Can scientific laws be discussed on philosophical grounds? A reply to naïve arguments on 'predators' proposed by Bramble (2021)

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Abstract

Can scientific laws be discussed on philosophical grounds? a reply to naïve arguments on 'predators' proposed by Bramble (2021). A recent paper by Bramble (2021) argues that given that predators inflict pain and fear on their prey we have the moral right to act to minimize these effects. The author proposes two alternatives. The first is to transform predators by 'genetically modifying them so that their offspring gradually evolve into herbivores'. The second is simply 'painlessly killing predators', which is the title of Bramble's essay. We address the misconceptions that Bramble uses as central in his arguments and present scientific reasoning to discuss the ethical implications of disregarding scientific knowledge when addressing animal welfare and animal rights. We conclude that both Bramble's alternatives are nonsensical, not only from a scientific point of view, but also, and more importantly, from ethical grounds.

Key words: Animal behaviour, Predation, Environmental ethics, Philosophy, Scientific law

Resumen

¿Se puede mantener un debate filosófico sobre las leyes de la ciencia? una respuesta a los ingenuos argumentos sobre "depredadores" propuestos por Bramble (2021). En un reciente artículo, Bramble (2021) sostiene que, dado que los depredadores infligen dolor y miedo a sus presas, tenemos el derecho moral de actuar para minimizar estos efectos, y propone dos alternativas. La primera es transformar a los depredadores "modificándolos genéticamente para que sus descendientes se conviertan gradualmente en herbívoros". La segunda es simplemente "matar a los depredadores sin dolor", que es el título del ensayo de Bramble. Aquí abordamos los conceptos erróneos utilizados por Bramble y que son centrales en sus argumentos y presentamos un razonamiento científico para analizar las implicaciones éticas de ignorar el conocimiento científico al abordar el bienestar y los derechos de los animales. Concluimos que las dos alternativas de Bramble carecen de sentido, no solo desde un punto de vista científico, sino sobre todo, desde el punto de vista ético.

Palabras clave: Comportamiento animal, Depredación, Ética ambiental, Filosofía, Ley de la ciencia

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Introduction

The naïve concept of predator

Studies performed in all kinds of ecosystems show that life is organised into trophic webs, with matter and energy transfers from producers to herbivores, then to first–level carnivores, and so on. 'Predation' is a general concept which includes several types of related interactions characterised by the predator's negative effect on the prey, and the fact that the predator attacks a prey which is alive (Begon et al., 2006). It includes not only 'Attenborough's ferocious beasts' (the only animals Bramble (2021) considered as predators, fig. 1A), but also, for example, animals that eat seeds (seed predation) or eggs (egg pre-dation) that kill 'would–be' organisms, and animals like mosquitoes, leeches, and herbivores, that eat only parts of their prey (fig. 1B). Parasitoids, insects that develop inside other insects, kill the host to complete their development and are also predators (Begon et al., 2006).

Bramble (2021) restricts his definition of 'predator' arbitrarily ('ferocious beasts'), simply to serve his argument:

> "A vital question here is which animals count as predators for the purposes of this argument? Do insect–eating birds count? **This should depend on the mental lives of insects**. If insects aren't capable of lives worth living, there would be no reason to prevent birds eating them. **For what it's worth, I'm not here thinking of insect–eating birds as predators in the relevant sense**." [footnote 7; the emphasis is ours]

Let us examine this argument from current scien-tific knowledge of the 'mental lives' of insects. Can insects feel pain or fear? They can, even if the debate about this topic is complex and therefore out of the scope of this essay (contrasting views are presented for instance in Adamo (2016) and Tiffin (2016)). For instance, dragonfly larvae are known to die of fear after being exposed to chemicals released by their predators (McCauley et al., 2011). This can be con-sidered a type of pain. The mental lives of insects allow them to count up to four (Dacke and Srinivasan, 2008), and honeybees are even able to recognize the concept of zero (Howard et al., 2018). Insects have complex personalities (Schuett et al., 2011); they can learn complex tasks (Dukas, 2008); social insects play among nestmates (Weber, 2014, p. 135) and ants use tools (Maák et al., 2017). Therefore, we conclude that insects are prey, and birds eating insects are predators.

