4 Don't eat the bugs!

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4.1 Introduction

"The protein transition" (see Tziva et al.) aims toward an equitable and balanced way of producing high-quality protein, specifically exploring alternative sources of protein that have significantly lower impacts on the environment than conventional livestock farming. Entomophagy, the consumption of insects, is increasingly hailed as a sustainable solution in this transition. Notable intergovernmental organizations such as the United Nations, in particular its Food and Agriculture Organization (FAO), promote the development of "insect industries" as a means to food security while taking the predicted global population growth (Alexandratos and Bruinsma) and the pressing issues of anthropogenic climate change into consideration (van Huis et al.). Present proposals frame insects as a novel food source, which could provide a solution to conflicting ecological and economic interests due to their relatively low environmental impact compared to conventional animal protein.

However, entomophagy is far from new: eating insects is common practice in a multitude of cultures and has been for millennia (Govorushko). It is estimated that 2,000 different species of edible insects are consumed by 2 billion people in 113 countries (Tao and Li). The countries where most insects are consumed lie in Sub-Saharan Africa – in particular the Democratic Republic of Congo, Congo, the Central African Republic, Cameroon, Uganda, Zambia, Zimbabwe, Nigeria, and South Africa – but insects are also regularly consumed in Latin American and Asian countries (Guiné). Moreover, Australian aborigines have a long tradition of consuming insects, which they term 'bush tucker,' and which includes honey ants and witchetty grubs, the large larvae of moths (Paoletti). The insects that are consumed most often are beetles, caterpillars, bees, wasps, and ants, but grasshoppers are also considered a delicacy (FAO). Many insects are eaten as a snack – for example, they are eaten instead of popcorn during a visit to the cinema – but for many people with a low income, for example

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in Vietnam and Thailand, they are the main source of protein. They, therefore, play an important role in ensuring food security (Raheem).

At first sight, the stimulation of entomophagy in Western countries sounds promising. On closer inspection, however, we can identify several practical obstacles and theoretical objections that potentially undermine the prospected merits of developing insect industries. First and foremost, the current literature on insect eating has mainly focused on the ecological, economic, and entomological aspects of the subject, thus largely escaping ethical reflection and philosophical scrutiny. As a result, relatively little research has been devoted to, for example, insect sentience and welfare conditions (Gjerris, Gamborg, and Röcklinsberg). Second, there are several practical obstacles that question the feasibility and sustainability claims surrounding insect industries related to global population growth, cultural changes, and the lack of consumer uptake of entomophagy. Of particular note is that due to the lack of Western consumer uptake of insects as food, the focus of insect industries has partially shifted toward using insects as feed for pigs and poultry. This move may promote Western positivist and progressivist assumptions that threaten non-Western practices and cultures. The latter could be considered problematic according to a tradition of environmentalists that criticize the widespread belief in progress, and, moreover, consider it a central aspect of Western culture that is related to – or even the cause of – environmental pollution, ecological degradation, and the exploitation of animals. According to this tradition, we have to limit our modern *modus operandi* and explore the rehabilitation of pre-modern ideals, values, and practices. In this chapter, we echo this call for intellectual and moral reform by appealing to the virtue of temperance.

Third, we address the aforementioned neglected ethical aspects, related to insect sentience and insect welfare; while research projects on and the promotion of entomophagy are already in advanced phases, and industrial mass-rearing facilities are already in production, there has been a slight increase in interest regarding the ethical treatment (Drinkwater, Robinson, and Hart) and welfare of invertebrates, including insects (Van Huis). Noteworthy, and contrary to what is morally desirable, insects that are currently being used are exempt from (species) specific welfare protection, both in food and feed production, as well as experimental settings. The fact that insects are currently unprotected relates to disagreement and uncertainty about insect sentience. This uncertainty, we argue, following Bennett and Hacker's *Philosophical Foundations of Neuroscience*, is deeply rooted in the history of philosophy and results from conceptual confusion. Under normal conditions, insects display behavior that is to be understood as constitutive evidence for ascribing pain and other mental capacities to them; insects can feel, desire, and want things. Although this provides reasons for regulating

insect welfare and grounds for utilitarian and deontological arguments, we posit that the presence of insect sentience need not be the morally decisive factor. Instead, we posit that our treatment of insects should be guided by our human capacities, particularly in the sphere of temperance and compassion, instead of insect capacities or the presumed absence thereof.

4.2 Preliminaries and practicalities

For some time, there have been promotional and lobbying efforts for entomophagy in the West. For example, our university (Wageningen University & Research) has published an insect cookbook, and this has been actively promoted by the former chair of the board, Louise Fresco. The FAO has published numerous reports on entomophagy, and in the 2013 report *The Contribution of Insects to Food Security, Livelihoods and the Environment*, eating insects is promoted by emphasizing the positive impact it could have on health, environment, and food security. Other influential non-governmental and international lobbying organizations, such as The World Economic Forum (WEF),[1] actively promote the idea of insect eating and advocate the development of insect industries. Indeed, many of the publications on insect eating, ranging from newspaper articles to academic literature, provide a predominantly positive perspective on the topic.

Although there may be certain benefits to, for example, eating mealworms instead of steak or mass-rearing flies on manure and feeding fly larvae to poultry, many consumers do not seem convinced: the uptake of insect eating remains low in many Western countries (Shelomi). There are several factors that could explain the lack of consumer interest. In the Western world, insects are generally associated with unhygienic conditions,[2] e.g., rotting and infestation (the "yuck factor"), which could explain why many people reject entomophagy. Numerous surveys have shown that it is very unlikely that European consumers will substitute their meat consumption for insects (Hartmann and Siegrist). Consumer research shows that only 12.8% of males and 6.3% of females in Western countries were likely to adopt insects as a meat substitute (Verbeke).

Besides neophobia, sociocultural factors influence consumers' amenability to consume insects (Tan et al.). While a small group of consumers in Western countries are willing to sample insects out of curiosity, routine consumption tends to lag behind and is dependent on many factors, including convenience, price, taste, presentation (whether the insects are visible or processed),[3] status, and cultural appropriateness (House); most insects are not considered halal or kosher and are thus culturally inappropriate food in Middle Eastern countries (Shelomi). As a review on consumer acceptance of a variety of alternative proteins shows, consumer acceptance of insects is the lowest compared to cultured meat (the second

lowest) and other plant-based proteins (the highest) (Onwezen et al.). Other research has shown that arguments about sustainability are not sufficient motivators for the consumption of insects (Tan et al.).

