Ecological Psychology and the Environmentalist Promise of Affordances

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Abstract

What is *ecological* about Gibsonian Ecological Psychology? Well-known senses in which Gibson's scientific program is 'ecological' have to do with its theoretical, ontological and methodological foundations. But, besides these, the Gibsonian framework is 'ecological' in an additional sense that has remained understudied and poorly understood—a sense of "ecological" that connects Gibson's view to the environmentalism of environmental psychology and environmental ethics. This paper focuses on the latter sense of 'ecological', and explores the relevance of Gibson's notion of "affordance" for thinking about environmental issues like deforestation, pollution and climate change. One existing account is criticized and an alternative is proposed.

Keywords: affordances; perception; environmental ethics; environmental psychology; moral psychology; responsibility.

Introduction

We live in a time of dramatic environmental challenges. According to the Food and Agriculture Organization of the United Nations (FAO 2016), from 1990 to 2015 almost 130 million hectares of forests were destroyed worldwide, an area about the size of South Africa. The United Nations Environment Programme (UNEP 2017) reports that over 80% of the world's wastewater is released into the environment without receiving any treatment, and that around 12 million tons of plastic waste end up in the ocean every year. Deforestation and pollution have a high impact on biodiversity. The World Wide Fund For Nature (WWF 2016) estimates that, since 1970, wild vertebrate populations have on average declined by 58%, with the strongest decline rate afflicting freshwater species (81%). Air and water pollution also take a high toll on human health. The World Health Organization estimates that 92% of the world population is exposed to air below minimum quality standards, which causes up to 6.5 million deaths per year (2017). The WHO also reports that more than 2 billion people worldwide drink water from sources contaminated by fecal matter, leading to over 800,000 deaths every year from diarrhea alone (i.e., not including other diseases caused by polluted water).

This ecological situation is not independent from human activity. Deforestation and the pollution of air, land and water, especially at their present levels, are not naturally occurring ecological events. Rather, they happen as the result of direct and indirect human activity—that is, either through active extraction and depletion of natural resources or, for most of us, through daily reliance on goods and services that exert that negative ecological impact. Environmental degradation poses threats to human health at the immediate and local scale, as in the case of polluted air and water which cause millions of deaths every year. Environmental degradation also presents more long-term and widespread hazards by contributing to global climate change, which endangers whole ecological niches and all sorts of animal and plant species that we also depend on. Awareness of our ecological entanglements has, over the past century, led to the rise of an "environmental" or "ecological" consciousness, a broad and multi-faceted social, political and cultural movement.

In the humanities, the environmental movement has motivated thinkers to question the *anthropocentrism* characteristic of the Western ethical tradition. From Ancient Greece through the medieval and modern periods, philosophers have, by an large, held that humans have a higher status than non-human animals, plants, and other environmental elements (White 1967). In this traditional view, human beings alone are *intrinsically* valuable and are full members of the "moral community": non-human animals, plants and other natural entities are valuable only as *means* to achieving human goals, and the way we treat non-human entities cannot in and of itself be judged as moral or immoral, only as more or less convenient for us. **Environmental ethics** questions the adequacy of these anthropocentric assumptions. Aldo Leopold, one of the pioneers in the field, proposed a view he called the "land ethic," namely an ethical framework in which moral value is holistic rather than individual and is to be found in entire biotic communities. For Leopold, by "thinking like a mountain" rather than as individual organisms fighting for survival, we come to understand that "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" (1949). That is, according to Leopold's land ethic, it is a mistake to think that polluting a river is only wrong when it harms other human beings—rather, polluting a river is wrong to the extent that it damages the whole biotic community, regardless of the consequences it may have for other people. Leopold's land ethic has been criticized, defended, modified and expanded by many after him (see an overview of various reactions in Callicott 1987, 1999). Importantly, whether Leopold's insights were right or not, his work and that of other pioneers in the environmental movement has drawn attention to the ethical dimension of our ecological situation.