More importantly, consider the opposite case: insects eating birds (fig. 1C). There are hundreds of observations of small hummingbirds falling prey of large insects like mantises (Nyffeler et al., 2017) or other invertebrates such as spiders (Brooks, 2012). Mantises can even make a hole in the victim's head through which the brain is extracted, but if insects do not qualify as prey because 'aren't capable of lives worth living', they surely cannot be also considered pre-dators, right? However, the concepts of predator and prey are indissoluble. If the birds eaten by mantises are considered prey, then, the mantises themselves are predators.

Let us now turn our attention to herbivores (fig.1B), because in Bramble's (2021) arguments they are clearly not predators given his proposal to 'herbi-vorise' predators. We suppose that the absence of 'mental lives' in plants would be the basic argument to consider that eating plants is 'good' whereas eating animals (except for insects) is 'bad'. But do plants feel 'pain' when they are attacked? The scientific answer is, again, yes. Trees attacked by herbivores release chemicals, which are detected by nearby trees, and trigger an anticipated response to a predictable attack. This explains why giraffes feeding on *Acacia* trees in Africa (fig. 1B) have to move to trees situated over 90 m away from the first attacked trees which produce chemical defences to avoid being eaten (Wohlleben, 2016). Plants also 'call for help' when attacked. Chemical compounds are released when insect herbivores eat leaves, attracting parasitoids that attack the herbivore, and indirectly help the plant. Herbivores therefore also qualify as predators.

And what about plants? Surely they are the quin-tessence of 'prey'. They have no nervous system, they do not move and they do not prey on other organisms. In fact, as with all naïve generalizations, this is wrong. Chemicals flow within the phloem and xylem, the vessels of vascular plants, acting as a nervous system (Muday and Brown–Harding, 2018); plants move, but in a time scale different to ours. An extreme case is the so–called 'walking palm', which is able to relocate itself away from its germination point (Bodley and Benson, 1980). Recent research has shown that mycorrhizal fungal networks linking the roots of trees in forests allow abilities such as perception, learning and memory in trees, and have a topology similar to neural networks (Simard, 2018). Some plants capture insects (fig. 1D) and some 'eat' them. Even Darwin (1888) was fascinated by these insectivorous plants. Should we eliminate them ac-cording to Bramble's arguments?

The arbitrary definition of 'predator' used by Bramble (2021) is scientifically flawed. Most 'herbi-vorous' animals do consume other animals, even if in small quantities. For instance, chimpanzees are mainly fruit and leaf–eaters, but they occasionally hunt and eat small monkeys and other animals, using highly elaborate hunting behaviours and strategies (Newton–Fisher, 2007). Using Bramble's arguments, we should extirpate chimpanzees, a species that shares a great part of our 'humanity'. Or should we make an exception if they only hunt occasionally? Many other animals are omnivorous, including our own species. Shall we 'painless kill' only those individuals that show carnivorous be-haviour? Or is the whole species deemed to be eradicated if some individuals show blood–appetite? The questions to pinpoint the practical terms of Bramble's claims are endless.

Fig. 1. Predators are all animals –and plants– that feed on whole or parts of other organisms. This includes the 'ferocious beasts' of nature documentaries like these lions feeding on a zebra in Nairobi National Park (A), but also all herbivores (B) like the giraffe eating *Acacia* leaves. Bramble (2021) arbitrarily excludes insect–eating birds from his definition of predators, because he naïvely assumes that insects have no worthy 'mental lives'. However, they can act as predators of birds (C), and if they can predate on birds, they cannot be considered as irrelevant when are prey. Lastly, some plants, like this *Erica ciliaris* (D), have structures that capture insects and kill them slowly. Some plants even digest the insects captured. Pictures by Adolfo Cordero–Rivera (A, B, D) and Darrell Ferriss (C).