Furthermore, in most Western countries, diets are already high in (animal) protein: the average protein consumption exceeds the recommended intake by one and a half up to twofold (de Boer and Aiking), and this often leads to adverse health impacts (Rouhani et al.; Wolk). This high protein intake is related to the overconsumption of meat (Rust et al.). In addition, due to the lack of Western consumer uptake of insects as food, the focus of insect industries has partially shifted toward using insects as feed for pigs and poultry. Although the latter could still provide environmental benefits, for example by utilizing agricultural waste streams as substrates for rearing insects, and thus contribute to a circular use of resources, the benefits will undoubtedly be lower than the benefits of the direct consumption of insects. Moreover, this divergent approach to insect industries could in fact facilitate economic efficacy and growth of the already existing intensive and industrial animal husbandry systems.[4] Consequently, utilizing insects as feed could facilitate the meat industry and thus sustain the ongoing (over)consumption of meat. Thus, contrary to the initial goal as a genuine substitute for meat, using insects as feed could further practices that are widely acknowledged for their contribution to anthropogenic climate change (Godfray et al.; Springmann et al.).

The foregoing is extra precarious when we take the prospected growth of the global population into account. On top of that, in some countries where insects were traditionally consumed, entomophagy is actually decreasing, as consumers turn to Western diets that are seen as socially superior (Shelomi). Given these cultural changes and the growing global population, "it seems that mankind is chasing a mirage: because humanity is propelled by its own population growth, the goal of a reasonably fed world population remains out of reach" (Lemaire *Against the Time: Comments on Our World*, 58). Note, however, that contrary to this kind of Malthusianism, and despite the painful fact that between 720 and 811 million people faced hunger in 2020, global food production is in fact sufficient to satisfy everyone's nutritional needs: the current food production may even meet the needs of the estimated global population in 2050, provided that there will be serious societal adaptations toward more plant-based diets (Berners-Lee et al.). Alternative vegetable sources of protein are readily available and there may be reasons to prefer those over animals; such a dietary change from animal-based foods to plant-based foods in high-income nations could even double "climate dividend" if agricultural land would be restored to its antecedent natural vegetation, thereby increasing carbon sequestration (Sun et al.).

Moreover, traditional entomophagy generally involves locally and wild-collected insects; this is likely a more "sustainable harvesting practice" compared to industrial infrastructures that aim to produce thousands of tons per year for the global marketplace; these traditional practices are not designed according to modern principles, operate without global logistics and transport, and originally take place in relative harmony with local ecosystems. Thus, the hopeful scenarios that envision insect industries as "modern science merged with valuable traditional knowledge and food culture," which "can contribute to innovation and the scaling up of mass-rearing technologies," as espoused by the FAO (2), can be understood as progressivist platitudes that obscure the continuous encroachment of the modern worldview and Western living standards, which have suppressed and erased non-Western traditional practices and cultures over the past centuries (Lemaire *On the Value of Cultures*). Instead of modernizing and industrializing traditional practices, we could actually learn from traditional knowledge, explore, and rehabilitate the underlying ideals, principles, and values thereof, such as localism, small scale, autarky, and, as we will argue, temperance.

In summary, we have illustrated that the problems outlined in the introduction are directly related to an excessive and, as we shall argue, inappropriate indulgence in animal protein by Western consumers. Note, moreover, that this is made possible by an unequal availability and distribution of food – not a lack of (global) food production. Therefore, it could be argued that there is no need for designing new intensive and industrial animal husbandry systems – rather, it is desirable to achieve a decrease in the total food intake in Western countries and specifically to moderate the intake of animal protein. If Western governments would nevertheless adopt these policies and further stimulate the rearing of insects on an industrial scale, it would be better to produce insects as food and try to stimulate actual entomophagy, instead of using insects as feed for pigs and poultry, as it may perpetuate the overconsumption of meat. As the uptake of entomophagy is slow, however, the use of insects for feed may be promoted as a step in the process of consuming insects directly, in an attempt to habituate consumers to insects as a part of the food system. Yet this is a step that may take us further away rather than closer to a sustainable future. Moreover, from an animal welfare perspective, both direct and indirect consumption of insects may be problematic. We will now turn to the question of whether insects can be considered to have a welfare that can be harmed.

4.3 Insect welfare and the search for sentience

The dominant theories in animal ethics, utilitarianism and deontology, are action-oriented and capacity-based theories. According to these theories,

our actions matter morally only if they affect beings that possess moral status, and sentience is said to be necessary for moral status (Singer; Regan; Palmer). Discussions on the absence or presence of sentience related to moral status are not restricted to non-human animals; this mental capacity also plays a fundamental role in debates and dilemmas surrounding, for example, euthanasia, abortion, severe mental illness, and neurological damage (Shepherd). Although the concept of sentience is used frequently, it is often unclear how animal ethicists exactly define it. Josh Milburn distinguishes four different ways in which sentience is commonly used in the animal ethics literature:

- Very narrowly (capacity to experience pleasure and pain)
- Narrowly (capacity to experience states that are positively or negatively valanced, such as frustration)
- Broadly (capacity to experience states, without necessarily caring about them)
- Very broadly (capacity to have some awareness of the world, even if this is not phenomenally or subjectively experienced).

Insects and other invertebrates are often said to lack moral status because it is commonly thought they do not fit these definitions. In particular, in the case of insects, it is questioned whether they qualify for very narrow sentience (Tiffin). More generally, with regards to pain, it has been argued that we have good reasons to think that animals experience pain when they show clear behavioral responses to noxious stimuli, if these responses can be mitigated by anesthetics, and if they possess homologue or analogue brain structures to humans. Regarding, for example, fish, it has been argued that these criteria have been met (Sneddon, Braithwaite, and Gentle).

Note that, contrary to conventional livestock such as cows, pigs, poultry, and fish, most invertebrates, including insects, have been excluded from welfare legislation.[5] Recently, however, it has been decided by the European Commission of the European Union (EU) that several species of "advanced invertebrates" (i.e. Celaphods, such as octopus and squid) ought to be treated as "sentient creatures" (Berry et al.), as a growing body of research shows that members of these species display considerable cognitive, behavioral, and neuroanatomical complexity and flexibility. Following these findings, these "advanced" invertebrate species have been included in EU legislation to protect their welfare in both production and experimental settings. But despite the attribution of sentience to these "advanced invertebrates," it remains unclear which definition of sentience is met, and, consequently, it remains unclear what *exact* capacities these "advanced" species possess that other ("simple") invertebrates, like insects, supposedly lack.

Moreover, these four definitions of sentience appear to have a great deal of overlap; all four are about certain *capacities*; three are about the capacity to *experience* certain states, whereas the very broad definition is about the capacity to have "some awareness of the world" – which is very broad indeed. We believe, as also argued by others (e.g., Carruthers *Human and Animal Minds*; Dawkins), that these common definitions of sentience can be reduced to two well-established concepts in the cognitive sciences and philosophy of mind: the first two definitions, which revolve around *experience*, should be understood as *phenomenal consciousness*, whereas the broad and very broad definition of sentience closely resembles so-called *access consciousness*. Access conscious states are mental states (e.g., sensations, beliefs, desires, intentions, thoughts) that ought to be accessible for decision-making, reasoning, formation of memories, and so forth. Note that access consciousness is functionally defined, and that access conscious states need not be accompanied by experience. Phenomenal consciousness, in contrast, aims to describe the experiential quality (or first-person *feel*) that a particular mental state can (but need not) have.

