advantage is not necessary for bee fitness, just like having the best selective advantage is not necessary for bat fitness.

Relatedly, because bee goals are relatively simple and easily achievable, it's unlikely that they need to care about their goals in order to achieve them. This is because creatures need to be motivated to achieve their goals only if achieving them requires highly proficient or skilled action.

Consider this: to become a professional philosopher, you must care about achieving this goal. Because developing the skills that are necessary for becoming a philosopher is so intellectually demanding and time consuming, you won't be able to pick up the requisite skills if you, for instance, spend your free time smoking weed and binge-watching Netflix. For weed and Netflix lovers to spend their time developing their philosophical talents, instead of spending it smoking weed and watching Netflix, they need to be motivated to become (i.e.,

they need to care about becoming) philosophers. After all, someone wouldn't spend so much time and effort developing philosophical skills if they didn't really care about becoming philosophers.

On the other hand, to be a garbage collector, you don't need to care about picking up trash, simply because collecting garbage is a task that requires little cognitive effort and minimal training. For instance, you certainly don't need to refrain from binge watching Netflix and smoking weed during your free time in order to achieve your goal of becoming a garbage collector. The point here is that the pursuit of difficult-to-achieve goals normally requires a significant amount of motivation, simply because creatures won't spend their time and exert their energy engaging in skilled action in an attempt to achieve a goal that they don't really care about. On the other hand, the achievement of an easy-to-achieve goal doesn't require those who pursue it to spend significant time or energy developing new skills. Rather, easy-to-achieve goals can be obtained with little to no effort, and thus there's no sense in which creatures need to care about easy-to-achieve goals in order for them to be able to achieve them.

Now, let's return to animals. Consider, for instance, cats. To achieve some of their goals, cats must care about these goals. This is because some feline goals are difficult to achieve. For instance, to achieve their hunting goals, cats must spend a significant amount of time patrolling their territories, defending their territories, searching for prey, tracking prey, waiting for prey, pouncing with precision, and so forth. Cats wouldn't spend so much of their time and energy engaging in this kind of skilled behavior if they didn't care about achieving their aims.

In fact, if they didn't care about these things, they'd likely just spend their time sleeping.

Now consider bee goals. Bees don't need to care about their goals in order to achieve them because bee goals are simple and often easy to achieve. Consider worker bees, for instance, all of which have only one task on any given day. The goal of some worker bees is something simple like feeding the queen or larvae. Others have the simple and straightforward goal of collecting pollen and nectar. And others have the goal of guarding the hive. Surely these bees don't need to engage in highly skilled behavior in order to achieve these simple, straightforward goals.

Now, think about cats again. Feral cats do all of these tasks, and more, at the same time. For instance, on any given day, they must protect their territories, hunt for food, and feed their young. Because of the effort and expertise involved in maintaining their fitness, it would make sense to say that, to remain fit, cats must be proficient at what they do, and this requires that they care about their goals. But it's plausible that all that is needed for bee fitness is some low-level bee proficiency, and perhaps this just amounts to certain action-tendencies or general aims built into them through natural selection.

So, even if bees would have some kind of advantage if they cared about their goals, it doesn't mean they do or must care about them. In other words, while caring about their goals might make bees perform in an extra-efficient manner, a lack of caring certainly won't make them unable to do the bare minimum that's necessary for achieving their very basic goals. Likewise, if a garbage collector really cares about picking up garbage, he likely will act in an extra (and unnecessarily) ef-

ficient manner, for instance, by picking up every single piece of trash he encounters. But this doesn't mean that a garbage collector who doesn't care about his goal of trash collection is unable to do the bare minimum that is necessary to achieve the very basic goal of trash collection.

Claim 2: Creatures would have a selective advantage if they are sentient.

As mentioned, DeGrazia seems to assume that because sentience provides many animals, such as mammals, with a selective advantage, sentience would provide insects with a selective advantage. Perhaps, though, the possession of certain capacities that seem to be beneficial for some animals aren't benefits to other kinds of animals. For one, it might be the case that problematic trade-offs have to be made for animals to have said capacities. In other cases, some animals will neither be harmed nor advantaged by sentience.