Fig. 1. Los depredadores son todos los animales (y las plantas) que se alimentan total o parcialmente de otros organismos. Esto incluye las "bestias feroces" de los documentales sobre la naturaleza como estos leones que se alimentan de una cebra en el Parque Nacional de Nairobi (A), pero también todos los herbívoros (B) como la jirafa que come hojas de Acacia. *Bramble (2021) excluye arbitrariamente a las aves insectívoras de su definición de depredadores, porque supone ingenuamente que los insectos no tienen "vidas mentales" que valgan la pena. Sin embargo, los insectos pueden actuar como depredadores de aves (C) y si pueden depredar aves, no se pueden considerar tan intrascendentes cuando son presas. Por último, algunas plantas, como esta* Erica ciliaris *(D), tienen estructuras que capturan insectos y los matan lentamente. Algunas plantas incluso digieren los insectos capturados. Imágenes de Adolfo Cordero–Rivera (A, B, D) y Darrell Ferriss (C).*

Evolutionary misconceptions

One of Bramble's arguments consists of the gradual herbivorisation of predators through genetic modifications. This is clearly an unjustified claim because individuals exhibit behavioural plasticity (Cordero–Rivera, 2017) to explore different foraging habits and food items, making it impossible to genetically control what an animal will eat. Bramble (2021) apparently ignores that the phenotype evolves in an integrated way. For example, the components of the vertebrate jaw (whose structure is different in herbivorous and carnivorous mammals) are influenced by at least 33 quantitative trait loci (Klingenberg et al., 2004). Artificial selection

on animal breeds produces many undesirable side–effects (Negro et al., 2021), illustrating the fact that deep changes like those suggested by Bramble are likely to modify most other biological attributes of the selected animals. That is, any attempt to alter this complex network of genes can lead to unexpected effects. And a change in diet needs a change in the structure of the digestive system, for example. Thus, changing the genetics of predators until they evolve into herbivores is a reductionist view of both genetic modification and the evolutionary process. Changing genetic traits of a species in such a large intervention will alter species characteristics in a way that it will result in a completely different species, and consequent new evolutionary and ecological processes.

Given that the evolutionary process will not stop after our intervention in nature, even if we were able to 'herbivorise predators', natural selection would favour the evolution of new predators. Bramble (2021) surprisingly assumes that the only new species evolving would be herbivores: 'New species of herbivores might emerge without predators there to immediately cut them down'. Evolution cannot be stopped at our will.

Scientific arguments

Although there is an endless discussion about what a scientific law is, one common definition is the view that laws are universal statements that are so well corroborated that everyone accepts them as the basis of scientific knowledge (Krebs, 2000). In other words, each scientific paradigm is grounded on basic principles that form a coherent explanation of the field. Some eminent scientists have argued that there are no laws in Ecology (Lawton, 1999). Krebs (2000) explicitly indicates: 'there are laws in physics, chemistry, and genetics but not in ecology.' However, as Murray (2000) indicates, the theory of evolution and the dynamics of populations offer clear ecological laws. In fact, Krebs (2016) changed his mind and more recently has written:

"The generalization that populations cannot increase without limits could be called a law of ecology and is a simple recognition that the Earth is finite."

This is a basic ecological law, apparently ignored in Bramble's essay. Given the finite nature of resources, no population can increase endlessly, and predators are precisely one of the elements that form part of this law.

Bramble (2021) attempts to revive or to elaborate the ideas propagated by McMahan, who published a similar essay in the New York Times (McMahan, 2010). McMahan's ideas received a lot of attention at the time and a great deal of replies. Likewise, Bramble's essay has spread in the social media, causing considerable turmoil among ecologists, conservationists, and defenders of animal rights. McMahan' and Bramble's arguments are absurd because they ignore the effects of species extinctions. Such arguments can be made about the extinction of *one* species of predator, but do not hold on the extinction of all predators.