Descriptions of phenomenal consciousness are commonly phrased in terms of "what it is like", echoing Nagel's ("What Is It Like to Be a Bat") influential paper. In this seminal text, it is suggested that, although we could be able to fully understand how bats are able to perceive and react to their environment through echolocatory senses (which can be explained by appealing to a variety of access conscious states) we, human beings, can never understand what it is like to experience the world as a bat does, from a bat's point of view. If we take this as our definition of sentience, an insect is sentient if "there is something it is like" to be an insect. Thus, if insects can feel an unpleasant sensation induced by a noxious stimulus (which we would call painful), then insects ought to be included in our moral deliberations.

If we conceive sentience this way, it follows that it is epistemically inaccessible to others, as the default assumption is that this type of consciousness is strictly subjective and therefore "private." If this is the case, we will never be able to reach certainty about sentience. It is for this reason that this kind of consciousness has led to philosophical and scientific debates surrounding difficulties known as "the explanatory gap," i.e., how subjective experiences arise from objective physical or neural processes (see Levine), and the so-called hard problem, i.e., how to bridge this gap by providing satisfactory physicalistic explanations (see Chalmers). This suggests that phenomenal consciousness poses a serious problem for animal ethicists who favor a very narrow, narrow, or broad conception of sentience. Only the very broad definition does not pose this peculiar "hard problem," as it is certainly possible to objectively study access conscious states.

Some philosophers, such as Nagel himself, maintain that we will never be able to fully understand phenomenal consciousness scientifically, or at

least not without being non-reductionist. There are theories of consciousness, however, that do attempt to explain how phenomenal consciousness comes about. And some theorists have argued, contrary to popular belief, that (certain) insects have the capacity for subjective experience. For instance, Barron and Klein have pointed out that honeybees and other Hymenoptera are candidates for subjective experience, based on an information integration theory of consciousness.[6] Similarly, but on different theoretical grounds, Tye also proposes that it is plausible that bees have a rich perceptual consciousness, can feel pain and emotions like anxiety, and concludes that "experiences are not restricted to the realm of vertebrates" and that "creatures with different nervous systems than ours are phenomenally conscious" (158–159).

Carruthers, however, denies phenomenal consciousness in insects (again, focusing on bees), following global workspace theory (Baars).[7] Interestingly, Carruthers ("On Being Simple Minded"; "Invertebrate Minds") maintains that insects and other invertebrates do possess a wide variety of access conscious states, which he deems sufficient to take a creature into moral consideration. His notion of "suffering without subjectivity" suggests that not the sole *feeling* of pain, but rather the *wanting* for the pain to cease (because it frustrates certain needs, desires and the possibility of performing related actions), is what really matters to the animal. Thus, harming an insect (or any other animal) is problematic not because the animal might have a subjective experience of pain, but because the (potential) damage disenables or disrupts the creature's attempts to pursue and fulfill its desires and goals.

It is debatable, of course, whether such "objective harms" (e.g., desire-frustration) matter morally. According to the dominant animal ethics theories they do not, as it is held that animals have interests only insofar as our treatment of them matters to them, subjectively. According to desire-fulfillment theories, on the other hand, desire-satisfaction always matters, as we could say that something goes better or worse for creatures depending on whether their desires are fulfilled or thwarted, even if they don't subjectively experience their desires being fulfilled or thwarted. It can be concluded, then, that there is disagreement about two questions: (1) what form of consciousness is necessary for moral status, and (2) what form of consciousness insects possess (if any)? In such cases of uncertainty about both facts and values, the precautionary principle is often invoked. What role might this principle play in the discussion about entomophagy?

4.3.1 Applying the precautionary principle?

One might argue that it would be more problematic if we erroneously assume that insects *do not* feel pain and we, therefore, keep them as livestock

and kill them, than if we erroneously assume that they *do* feel pain and we decide not to use them for feed or food. This reasoning is too simplistic however: perhaps we stand to lose a lot if the future scenarios from organizations like the FAO are correct and we don't use them in an attempt to tackle the problems outlined in the introduction. The precautionary principle states, "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Raffensberger and Tickner, 8). However, in order to invoke the principle, we need to at least have a certain level of confidence that the proposed activity (in this case farming insects) raises threats of harm. This means that we need to at least have a certain level of confidence that insects are sentient. Moreover, the principle refers to threats of harm to human health or the environment. This entails that threats to food security and sustainability need to be taken into consideration; these could be adversely affected if we were *not* to farm insects. Reasoning on the basis of the precautionary principle, then, is inconclusive.

If we were to reason only based on an account of insect welfare, assuming that certain insects are sentient, we could still argue that raising them for food is not problematic. After all, in the case of some insects, we could closely mimic their natural environment and we could raise them without seriously harming their welfare.[8] On the other hand, many insects would be eaten in their larval stage, and according to the foregone opportunities account of the harm of death, a premature death harms a creature when it deprives the creature of potentially valuable experiences (DeGrazia). Also, we do not know the consequences of domesticating a new group of animals.[9] Furthermore, cooling or heating will be necessary, depending on the type of insect and the climate. So we must ask: is insect eating more sustainable than eating alternative sources of protein?

Recently, Knutsson and Munthe provided an interesting perspective by incorporating sentience and moral status into virtue theoretical thought, specifically addressing this epistemic uncertainty, and argued for "the virtue of precaution." This virtue is a kind of humility with respect to our limited knowledge, and it would require us to consider that insects "*may* very well be sentient" (ibid., 214). Given the uncertainty about sentience in insects (and perhaps of phenomenal consciousness altogether), a virtuous person should be careful to simply exclude "undetermined beings" from the moral community. Furthermore, as we will demonstrate in the next section, the epistemic uncertainty with regards to other minds, and in particular the uncertainties that surround our knowledge about the subjective experiences of others, are in fact the result of an erroneous line of reasoning rooted in the history of philosophy. Following Bennett and Hacker, and similar to our view of ethics, our approach to sentience will be (neo)

Aristotelean, which allows us to avoid the alleged metaphysical difficulties that stem from a Cartesian conception of the mind.