3.1 The reduction of valuable bee traits

Consider this: the capacity to launch from the ground seems, at first glance, to be a good capacity for bats to have. After all, this capacity works to the favor of birds. But while having the capacity to launch might give birds a selective advantage, it might not give bats a selective advantage. For instance, in order for bats to have this capacity, their bodies would have to be lighter, which would mean that some of their organs must be smaller, or their bones thinner; or they'd have to have much larger muscles, which would require more calories to maintain.

Similarly, while sentience arguably benefits mammals, perhaps it wouldn't give bees a selective advantage, insofar as the emergence of bee sentience may involve unfavorable trade-

offs. Here's something to consider: while bees have around one million neurons, humans have around 100 billion. While we don't know what the neurophysiological requirements for sentience are, perhaps it requires some number of neurons much greater than the current number of bee neurons, and perhaps the neurons that are part of the pain network are quite larger than current bee neurons. Perhaps, then, in order for bees to have the number and size of neurons required for sentience, their brains would have to be thousands of times lager, which arguably wouldn't be adaptive.[6] Relatedly, citing Garcia-Larrea and Bastuji (2018), Amado (2019) points out that the pain network in the brains of sentient animals may require extensive wiring, which in turn involves high metabolic energy use. She thus suspects that if insects acquired the neural requirements for sentience, they would undergo other trait-reductions, such as reduced reproduction.

3.2 Learned Helplessness

Consider other possible costs of bee sentience. If bees are sentient and care about their goals, they likely will feel frustration when they don't obtain their aims, and repeated feelings of frustration may cause them to altogether stop attempting to complete their aims.[7] This is known as learned helplessness. Given the brutality of nature, we should expect that many animals, including bees, commonly face events they can't con-

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[6] As Zheng et al. (2018) point out, 100 additional neurons would increase the cost of the brain by 0.1% in insects that normally have 100,000 neurons in their brain. Chittka and Niven (2009) doubt that the insect brain provides the room required for the pain network.

[7] Relatedly, if one feels satisfaction in the face of achievement, one might relish the moment a little too long, failing to move on promptly to the next task, which may also reduce fitness.

trol or do anything about. And as Seligman (1972) notes, "such uncontrollable events can significantly debilitate organisms: they produce passivity in the face of trauma, inability to learn that responding is effective, and emotional stress in animals" (407).[8]

Consider again male drone honeybees, whose primary, if not sole, purpose is to mate with a queen bee. Bee mating takes place in what are called drone congregational areas (DCAs). 8,000-15,000 drones from up to 240 colonies typically occupy every DCA, where the drones will compete with one another to mate with a queen bee(s) who visits (Heidinger et al. 2014). Because each queen bee mates at only one period of her life, usually with only 6-26 drones, most drone attempts to mate with queen bees are unsuccessful (Heidinger et al. 2014). Nevertheless, day after day, drone bees continuously attempt to mate with queen bees.

Arguably, if drone bees were sentient and cared about their primary aim of mating with a queen bee, they would feel perpetual frustration in response to their repeated failure to mate. And we could only expect that drones would altogether give up on their mating goal, as many humans might do if they constantly face rejection while trying to date. Moreover, the few drones that do achieve their goal of mating with a queen bee usually die immediately after copulation (Schlüns et al. 2005).

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[8] There have been learned helplessness studies conducted on honey bees. The researchers found that "Unlike learned helplessness studies in other animals, no decrease in general activity was observed. Furthermore, we did not observe a "freezing" response to inescapable aversive stimuli-a phenomenon, thus far, consistently observed in learned helplessness tests with other species. The bees, instead, continued to move back and forth between compartments despite punishment in the incorrect compartment" (Dinges et al 2017). This suggests that bees aren't sentient.

So, drones wouldn't have a selective advantage if they experienced satisfaction after achieving their aim of mating—after all, they die within seconds of achieving that aim. So, it's not as if feelings of satisfaction could increase bee fitness by motivating them to achieve other tasks.