The environmental or ecological movement has also influenced developments in psychology and cognitive science. In the field of **environmental psychology**, two lines of research have been particularly productive. The first line focuses on the psychological effects of having contact with natural and built environments. The experimental evidence indicates that mental well-being is closely linked to experiencing nature. A longitudinal study has suggested, for example, that relocation from low-income housing to a new environment with access to more "natural" elements such as a garden space or

windows with a view of trees was associated with improved cognitive performance, especially increased attentional ability, in children from 7 to 12 years of age (Wells 2000). But the effects are not limited to long-term relocation in closer proximity with nature. Studies also suggest that even a brief walk in nature can have significant affective and cognitive effects, e.g., leading to stress relief (Tyrvinen, Ojala, Korpela, Lanki, Tsunetsugu & Kagawa 2014), decreased anxiety and increased working memory performance (Bratman, Daily, Levy & Gross 2015). A comprehensive review of this literature revealed that there is strong evidence that "knowing and experiencing nature makes us generally happier, healthier people" (Russell, Guerry, Balvanera, Gould, Basurto, Chan, Klain, Levine & Tam 2013).

Another major line within environmental psychology seeks to understand our attitudes toward nature, how those attitudes affect our behavior, and what can be done to promote more environmentally-friendly behavior. Studies suggest that spending time in nature and feeling connected to nature lead to more ecological concern and sustainable action: in children, this is associated to their perceived family value toward nature (Cheng & Monroe 2010); and in adults, contact with nature leads to more pro-environmental intentions and behavior particularly when ecological problems are perceived as social dilemmas (Zelenski, Dopko & Capaldi 2015). But the literature also indicates that merely providing access to information about environmental issues (e.g., the data presented at the beginning of this Introduction) is insufficient to generate more pro-environmental behavior in individuals. People tend not to go out of their way to act more sustainably out of personal conviction, but they form and act out pro-environmental convictions when it is easy to do so—for example, individuals recycle more when they have more opportunities to do so (Vining and Ebreo 1992). In line with this and related findings, Lucas, Brooks, Darnton & Jones (2008) suggest that public policies will be most effective when they encourage pro-environmental behavior at multiple levels: measures that target individuals' motivation and attitudes toward nature will not be sufficient to generate sustainable behavior if there are no system-wide mechanisms to facilitate and even reward pro-environmental behavior.

Research in these two main strands of environmental psychology is closely aligned with, and lends itself to applications in, the moral and political dimensions of environmentalism. The same does not seem to be the case with the independent but similarly-named scientific tradition of Gibsonian *ecological psychology*. Scholars working within the Gibsonian framework have made important contributions to the study of perception-action dynamics in organism-environment relations, but they have had surprisingly little to say about the environmental challenges we face, such as deforestation, pollution, and climate change. The goal of this paper is to investigate how, if at all, the Gibsonian framework and particularly the notion of "affordances" can contribute to the environmentalism of environmental ethics and environmental psychology.

What is "Ecological" in Ecological Psychology?

The label "ecological psychology" has been applied to different scientific traditions (Heft 2001), but, given our present focus, in the remainder of this article that phrase will be used to refer to the one initiated by James J. Gibson (1966, 1979). The present section overviews some of the key themes in Gibson's vision for ecological psychology in order to elucidate what exactly was "ecological" about it. Four related senses of ecological are identified: theoretical, ontological, methodological, and ethical.