4.4 Consciousness and the mereological fallacy

It seems that subjectivity, our first-personal and privileged access to the "what-it-is-like" character of consciousness, is one of the great mysteries left to be solved by scientific experimentation and theoretic explanation. Bennett and Hacker, however, argue that this entire concept of consciousness and the closely related concept of privacy are confused. This confusion, they argue, can for the most part be attributed to René Descartes' (1596–1650) philosophy, whose theory of mind is referred to as substance dualism. Cartesian theory states that the soul (mind) and body can (in principle) exist independently from one another, as humans (unlike all other animals) consist of two parts: a material body and an immaterial soul,[10] leading to the famous "mind-body" dichotomy. Descartes did propose that there is continuous interaction between the two, and the brain, in particular the pineal gland (which was assumed to be "the seat of the soul"), was thought to play a crucial role in these interactions, being the only physical element that directly related to and interacted with the mind.

While all modern theories attempt to solve or avoid the mind-body problem, many contemporary theories of the mind and consciousness are still contaminated with a distinctive and important Cartesian feature: most theories identify the mind (including all kinds of psychological or mental attributes) in (parts of or activity in) the brain. But such neuroreductionism is doomed to remain dualistic. The central error is to ascribe mental states and psychological attributes – including different kinds of consciousness – to the brain, while these concepts only make sense if they are applied to an animal as a whole. Simply put: our brains are not conscious, nor do our brains feel, perceive, think, believe, or memorize things. Our mental capacities are not part of our brain, even though brain events correlate with our mental capacities. As Bennett and Hacker put it,

> It is the animal that perceives, not parts of its brain, and it is human beings who think and reason, not their brains. The brain and its activities make it possible for us -not for it- to perceive and think, to feel emotions, and to form and pursue projects.
>
> (3)

The mistake of replacing psychological explanations, which only apply to humans and animals as "wholes," with neurological scientific explanations, which only apply to the brain, is what they call the mereological fallacy.

Contrary to the Cartesian conception of the mind and departing from Aristotelian thought, Bennett and Hacker argue that the concept of 'soul' (*psyche*) as posited by Aristotle should not be translated as 'mind,' nor should the latter be substituted for brain. Rather, 'soul' is conceptualized as a biological concept that applies to an entire organism. Mental powers, including what is commonly referred to as phenomenal consciousness, are thus not a *part* of an individual animal or person in a physical sense, nor do these abilities signify ownership in the sense of possession akin to *having* an (external) object (compare: 'to have a car', 'to have an experience' and 'to have a psyche'). Instead, it is a set of powers of a living thing, in the sense of potentialities that are characteristic for a specific creature. As Bennett and Hacker put it,

> Powers or abilities (we shall use these terms interchangeably) are potentialities that are exhibited in actual performances, given appropriate conditions or opportunities. Potentialities are not physical parts of the object that possesses the potentiality. What a creature can do is determined by reference to what it does. Hence the Aristotelian psyche does not stand to the body as the brain does, for it is not a part of the body. The soul or psyche is constituted by the distinctive powers of the living creature as a whole, not of its parts that have functions. The proper exercise of the functions of parts of the body contributes to the good or welfare of the creature.
>
> (Ibid., 23)

Consciousness, then, does not relate to an 'inner agent.' Humans and other animal species are not "subjects of experiences" that are produced by or contained ("represented") in the brain. Consequently, the capacity for experience is not to be found in the brain; any ascription of experience, whether it is a sensation, perception, or emotion, is to be actualized and adequately ascribed in relation to the exhibition of behavior, displayed by the entire living being. Indeed, from the Aristotelian perspective, the psyche is "the principle of animal life" and should be viewed as "the form of a natural body that has life" (ibid., 22). Behavioral expressions by a certain animal are thus the appropriate grounds to attribute consciousness, not the underlying neuroanatomical aspects or neurophysiological events, which make it possible for the animal to behave in the way it does.

Indeed, all our ascriptions of psychological attributes or mental states – to both humans and non-human animals, be it conscious, unconscious, or non-conscious – are ultimately grounded in behavior, and not in detailed descriptions of parts or activity in the brain. Behavioral changes are the most direct kind of evidence for, say, the experience of pain, but also consciousness in a more general sense. In this regard, it is important to note

that the Aristotelian approach as espoused by Bennett and Hacker is not a variety of behaviorism, as their account is not reductionist, but *a priori* evidential: under normal conditions, we are perfectly able to determine whether another person or an animal is conscious (that is, transitive, in the sense of being awake, asleep, or comatose), as well as what they are experiencing or feeling (say, an object or event in its environment), based on a wide variety of contextualized behavioral responses. Additional evidence or explanations (such as inductive correlations) do not overrule the constitutive, behavioral evidence.

For obvious reasons, we cannot provide an extensive review of the literature on the relevant aspects of insect behavior and their neural cognates; we have already mentioned several theorists who claim that insects have the capacity for "very narrow sentience" and thus suggest that insects can and do experience pain and suffering. Moreover, insects such as *D. Melanogaster* (fruit flies) have become model organisms for studies on pain. It comes as no surprise, then, that these animals display a behavioral repertoire that is reasonably expected from a creature that is capable of perceiving pain and experiencing harmful stimuli. Examples of pain behavior are even found in larval stage; Kortsmit et al. provide an overview of "nociceptive behavior"[11] in flies: larvae display curling and rolling ("corkscrew-roll") behavior in response to thermal, chemical, and mechanical noxious stimuli (Dason et al.). In the case of complete exposure via heat plates, these insects show whipping behavior, as well as seizures and paralysis (Chattopadhyay et al.). Cold temperatures result in a swift full-body contraction (Turner et al.). In imaginal (adult) stage, these flies make a characteristic jump when presented with noxious thermal stimuli (Xu et al.). Under such circumstances, to ask "What was it like for the insect to perceive potentially damaging temperatures?", "Is there something like it for the insect to be exposed to noxious stimuli?", or "Did the insect experience or feel the heat?" are misconceived questions (Hacker). Perhaps these questions can be considered reasonable if the insect did *not* respond as expected; only the absence of such an appropriate behavioral response would justify doubt about the insect's capacity to feel pain; and such an anomaly would indeed require additional inquiry and explanation.

If we take the common conception of sentience, it could be suggested that nociception need not be accompanied by phenomenal experience. Yet such a conceptual configuration clearly gives testament to the mereological fallacy because "the subject of pain is a human or animal that manifests it, not his mind or brain" (Bennett & Hacker, 134). Principally, it is their behavior that makes it reasonable for us to use them to study pain – nociceptive processes are not visible in behavior. Moreover, only if such pain behavior is absent under normal conditions in response to noxious stimuli, then we would have reasons to doubt that a creature *felt* pain. To a priori

doubt this capacity, and thus ignoring existing behavioral evidence, suggests an untenable form of radical skepticism (akin to Descartes' methodological doubt). Even if we would assume that such behavioral responses are a "mere reflex," it by no means follows that an associated feeling was absent.