Let us for a moment assume that we could 'herbivorise or painlessly kill predators', obtaining a new ecosystem with only plants and plant–eating animals (and of course decomposers and detritivores, ecological roles apparently ignored by Bramble and McMahan). Would this be stable? Clearly not. The intricate trophic dynamic equilibria of all ecosystems include several types of predators. To our knowledge, there is not a single case of an ecosystem completely devoid of predators, and even more, we argue that it is theoretically impossible. A basic ecological law predicts that natural selection would always favour predators, given the high rewards in terms of efficiency (and consequently, reproduction) of using complex molecules to feed on, instead of newly assembling them using the energy of light or other sources. In the classic reference 'Origins and early evolution of predation', Stefan Bengtson (2002) comments that:

"[…] whenever predatory lifestyles evolved they became a strong evolutionary force. […] Predators and prey may enter into symbiotic relationships and emerge as new organisms. Current theories on a number of major transitions in evolution (non–cellular to cellular; prokaryote to eukaryote; non–sex to sex; small to large; unicellular to multicellular; multicellular to tissue grade; sessile to motile; soft to hard; smooth to spiny) tend to focus on the introduction of predation as a decisive factor."

This is true on this planet, but would also hold true in the Universe had life evolved more than once. Bramble (2021) disregards a solid body of contrary evidence to his thesis. For instance, when human activity has eradicated key predators, the effects on ecosystems have been devastating. Viruses, bacteria, and protozoa responsible for various diseases and epidemics use rodent populations to spread and invade humans, and predators can control the population density of the majority of species of zoonotic reservoirs. Therefore, the biotic homogenization advocated by Bramble (2021) can expand the incidence and distribution of infectious diseases affecting humans and increase the risk of novel diseases (Wilkinson et al., 2018). A recent study found that wolf predation can lead to a marked reduction in the prevalence of tuberculosis in wild boar, without leading to a reduction in prey population density (Tanner et al., 2019). Therefore, eliminating wolves would harm their prey, due to increased disease prevalence, with the unavoidable suffering of prey, which is the main argument to eradicate predators! The most common effect of human activities has been labelled as the 'empty forest' syndrome (Redford, 1992) or 'defaunation', which normally targets the largest forest animals, affecting plants when the animals eradicated are mainly frugivorous, which are a clear type of predators despite Bramble's arguments (Bello et al., 2015). In conclusion, the premise of McMahan (2010) that his

arguments are only valid 'provided that this could occur without ecological upheaval involving more harm than would be prevented by the end of predation' is clearly unjustified. Eliminating predators produces more harm than good, even for herbivores.

Ethical arguments

In his influential book 'A sand county almanac', Aldo Leopold (1949) develops a 'land ethic', which was the seed for ecocentric ethics (Knight and Riedel, 2002). In a particularly emotive –and science–based– passage, he describes the killing of a wolf:

> "We reached the old wolf in time to watch a fierce green fire dying in her eyes. […] I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise. **But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view**. Since then I have lived to see state after state extirpate its wolves. […] I **now suspect that just as a deer herd lives in mortal fear of its wolves, so does a mountain live in mortal fear of its deer**. […] The cowman who cleans his range of wolves does not realize that he is taking over the wolf's job of trimming the herd to fit the range. **He has not learned to think like a mountain**. Hence we have dustbowls, and rivers washing the future into the sea." [the emphasis is ours]

Leopold (1949) describes in the above passage what is now known in Ecology as 'trophic cascades', i.e., the effect of a trophic level (wolves) on another trophic level (plants) via an intermediate level (ungulates). In Leopold's 'land ethics' mountains have moral rights, they live 'in mortal fear of its deer', and wolves precisely help mountains to maintain a good health. Have we the moral rights to extirpate predators and ignore the consequences? Should we instead learn to 'think like a mountain'? This is not simply a matter of opinion. The consequences are real, as the cases discussed above or the famous reintroduction of wolves to Yellowstone National Park exemplify (Smith et al., 2003). For instance, 'browsing by elk prior to wolf reintroduction had suppressed growth of willows across Yellowstone's Northern Range' and 'largely eliminated cottonwoods from Yellowstone with only a few old trees remaining' (Boyce, 2018), demonstrating the accuracy of Leopold's ethical ideas: wolves are crucial for the survival of trees!