Now, consider the female worker honeybees. Presumably, the most important aim of the "workers" is the protection of fellow bees and promotion of colony growth. But even in healthy colonies, bees die every day. For instance, the average foraging life of a bee is less than seven days (Khoury et al. 2011). In the summertime, standard bee colonies lose approximately 1,000 bees each day (O'Toole and Raw 1991). Perhaps, then, if worker bees cared about accomplishing their task of promoting colony growth and protecting individual colony members, the significant and continual loss of bee life would be terribly upsetting. Perhaps worker bees would endure high levels of fear, anxiety, and stress from witnessing so many of their fellow workers drop dead, which arguably would impair bee productivity and fitness. The point here is that if bees cared about their aims, they might be less likely to complete their tasks. Perhaps, then, a lack of "bee-caring" can explain why they have existed for approximately 100 million years.

3.3 Wasted efforts

For the sake of argument, say that bees wouldn't give up easily or become easily distracted if they could experience feelings of frustration when they fail to achieve their aims. Still, there's reason to deny that bees would have a selective advantage if they cared about their aims.

Consider the following: I'm highly motivated to win a running race. But my motivation to win the race will not help me

run at 10 mph if I physically cannot run at 10 mph, which is how fast I must run to win the race.

But say I can, with incredible effort, run at 10 mph. I'm more likely to win the race if I really care about this goal, since I can make the choice to use all of my abilities or just some of my abilities during the race. If I really care about the race, I presumably will max out my running capabilities. I might even run at 10 mph. On the other hand, if I come to the race with a goal of winning, but I don't really care that much about winning, I'm less likely to put forth my utmost effort, and thus I'm less likely to achieve my goal than I would have been, had I put forth a full-faith effort.

Likewise, even if bees are motivated to achieve their goals and they can choose how much effort to exert in the pursuit of these goals, there is a limit to what they can do and how proficient they can be, given their limited capacities. Call this limit "limit Z". And perhaps if bees really cared about their goals and could choose how much effort to exert, they would perform at limit Z.

But maybe it's the case that the action-tendencies or general aims built into bees through natural selection cause them to act as proficiently as possible, relative to bee abilities, and this is why they perform at Limit Z. It thus doesn't seem that bees that both care about their aims and can choose how much effort to exert in the pursuit of their aims would have a selective advantage over bees that are "programmed" by natural selection to act in the most proficient way possible. The outcomes of their movements might be the same either way, as it's possible that both types of bees would exercise their abilities in the most proficient way possible.

My point is that caring about one's goals and choosing how much effort to exert in pursuit of these goals would be an advantage for an organism if the only alternative is that it would be "programmed" to underperform or to perform at a level beneath its abilities. Yet there's a third possibility I've presented here: perhaps there are organisms, such as bees, who are "programmed" to "max out" their abilities.

Concluding remarks

On a separate but related note, we ought to consider whether caring about one's goals is ever valuable in the absence of free choice. Consider DeGrazia's discussion of robots, which seems to assume that a robot can fail to do what it is programmed to do if it doesn't have qualia to motivate it. But a robot with no qualia would, by definition, just automatically do whatever it's programmed to do. And it's impossible for it to get any better at that because, presumably, it cannot go beyond what it is programmed to do. So even if it cared about its goals, its movements would still be determined by the programmer, and thus it could not act more "efficiently" than an insentient robot with the same programming.

There seems to be some sort of category mistake within DeGrazia's argument for bee motivation. While motivation and caring is likely good (i.e., improves fitness) for life forms that make free choices (insofar as if they don't really care about their aims, they may choose to underperform), motivation/caring wouldn't be a good thing to acquire for life forms that can't make such choices. And if I'm right that motivation and caring would be good to have only for beings who make free choices, then DeGrazia's argument for bee sentience is seriously flawed. It assumes that because motivation matters for

life forms that make free choices, bees likely have it. But this prematurely presupposes that bees do make free choices.

In summary: I think that DeGrazia's argument only applies to animals whose behavior is not physically determined. If one's behavior is physically determined, then it won't matter if that being acquires the ability to care. Maybe human behavior is not physically determined, because we have free will. But arguably, bees lack free will, whether or not you think they are sentient. So the ability to care probably would not change bee behavior.

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