We also believe that, by reversing Descartes' inverted epistemology and related concept of mind, the burden of proof shifts to those who deny that insects are capable of feeling pain. However, if insects would be capable of feeling pain, this does not yet imply that it would be morally objectionable to eat them. Such a conclusion depends on a host of other considerations as well – for example on the question of whether we could rear them in a welfare-friendly way in a system that closely mimics their natural environment. That said, we need not dwell on the capacities of insects, as we will argue that our own human abilities – in particular our moral powers – should be decisive. In the next section, we elaborate on this different approach to ethics; we will continue our discussion by appealing to the human ability to acquire and master a set of skills to moderate our desire for food. This allows people to achieve, among other things, the mean between excess and deficiency, including their protein sources and intake.

4.5 Virtue ethics as an alternative approach

In the previous section, we showed that insects are sentient and hence morally considerable from an Aristotelian perspective. Although this insight allows for deontological and utilitarian arguments against eating insects, arguments on whether or not it is morally permissible to use insects as food and feed also rely on other factors and considerations. However, there is another neo-Aristotelian argument against eating insects that avoids questions of sentience altogether because virtue ethics has no need for the concept of moral status (see Hursthouse).

Unlike utilitarian and deontological theories, virtue ethics does not posit or require a set of law-like principles to determine how everyone should act; it expresses a doctrine that advocates the training of one's own rational, emotional, and social skills, and acquiring practical wisdom, without any need for antecedent discoveries about which groups of living beings deserve our moral consideration or not. Thus, virtue ethics provides ways to determine right action without having to invoke complex (and perhaps confused) concepts such as sentience and moral status. Nor does it demand extensive scientific study (also contrary to Plato's philosophy, for example), say, to require modern brain imaging techniques to "locate" phenomenal consciousness. From the perspective of virtue, it is not *per se* relevant to know whether insects – or any other animal, and even plants, for that matter – possess a specific mental capacity in order to subsequently

attribute moral status. Possessing and cultivating moral virtues and aiming for excellence relates to many *human* traits and abilities, which are constitutive of being a morally decent person.

Moreover, as mentioned, the entire notion of moral status could be considered superfluous, as almost anything can be incorporated into our "circle of moral concern," albeit indirectly (Midgley). Sentient beings can, for example, attribute value to many (and seemingly worthless) things, through which these things – without being sentient themselves – are still to be considered in our moral deliberations, even if they do not have direct moral status (e.g., a painting, family heirloom, and so forth). Additionally, in our moral decisions, we must always allow for other criteria, given that we inevitably encounter conflicting claims between two or more sentient beings; in most of our everyday moral practices, something other than moral status is morally decisive. The concept of personhood, for example, is invoked by some deontologists and utilitarians, which allows them to favor humans over other sentient animals in many conflicts (e.g., Warren; for a discussion, see Aaltola).

Virtue ethical approaches provide an alternative way to think about the ethical treatment of animals by appealing to the virtue of compassion (sometimes "benevolence" or "charity"). While compassion is not listed as a virtue in the works of Aristotle, nowadays it is widely acknowledged as one of the virtues. The virtue of compassion involves having the aim to alleviate pain and suffering. Compassionate acts can certainly be extended to animals, as all sentient animals can suffer. We maintain that compassion (properly mediated by reason) is a sufficient ground to consider insects and regard it as a satisfactory alternative to moral status. Next, we will turn to the virtue central to our argument: temperance.

4.5.1 Insect industries and the virtue of temperance

The virtue of temperance (*sophrosyne*) is the virtue that regulates human desires that relate to food, drink, sex, and, arguably, several other sensual pleasures (Curzer). The sphere of temperance not only regulates the enjoyment of these goods but also the pain that can be caused by unsatisfied desire. Temperance is properly defined as moderation or self-restraint, particularly in actions and statements, and it demands the development of self-control. Temperate people are those who possess the character to regulate and restrain themselves with regard to the indulgence of a natural appetite or passion. As discussed in the first section, the problems we are faced with are intertwined with an inappropriate indulgence in food; intemperate diets are the result of people who lack restraint with regard to natural appetite. Aristotle states that intemperate people go wrong with respect to three parameters that regulate this virtue: (1) objects, (2)

occasions, and (3) amounts. We will argue that the second and third parameters are violated by the modern use of insects as animal feed, through the appropriation, modernization, and industrialization of traditional insect-eating practices. Hence we question the moral desirability of the development of insect industries. We will treat the three parameters of temperance in turn.

(1) Although many Western consumers might find the idea of insect-eating repugnant, it does not follow that entomophagy involves an inappropriate object to fulfill one's desire for food. It is culturally inappropriate in the West, but not from a nutritional or even necessarily from a moral perspective. As mentioned, insects are part of the regular diet in many cultures and countries around the world. Furthermore, insects provide high-quality and essential fats, proteins, and micronutrients (Churchward-Venne et al.; Hermans et al.), which makes them a viable meat substitute and, more generally, an appropriate source of nutrition.[12]
(2) The occasion is dubious and perhaps even unconvincing: the proposed insect industries, quintessentially, aim to address anthropogenic environmental degradation caused by intensive and industrial animal farming systems. Therefore, it is questionable whether the continuation of industrial farming systems is desirable; extensification, small-scale and local production, frugality, as well as vegetable protein sources, are more likely to address the actual underlying problems of the agro-industrial complex, including its contribution to anthropogenic climate change and ecological degradation, by addressing the unequal distribution of and excessive indulgence in food (Wensveen). And despite that, there are theoretical grounds and empirical evidence for sentience, adequate welfare conditions are still largely unknown, and welfare protection is currently absent, while a staggering amount of insects are being kept and killed in such systems. We believe this raises serious doubts about the correctness of the occasion; it is likely that this new industry is repeating the mistakes that have been made in conventional animal husbandry systems.
(3) The amount could be considered in terms of consumption on the individual level (temperance proper) but also on the level of production, that is, by means of intensive and industrial design. With regards to the latter, the amounts are questionable: in order to produce significant amounts of insect protein, an unimaginable amount of insects have to be kept and killed. Mass-rearing via industrial cultivation is likely to be necessary for economic feasibility[13] given the small size and yields per insect. The total number of individual animals in our

> food system will increase drastically as insect industries grow and develop. With regards to the personal or individual level, the right amount can only be determined by self-examination and personal practice: each individual has a unique body, with its own body composition, basal metabolism, activity rate, and so forth. Yet, as we have already mentioned, actual entomophagy is reconcilable with a healthy diet; from a sustainability perspective, it is preferable to conventional animal protein.