A good starting point to understand the Gibsonian ecological framework is to consider its theoretical scope and context. Contemporary ecological psychology has been identified as a radical embodied approach to cognitive science (Chemero 2009), but understanding Gibson's own work in these terms is anachronistic. At the time of its inception in the 1960s and 1970s, ecological psychology was meant as an alternative to both behaviorism and cognitivism. From a behaviorist perspective, the scope of psychology as a science was limited to observable or otherwise measurable responses in association with stimuli or reinforcements. This corresponded, in theory and in practice, to black-boxing internal processes, which were seen as scientifically uninteresting or, perhaps for radical behaviorists, inexistent. In contrast, from the perspective of the then emerging approach of cognitivism, the task of scientific psychology was to investigate the internal cognitive processing that occurs in between sensory input and behavioral output—precisely what behaviorism had long neglected. In line with the computer metaphor, cognition was seen as the internal computational processing of what had been obtained from, and would then be exhibited by, the peripherals. While being different in various repects, both behaviorism and cognitivism accepted the same theoretical model for scientific psychology, disagreeing mainly on what the focus of inquiry should be (see Figure 1).
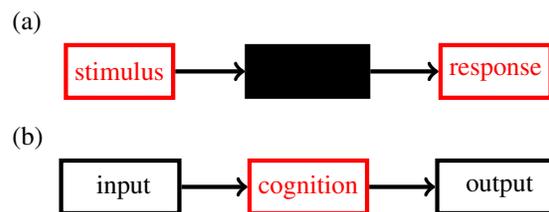
(a)

(b)

Figure 1: The scope of psychological science indicated in red for (1a) behaviorism and (1b) cognitivism.

Gibson rejected the theoretical and ontological assumptions endorsed by behaviorists and cognitivists. Instead, his vision for psychology was "ecological" in that it shifted the theoretical scope of psychology to study informational action-perception dynamics, and, this, grounded on an ontology of organism-environment systems as single ecological units. To make this clear, consider first how the traditional model in Figure 1 draws a clear distinction between perception and action (i.e., between stimulation and response, or between input and output, in each case). Gibson saw the two as

inseparable: perception *is* an action and it is *for* action, that is, we perceive by acting and in order to act, and no action is ever divorced from perception. Now, Gibson spoke of there being a mutuality or reciprocity between organism and environment. He claimed that "information about a world that surrounds a point of observation implies information about the point of observation that is surrounded by a world. Each kind of information implies the other" (1979: 75). This means that as an organism acts/perceives, it generates *relational ecological information*, that is, information that specifies "*affordances*," or what the organism can do given its own abilities and what the environment is like. In this way, ecological psychology is "ecological" in related theoretical and ontological senses: first, the theoretical scope of psychology is organism-environment relations (rather than internal processing or behavior conditioning); and second, this is based on the ontological view that there is relational information inherent to action-perception dynamics which organisms can directly perceive or "pick up" (see Figure 2).

organism ←→ information ←→ environment

Figure 2: The theoretical scope (in red) and ontological basis of ecological psychology: the information *generated* by action-perception dynamics in an organism-environment system *specifies* the same relational dynamics—the information points both ways, hence the bidirectional arrows. (Inspired by diagram in Turvey and Carello 1986: 143)

These related theoretical and ontological senses in which Gibson's framework was "ecological" also led him to be concerned with the ecological validity of psychological experiments—which brings us to the methodological sense of "ecological" at play in ecological psychology. Psychological experiments typically require participants to perform artificial actions in artificial situations. Consider, for example, how research in experimental psychology often asks participants to perform tasks they have never tried before, and to do so under conditions they are not familiar with. Participants are often shown stimuli that are ambiguous, that generate some illusion, that are shown only partially or too fast to be fully perceived. Moreover, they are often expected to hold still (e.g., if in an fMRI machine) and to focus their sight and attention to the task at hand. Ecological psychology sees all of these as dangerous constraints, and calls for a methodological approach that is closer to the real tasks participants perform in real environments. To be sure, scientific experiments in any discipline are by nature artificial: they are man-made situations, tailored to some interest, and carefully designed so as to control for confounding variables and unwanted influences. But Gibson was among the first to explicitly call for experiments that were "ecologically valid." As Gibson (1979) explains, "natural vision" is not static and punctate like the snapshots of a camera, but we see by looking around by moving our eyes, moving our head, and walking around: "the

evidence suggests that visual awareness is in fact panoramic and does in fact persist during long acts of locomotion" (p. 2). For this reason, if we are to understand vision as it occurs in reality, we should design our studies accordingly: "It is not true that 'the laboratory can never be like life.' The laboratory must be like life!" (p. 3) As Brian Rogers (2017) explains, the methodology of cognitivism has relied on experimental setups "where the perceptual system makes mistakes," while researchers in ecological psychology typically design "situations where the perceptual systems provide correct answers—for instance, where there is a clear link between the information available in the spatio-temporal patterning of light reaching the eye(s) and the control of our actions" (p. 27). This captures the methodological sense in which ecological psychology is "ecological": it strives to study psychological phenomena in ecologically valid situations.