Bramble (2021) assumes the right of humans to judge animals by their behaviour. He proposes that humans might change other species before proposing changes in human behaviour (paradoxical, because we humans mostly fed on herbivores). He claims for behavioural censorship in order to obtain a calm environment free of harm, but following his no–harm arguments, he should prohibit all aggressiveness between herbivorous species too (e.g., male–male contests, sexual harassment…), and ultimately, all ways to feed on living matter (all predators, including herbivores and humans). We also should eliminate most of our pets, because they are carnivorous and cause extensive harm to wildlife, particularly cats (Marra and Santella, 2016) and dogs.

Furthermore, who is predator and who becomes prey is dependent on the context (relative size, random factors, accidents), and therefore we cannot naively propose that predators are intrinsically bad, and that we have the moral duty to control or eliminate them. In his 'Anthropology beyond the human' Kohn (2013) tells a story that people from the Amazonian forests of Peru use to exemplify the intricate relationships among living beings: a jaguar attacked a turtle and became trapped with its canines in the turtle's carapace, being forced to abandon the prey and the teeth. Toothless, the jaguar died from starvation, and the turtle fed on the carrion of its former predator. Matter and energy circulate from one living being to another and to the soil. In his concluding essay 'The land ethic', Leopold (1949) gives clear advice against 'painless killing of predators' with these words:

> "**A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise**. […] Conservation is paved with good intentions which prove to be futile, or even dangerous, **because they are devoid of critical understanding either of the land, or of economic land–use**."
> [the emphasis is ours]

At first glance, the ideas of Bramble (2021) appear to be compassionate and, even morally superior. However, the compassion proposed by Bramble is selective, and this poses many problems. What about carnivore plants? What about the suffering they cause to insects trapped and slowly digested? Bramble (2021) elaborates a succession of premises and conclusions that lead to absurdity, creating an unreal premise to manipulate the reader's feelings (*appeal to emotion* fallacy). Then, the author uses another fallacy called 'appeal to pity' (or 'argumentum ad misericordiam'), for the conclusion to be accepted:

> "I want to end by asking you to consider how predators themselves might feel about their lives were they somehow to come to understand the true nature of the harms they inflict on prey. Many of these predators, I suspect, would feel deeply sad, or even horrified, at what they are involved in–indeed, at what they are. I could even imagine them forgiving or excusing us for painlessly killing them."

Conclusions

Bramble (2021) confuses human ethics, a construct built in human societies to support their rules, with the behaviours of animals (naively classified as good and bad). He proposes to kill all the animals that he considers as bad, meaning only vertebrates that

feed on vertebrates. These animals are described as evil organisms enjoying the sufferance of others. No plants, fungi and unicellular organisms are considered. Other organisms are considered as irrelevant (for instance, insects). This fact triggers hate towards some species according to personally biased criteria. In words of Leopold (1949):

"It is only in recent years that we hear the more honest argument that predators are members of the community, and that no special interest has the right to exterminate them for the sake of a benefit, real or fancied, to itself."

In conclusion, discussing the possibility to extirpate predators (but arbitrarily only some…) because they are intrinsically bad is a modern version of the medieval age theological discussions about the number of angels that could dance on the head of a pin. Scientific knowledge is a fundamental basis of human culture, which has long separated from philosophy and other social ways of learning (Hirsch Hadorn et al., 2008) but cannot be simply ignored in this discussion. Scientific laws, and the trophic chains are an example of an ecological law, are not susceptible to be derogated or annihilated at our will. We could feel depressed by the fact that gravity exists and therefore we cannot fly. But we cannot eliminate gravity. We can feel sad when a herd of lions captures a zebra (fig. 1A), or when a shark devours a live turtle, but we cannot eliminate predation. We must also recognize that other people might prefer to show their empathy towards starving, sick tigers or wolves, and this compassion would not be morally inferior to that for the species of herbivores.

Acknowledgements

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