Thus, determining the right occasions and amounts cannot be done by reference to universal rules. How much protein one should consume is entirely dependent upon each individual person's needs. There are averages that can be taken as a reasonable indicator for protein intake, akin to the Dietary Reference Intake. But an average is by no means adequate or right. Similarly, we cannot conceive of a general law that prescribes the adequate number of insects we should produce and consume to guarantee the widely pursued "global goals," such as sustainable agriculture, food security, livelihoods, and everyone's personal need for protein. But designing new mass-rearing facilities according to modern principles that are specifically aimed at economic growth challenges the right amount, as the creation and growth of insect industries will certainly increase overall (mini)livestock production and could, therefore, and contrary to the goal, add to the global challenges and problems we are faced with – especially considering the already existing overindulgence, prospected population growth, and the growing popularity of a Western diet. With respect to the right amount, then, other traditional values and archaic ideals, such as autarky and frugality, could supplement our call for moral and intellectual reform. To achieve ecological sustainability, we need to restrict the desire for infinite economic growth and counter consumerism. Exploring different notions of self-sufficiency and moderation could provide an ancient solution to our contemporary global issues, by reducing the amounts to the necessary minimum. (For an interesting discussion on the viability and varieties of autarky, including Aristotle's, see Bosman).

Furthermore, according to Aristotle, a virtue is always the "golden mean," and is thus a condition that lies between the two extremes of excess and deficiency. Hence temperance does not entail the painful renunciation of pleasure, nor does it demand self-mortification. It demands practical wisdom (*phrónēsis*) to find the middle way. Meanwhile, Western countries enjoy an excess of animal protein, while others live in deficiency, and although we cannot elaborate on it here, we must stress that this injustice is also a crucial (yet often underexposed) aspect with regard to the protein transition. In areas where entomophagy is commonly practiced, especially

where there is food scarcity, and insects are gathered in the wild or in a small-scale setting, the occasions and amounts are assumedly appropriate, and perhaps professionalization (not necessarily industrialization) would benefit local communities to ensure food security. At the same time, it is important to keep declining insect populations, caused by climate change, loss of habitat, agro-chemicals, and so forth, in mind. A moderate approach could contribute to the protection of local environments as well as general insect conservation and overall biodiversity preservation (DeFoliart) while taking the livelihoods of economically marginal rural families into consideration.

4.6 Conclusions

We have argued that the focus on sentience, moral status, and welfare of insects does not give us clear moral guidance with regard to eating insects or using them as animal feed. Furthermore, standard approaches result in confused debates about (seemingly profound) philosophical difficulties in the mental capacities of non-human animals. Consequently, it seems hard (or even impossible) to put the dominant ethical doctrines into practice because (supposedly) we are unable to determine the moral status of insects with certainty. This indeterminacy exposes an impractical aspect of utilitarian and deontological doctrines. But, as we have argued, this uncertainty is the result of conceptual confusion. Once the misconceptions about consciousness are dissolved, we must conclude that insects *at least* qualify for the very narrow definition of sentience, and, consequently, insects are morally considerable. Yet the question of whether or not we should eat insects or feed them to livestock remains.

Virtue ethical theories can avoid or circumvent these problems because they are not committed to the concept of moral status. The virtue of temperance also applies to insentient sources of food, such as fruits, vegetables, and nuts, and hence we believe that it provides a more fundamental way to solve problems such as greenhouse gas emissions and ecological degradation. The rehabilitation of non-modern practices, values, and ideals, can easily incorporate insects as sentient creatures based on the virtues of compassion. An appeal to these virtues seriously questions the moral desirability of the industrial cultivation of insects, in particular to serve as feed for conventional livestock. A fundamental and renewed examination of our attitudes toward nature and non-human animals is diametrically opposed to our enduring Western, modern ways: overindulgence in food and the excessive consumption of animal protein is not good; it contributes to social inequality, health problems, environmental damage, and, therefore it is incompatible with a sustainable way of life.

Notes

1 The WEF, an international foundation with 1,000 member companies, including prominent insect companies, promotes insects as food and feed. Their 2019 white paper, "A Roadmap for Delivering 21st-Century Protein," advocates for more sustainable and circular models such as insect-based feed for livestock to reduce environmental impact. WEF members also include government officials and national parliament and cabinet members, for example, Carola Schouten, former Minister of Agriculture, Nature and Food Quality of the Netherlands. In 2019, she accompanied His Majesty King Willem-Alexander to the opening of Protix, one of the world's largest insect producers, founded and led by Kees Aarts, a member of the WEF Global Council for Food Security and Agriculture.

2 Several insect species, however, are usually seen and depicted positively, most notably honeybees and butterflies. Arguably, this illustrates our rather arbitrary attitudes towards insects.

3 As House (2016, 56) explains, on the one hand the strategy of concealing insects in food stuffs may lead to an increased willingness to consume insects but on the other hand seems to backfire as "the absence of a distinct appearance or taste reduces the positive reasons for selecting an insect-based food product in the first place, rather than a cheaper or tastier non-insect equivalent."

4 This claim is not an economic hypothesis, but a logical conjecture: as the world population increases, the demand for proteins increases, the production must increase to meet this demand. If Westerners do not voluntarily switch to entomophagy (or change to a more plant-based diet), and countries where insect eating is normal move toward a Western diet (i.e., increased meat consumption), then insects become a part of the production process of the meat industry, instead of a genuine substitute for meat. Moreover, using insects as feed may allow the meat industry to circumvent a limiting factor – namely, manure surpluses, through the 'upcycling' of manure. Therefore, insects as feed could increase the economic efficiency of the meat industry, thereby facilitating the industry as such.

5 In the United States, birds are still excluded from federal welfare legislation. Only recently the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) started to develop an Animal Welfare Act standards for birds to ensure their humane care and treatment.

6 Integrated Information Theory and Global Workspace Theory are thoroughly discussed and rejected in Bennett and Hacker's *Philosophical Foundations of Neuroscience* (see chapter 12, section 1 and 2).

7 See the previous endnote.

8 How exactly their natural environment can be mimicked is species-specific and more research needs to be carried out for each species. One reason for thinking it would be possible to promote the welfare of insects on farms is that, for example, fly larvae often crowd together in their natural environment and therefore keeping them in high densities may not be adverse for their welfare. An example of potentially harming their welfare would be if we confine adult flies without providing them with the opportunity to fly.

9 Any animals who are farmed, in particular in large numbers, undergo a form of domestication, as their genetic make-up changes due to artificial (human) selection-pressures. Here, genetic drift is a potential risk for long-term welfare.