These theoretical, ontological and methodological "ecological" aspects of ecological psychology are well known. But an additional sense of "ecological" is at play in the Gibsonian framework which has not received nearly as much attention. This is the ethical sense of "ecological" which connects ecological psychology to the environmentalist ideals behind environmental psychology and environmental ethics. There is good evidence that Gibson was sympathetic to values guiding the ecological movement and that he understood the urgency of environmental issues. In his 1979 book he points out, for example, that "we human animals have altered [the world] to suit ourselves" but he adds that "[we] have done so wastefully, thoughtlessly, and, if we do not mend our ways, fatally" (p. 130). Gibson's focus was not on advancing the environmentalist agenda—articulating new foundations for psychological science was challenging enough! Still, passages like this suggest that he saw his framework as having important implications for understanding the ethical and political dimensions of our environmental situation, and that perhaps even the choice of the label "ecological psychology" was meant to capture such connotations as well.

Perception and Environmental Issues

Edward Casey's (2003) account is one of very few to explicitly apply the framework of ecological psychology to thinking about our current environmental challenges. Casey's goal is to ground environmental ethics on the experience of environmental destruction, or "the sheer and simple fact of being struck by something wrong happening in the surrounding world" (p. 187). He claims that ethicists too often focus on the morality of our actions and neglect *what* makes that action possible, namely our *experience* of the world. Casey thus proposes that we consider "the moment of the glance" as the "first moment of ethical responsiveness" (p. 188). By this he means that seeing is not only what chronologically precedes moral action but it is what gets it started and is already integral to moral action: seeing or refusing to see is itself an action—a morally relevant one—and it should accordingly have

a more prominent place in our study of moral psychology and environmental ethics.

The view of perception underlying Casey's proposal is decidedly Gibsonian. As briefly suggested earlier, in ecological psychology perception is the direct pick up of ecological information. This means that we do not need to internally represent and process information so as to infer some meaning (as is assumed in the cognitivist tradition). Rather, we directly perceive (or "pick up") information that is relational and is therefore informative of what the environment means to us—it is information that specifies what actions the environment *affords*, or what we can *do* in that environment. Drawing from this view of perception as the pick up of ecological information, Casey proposes: "A glance suffices not just to see distress and disorder. It also picks up the imperative to do something about that disarray" (p. 198). Casey illustrates his point by describing his experience of happening upon a mountainside that had been deforested. He claims that the mere sight of that deforested area included the detection of an ethical imperative to fix the situation: "The imperative for ecological action stemmed from the intensity of the scene itself, its damaged surfaces speaking dramatically to my bare apperception" (p. 199). Casey's proposal thus corresponds to two key ideas to be examined independently: (1) that in perceptual experience we can directly detect natural distress or disorder, and (2) that in perceptual experience we also detect an ethical imperative to fix that disorder.

The Direct Perception of Natural Disorder

Consider first Casey's claim that we directly perceive natural distress and disorder. Casey proposes that certain events provide the 'direct presentation of environmental distress', such as in his own experience of seeing a deforested area: "When I glimpse clearcutting on a mountain slope or the dumping of waste in a swamp or the ruination of soil on a farm, I am witnessing disorder in the environment" (p. 197). By "disorder" Casey means "any feature of the layout that goes contrary to the natural order," further adding that in such cases, "instead of an optical array that is well-ordered with regard to being and well-being, we are confronted with manifest disarray" (ibid.). Thus construed, the claim that we directly perceive natural disorder is problematic for two reasons.