10 Descartes held the infamous position that all non-human animals are automata (that is, mindless machines), as he insisted that all animal behavior needs to be explainable in mechanistic terms. This is no longer the dominant view. Nevertheless, the idea that animals are essentially like machines has proven to be persistent, especially in the case of "simple organisms" like insects, as also remarked by Tiffin. Of course, animals are not *mere* physical systems but *also* physical; this is precisely why we *contrast* sentient beings with machines.
11 We deem *pain behavior* more appropriate (cf. Hacker and Bennett, 518) because "nociceptive behavior" commits the mereological fallacy: nociception is involved in the expression of pain behavior, but nociception is not visible or otherwise manifested in behavior.
12 The widespread consumption of insects by various cultures as a dietary staple is evidence of their viability as a food source. Additionally, insects are a suitable form of feed for poultry, as they are a natural component of their diet. We take issue with the notion of modernizing and industrializing these practices specifically for the purpose of egg and meat production.
13 It should be noted that "uneconomic" essentially means "not profitable in terms of monetary gain" for those who undertake the economic activity (Schumacher, 1989, p. 24).

Bibliography

Aaltola, Elisa. "Personhood and Animals." *Environmental Ethics* 30.2 (2008): 175–193.

Alexandratos, N., and J. Bruinsma. "World Agriculture Towards 2030/2050: The 2012 Revision." *ESA Working Paper* 12.03 (2012): 23–131.

Baars, Bernard J. "In the Theatre of Consciousness: Global Workspace Theory, a Rigorous Scientific Theory of Consciousness." *Journal of Consciousness Studies* 4.4 (1997): 292–309.

Barron, Andrew B., and Colin Klein. "What Insects Can Tell Us About the Origins of Consciousness." *Proceedings of the National Academy of Sciences* 113.18 (2016): 4900–4908.

Bennett, Maxwell R, and Peter Michael Stephan Hacker. *Philosophical Foundations of Neuroscience*. John Wiley & Sons, (2022).

Berners-Lee, M., et al. "Current Global Food Production Is Sufficient to Meet Human Nutritional Needs in 2050 Provided There Is Radical Societal Adaptation." *Elementa: Science of the Anthropocene* 6.52 (2018): 1–14.

Berry, A., et al. "Eu Guidelines for the Care and Welfare of an "Exceptional Invertebrate Class" in Scientific Research. Commentary." *Ann Ist Super Sanita* 51.4 (2015): 267–269.

Bosman, Philip. "Ancient Debates on Autarkeia and Our Global Impasse." *Phronimon* 16.1 (2015): 16–28.

Carruthers, Peter. "On Being Simple Minded." *American Philosophical Quarterly* 41.3 (2004): 205–220.

———. "Invertebrate Minds: A Challenge for Ethical Theory." *The Journal of Ethics* 11.3 (2007): 275–297.

———. *Human and Animal Minds: The Consciousness Questions Laid to Rest*. Oxford University Press, (2019).

Chalmers, David J. "Facing up to the Problem of Consciousness." *Journal of Consciousness Studies* 2.3 (1995): 200–219.

Chattopadhyay, Abanti, V Gilstrap A'tondra, and Michael J Galko. "Local and Global Methods of Assessing Thermal Nociception in Drosophila Larvae." *JoVE (Journal of Visualized Experiments)* 63 (2012): e3837.

Churchward-Venne, Tyler A, et al. "Consideration of Insects as a Source of Dietary Protein for Human Consumption." *Nutrition Reviews* 75.12 (2017): 1035–1045.

Curzer, Howard J. "Aristotle's Account of the Virtue of Temperance in Nicomachean Ethics Iii. 10–11." *Journal of the History of Philosophy* 35.1 (1997): 5–25.

Dason, Jeffrey S, et al. "Drosophila Melanogaster Foraging Regulates a Nociceptive-Like Escape Behavior through a Developmentally Plastic Sensory Circuit." *Proceedings of the National Academy of Sciences* 117.38 (2020): 23286–23291.

Dawkins, M. S. "Animal Welfare With and Without Consciousness." *Journal of Zoology* 301.1 (2017): 1–10.

De Boer, Joop, and Harry Aiking. "Prospects for Pro-Environmental Protein Consumption in Europe: Cultural, Culinary, Economic and Psychological Factors." *Appetite* 121 (2018): 29–40.

DeFoliart, Gene R. "An Overview of the Role of Edible Insects in Preserving Biodiversity." *Ecology of Food and Nutrition* 36.2–4 (1997): 109–132.

DeGrazia, David. *Animal Rights: A Very Short Introduction*. Oxford University Press, 2002.

Drinkwater, Eleanor, Elva J. H. Robinson, and Adam G. Hart. "Keeping Invertebrate Research Ethical in a Landscape of Shifting Public Opinion." *Methods in Ecology and Evolution* 10.8 (2019): 1265–1273.

Gjerris, M., C. Gamborg, and H. Röcklinsberg. "Entomophagy – Why Should It Bug You? The Ethics of Insect Production for Food and Feed." *Know Your Food: Food Ethics and Innovation*. Wageningen Academic Publishers, (2015). 423–432.

Godfray, H. Charles, J., et al. "Meat Consumption, Health, and the Environment." *Science* 361.6399 (2018): eaam5324.

Govorushko, Sergey. "Global Status of Insects as Food and Feed Source: A Review." *Trends in Food Science & Technology* 91 (2019): 436–445.

Guiné, Raquel P.F., Correia, Paula, Coelho, Catarina, and Costa, Cristina A. The Role of Edible Insects tot Mitigate Challenges for Sustainability. *Open Agriculture* 6(1) (2021): 24–36.

Hacker, Peter MS. "Is There Anything It Is Like to Be a Bat?" *Philosophy* 77.2 (2002): 157–174.

Harfeld, Jes Lynning, et al. "Seeing the Animal: On the Ethical Implications of De-Animalization in Intensive Animal Production Systems." *Journal of Agricultural and Environmental Ethics* 29.3 (2016): 407–423.

Hartmann, Christina, and Michael Siegrist. "Insects as Food: Perception and Acceptance. Findings from Current Research." *Ernahrungs Umschau* 64.3 (2017): 44–50.

Hermans, W. J. H., et al. "Insects Are a Viable Protein Source for Human Consumption: From Insect Protein Digestion to Postprandial Muscle Protein Synthesis in Vivo in Humans: A Double-Blind Randomized Trial." *The American Journal of Clinical Nutrition* 114.3 (2021): 934–944.

House, Jonas. "Consumer Acceptance of Insect-Based Foods in the Netherlands: Academic and Commercial Implications." *Appetite* 107 (2016): 47–58.

Huis, A. van. "Welfare of Farmed Insects." *Journal of Insects as Food and Feed* 5.3 (2019): 159–162.

Hursthouse, Rosalind. "Virtue Ethics and the Treatment of Animals." *The Oxford Handbook of Animal Ethics*. Eds. Beauchamp, T.L. and R.G. Frey, Oxford University Press, (2011). 119–143.

Knutsson, Simon, and Christian Munthe. "A Virtue of Precaution Regarding the Moral Status of Animals with Uncertain Sentience." *Journal of Agricultural and Environmental Ethics* 30.2 (2017): 213–224.

Kortsmit, Y., van der Bruggen, M., Wertheim, B., Dicke, M., Beukenboom, L.W., and van Loon, J. J. A. "Behaviour of Two Fly Species Reared for Livestock Feed: Optimising Production and Insect Welfare." *Journal of Insects as Food and Feed* 9.2 (2023): 149–169.

Lemaire, T. *On the Value of Cultures: Between Europacentrism and Relativism*. Ambo, (1976).

———. *The Fall of Prometheus*. Ambo, (2010).

———. *Against the Time: Comments on Our World*. Ambo Anthos, (2022).

Levine, Joseph. "Materialism and Qualia: The Explanatory Gap." *Pacific Philosophical Quarterly* 64.4 (1983): 354–361.

Midgley, Mary. *Animals and Why They Matter*. University of Georgia Press, (1983).

Milburn, J. *Food, Justice, and Animals: Feeding the World Respectfully*. Oxford University Press, (2023).

Nagel, Thomas. "What Is It Like to Be a Bat." *Readings in Philosophy of Psychology* 1 (1974): 159–168. Print.

———. *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature Is Almost Certainly False*. Oxford University Press, (2012).

Onwezen, M.C., Bouwman, E.P., Reinders, M.J., and Dagevos, H. A Systematic Review on Consumer Acceptance of Alternative Proteins: Pulses, Algae, Insects, Plant-Based Meat Alternatives, and Cultured Meat. *Appetite* 159 (2021): 1–57.

Organization, Food and Agriculture (FAO). *Looking at Edible Insects from a Food Safety Perspective. Challenges and Opportunities for the Sector*. Rome, (2021).

Organization, Food and Agriculture. *The Contribution of Insects to Food Security, Livelihoods and the Environment*, (2016).

Paoletti, M.G. Insect and Other Invertebrate Foods of the Australian Aborigines. *Ecological Implications of Minilivestock*. CRC Press, (2005).

Palmer, C. *Animal Ethics in Context*. Columbia University Press, (2010).

Raffensberger, C., and J. Tickner. *Protecting Public Health and the Environment: Implementing the Precautionary Principle*. Island Press, (1999).

Raheem, Deel, Carrascosa, Conrado, Oluwole, Oluwatoyin Bolanle, Nieuwland, Maaike Saraiva, Ariana, Millán, Rafael, and Raposo, António. Traditional

consumption of and rearing edible insects in Africa, Asia and Europe, *Critical Reviews in Food Science and Nutrition*, 59(14) (2019): 2169–2188.
Regan, T. *The Case for Animal Rights*. University of California Press, (1983).
Rouhani, M. H., et al. "Is There a Relationship between Red or Processed Meat Intake and Obesity? A Systematic Review and Meta-Analysis of Observational Studies." *Obesity Reviews* 15.9 (2014): 740–748.
Rust, Niki A., et al. "How to Transition to Reduced-Meat Diets That Benefit People and the Planet." *Science of The Total Environment* 718 (2020): 137208.
Shelomi, M. "Why We Still Don't Eat Insects: Assessing Entomophagy Promotion through a Diffusion of Innovations Framework." *Trends in Food Science & Technology* 45.2 (2015): 311–318.
Shepherd, Joshua. *Consciousness and Moral Status*. Taylor & Francis, (2018).
Singer, P. *Animal Liberation. A New Ethics for Our Treatment of Animals*. New York Review, (1975).
Sneddon, Lynne U, Victoria A Braithwaite, and Michael J Gentle. "Novel Object Test: Examining Nociception and Fear in the Rainbow Trout." *The Journal of Pain* 4.8 (2003): 431–440.
Springmann, Marco, et al. "Options for Keeping the Food System within Environmental Limits." *Nature* 562.7728 (2018): 519–525.
Stent, Gunther Siegmund. *Paradoxes of Progress*. San Francisco W.H. Freeman and Company, (1978).
Sun, Zhongxiao, et al. "Dietary Change in High-Income Nations Alone Can Lead to Substantial Double Climate Dividend." *Nature Food* 3.1 (2022): 29–37.
Tan, Hui Shan Grace, et al. "Insects as Food: Exploring Cultural Exposure and Individual Experience as Determinants of Acceptance." *Food Quality and Preference* 42 (2015): 78–89.
Tao, Jaynie, and Yao Olive Li. "Edible Insects as a Means to Address Global Malnutrition and Food Insecurity Issues." *Food Quality and Safety* 2.1 (2018): 17–26.
Tiffin, Helen. "Do Insects Feel Pain?" *Animal Studies Journal* 5.1 (2016): 80–96.
Tononi, Giulio. "An Information Integration Theory of Consciousness." *BMC Neuroscience* 5.1 (2004): 1–22.
———. "Consciousness as Integrated Information: A Provisional Manifesto." *The Biological Bulletin* 215.3 (2008): 216–242.
Turner, Heather N, Christian Landry, and Michael J Galko. "Novel Assay for Cold Nociception in Drosophila Larvae." *JoVE (Journal of Visualized Experiments)*.122 (2017): e55568.
Tye, Michael. *Tense Bees and Shell-Shocked Crabs: Are Animals Conscious?*: Oxford University Press, (2016).
Tziva, M., et al. "Understanding the Protein Transition: The Rise of Plant-Based Meat Substitutes." *Environmental Innovation and Societal Transitions* 35 (2020): 217–231.
Van Huis, A., et al. *Edible Insects: Future Prospects for Food and Feed Security*. FAO Forestry Paper. Vol. 171: Food and Agriculture Organization of the United Nations (2013).
Vantomme, P.; Halloran, A. *The Contribution of Insects to Food Security, Livelihoods and the Environment*. The Food and Agriculture Organization of the United Nations, (2013).

Verbeke, W. "Profiling Consumers Who Are Ready to Adopt Insects as a Meat Substitute in a Western Society." *Food Quality and Preference* 39 (2015): 147–155.

Warren, Mary Anne. *Moral Status: Obligations to Persons and Other Living Things*. Clarendon Press, (1997).

Wensveen, Louke van. "Attunement: An Ecological Spin on the Virtue of Temperance." *Philosophy in the Contemporary World* 8.2 (2001): 67–78.

Wolk, A. "Potential Health Hazards of Eating Red Meat." *Journal of Internal Medicine* 281.2 (2017): 106–122.

Xu, SY, et al. "Thermal Nociception in Adult Drosophila: Behavioral Characterization and the Role of the Painless Gene." *Genes, Brain and Behavior* 5.8 (2006): 602–613.

Yen, Alan L. "Entomophagy and Insect Conservation: Some Thoughts for Digestion." *Journal of Insect Conservation* 13.6 (2008): 667.