The first problem concerns the "direct perception" part of the claim. Althouh the "directness" of perception assumed by Casey aligns with the Gibsonian ecological framework he means to adopt, the idea that something like environmental distress or disorder can be directly perceived does not. As indicated earlier, ecological psychology takes it that what is directly accessible in perception is 'ecological information': that is, not information that is *absolute* (i.e., what an element in the environment is like in and of itself, without reference to an interacting organism) but instead information that is *relational* (i.e., information that specifies what an element in the environment affords to a particular organism). The problem is that environmental distress, as Casey describes it, is an absolute rather than relational feature of the environment.

He claims that the mountain slope, the swamp or the farm soil have their well-being "trespassed and undermined" (p. 197). To be sure, in all of these cases what threatens the environmental element's well-being is a relation or interaction (namely, human action); still, to frame the result as a loss in well-being is to frame it as an absolute change in that environmental element. And if environmental disarray and lack of order are absolute features of that environment, then, strictly speaking, we could not directly perceive them because perception only detects relational features.

The second problem with Casey's idea that we directly perceive natural disorder concerns the "natural disorder" part of the claim. Casey seems to assume that nature has some essential, human-independent order and that human activity disrupts that naturalness, almost as if humans were somehow breaking into the realm of the natural from outside of it. Philosophers working in environmental ethics have questioned the adequacy of this common understanding of "natural" as being opposed to "artificial" or "man made" (e.g., Elliot 1982, Katz 1992, Vogel 2015). But even earlier, Gibson himself had vehemently rejected this form of dualism: "It is a mistake to separate the natural from the artificial as if there were two environments"; instead, "This is not a new environment—an artificial environment distinct from the natural environment—but the same old environment modified by man" (Gibson 1979: 130). Humans are as natural as any other animal, and the environmental effects of human activity (including deforestation, pollution and climate change) are as natural as the environmental effects of the activity of any other species. Strictly speaking, then, it seems we cannot directly perceive "natural disorder," as Casey claims, because "natural disorder" does not exist. The environmental problems we face are real, of course, but they are not adequately understood as the disruption of natural order. The clearcut mountain slope Casey saw is perfectly natural even though it was created by humans: deforestation transforms previous environmental dynamics, but so do other non-human-initiated ecological events such as hurricanes and volcanic eruptions. For this reason, framing our environmental situation in terms of "natural disorder" is problematic not only because it places it outside the scope of perceptual experience (as an absolute feature), but also because it implies an untenable dualism according to which human action disrupts some independent natural order, as if humans were not part of nature.

The Picking Up of Ethical Imperatives

Independently of the reasons given above for rejecting Casey's claim that we perceive natural disorder, there is good reason to question his further claim that we also perceive an ethical imperative to fix natural disorder. This is because Casey's idea that the perception of natural disorder already includes imperatives of a moral sort is based on a scientifically questionable understanding of the notion of "affordances".

Casey quotes Gibson in saying that through perception we come to know "what [the substances of the habitat] afford, what they are good for," to which Casey adds: "This points

in the direction of the ethical, which allows us as well as commands us to be and do good in terms of what the surfaces of our immediate environment afford—what they are 'good for'" (p. 196). As this makes clear, Casey interprets affordances as having some moral dimension to them: in his view, 'what things are good for' refers to the actions that are justified or called for morally. But this is a gross misunderstanding of "affordance" as the technical term is used in ecological psychology. To be sure, there has been intense debate in the ecological psychology community about the ontological status of affordances, namely if they are to be understood as dispositions (Turvey 1992, Scarantino 2003), resources (Reed 1996), or relations (Chemero 2003, 2009). But it is generally understood that affordances have only instrumental value. For example, basic affordances of fire include illumination, warmth, and injury to the skin; "once control is learned" fire also affords cooking, boiling water, glazing clay, reducing minerals to metals (Gibson 1979: 39), and to this list we can add slash-and-burn agriculture and injury to others by combining fire with gunpowder. Similarly, trees can afford climbing and shelter from sun or rain, as well as injury through collision, and cutting down to clear an area for agriculture or to extract wood with which to create shelter, tools, or fire. Strictly speaking, then, affordances cannot "point in the direction of the ethical," as Casey suggests, because things can be 'good for' all sorts of purposes, including the immoral and the amoral. If it makes sense to say that affordances contain any 'imperative' for action, then this imperative has to be purely instrumental rather than moral. For this reason, Casey's claim that we perceive an ethical imperative to fix natural disorder is incompatible with the Gibsonian ecological theory Casey means to advocate: the same deforested mountainside that affords protection and reforestation also affords further clearing for agricultural ends; if any imperative for action is picked up in perception, it cannot have inherent moral valence.

Perception, Learning, and Responsibility

Having examined some of the challenges with applying the framework of ecological psychology to understanding our environmental situation, we can now move closer to a positive account that is more theoretically sound.

Earlier I quoted Gibson's (1979) claim that we humans have altered the world 'wastefully', 'thoughtlessly' and possibly 'fatally' (p. 130). In the same passage Gibson also explains *why* we have done so:

> "Why has man changed the shapes and substances of his environment? To change what it affords him. He has made more available what benefits him and less pressing what injures him. In making life easier for himself, of course, he has made life harder for most of the other animals. Over the millennia, he has made it easier for himself to get food, easier to keep warm, easier to see at night, easier to get about, and easier to train his offspring" (Gibson 1979: 130)

As this suggests, we could only get to our current environmental situation by acting on the affordances of the environ-

ment. Natural resources afforded extraction and transformation, forests afforded cutting down, rivers afforded a rudimentary way of getting rid of sewage, and the air afforded getting noxious smoke outside of our houses and factories, and it was only because all of this was afforded by the environment that we developed these practices in the first place. These interactions with the environment—our acting on what it affords—necessarily transforms the environment and what it affords as well: the deforested area affords us agricultural cultivation but it no longer affords inhabiting by various other species, therefore no longer affording us hunting; water and air, once polluted, can afford poisoning and death to us and various organisms exposed to them. All environmental challenges we currently face follow the same pattern, arising from interactions that the environment afforded, followed by the transformation of those affordances and the creation of new ones that may be more or less desirable from a variety of perspectives. These ecological facts of perception and action support the idea that our current environmental situation (which includes pollution, deforestation and climate change) is perfectly *natural*: humans are not outside of the realm of nature, and we, just like all other living beings, can only ever act on what we detect that the environment affords. But naturalizing anthropogenic environmental impact should not be seen as entailing passivity or fatalism, as if being natural also made something like climate change *good* or *unavoidable*.

Instead, the ecological facts of perception and action described above are inadequately understood if we do not also take into account the various ways in which perception is flexible and fine-tunable, or how it is shaped by learning and the "education of attention" (Gibson 1966, Jacobs and Michaels 2007, Araujo and Davids 2011). The education of attention is the differential attunement of a perceptual system to ecological informational variables—put simply, it is the process by which, through practice, we become more sensitive to information that is more relevant for certain actions (this explains the skill of the expert wine taster, as well as any adult's skill in reading and doing mathematics, for example). And a key reason why the flexibility and educability of attention is important for the present discussion is that it helps to make clear how our perception of environmental resources and environmental challenges can develop. Even if deforestation and pollution arise naturally from our acting on what the environment affords, we can equally naturally come to better perceive other affordances that may be more adaptive. The fine-tuning of perception thus enables us to more fully understand our situation and see that, as Gibson put it, "Some ecological events are reversible sequences, whereas others are nonreversible" (1979: 101). This in turn empowers us to make more informed decisions, and to choose, for example, to limit our contribution to nonreversible events that will have undesirable consequences (e.g., climate change). The fine-tuning of perception can thus guide which affordances we choose to act on and which new affordances we choose to create.

Further developing this view of our environmental situation in Gibsonian ecological terms—in terms of the ecological facts of affordance-based perception-action dynamics and the education of attention—will make an important contribution to the environmental movement in its various facets. In environmental ethics, the Gibsonian ecological framework motivates not an ethics of imperatives (Casey 2003) but an ethics of 'responsibility' (Vogel 2015): coming to see ourselves as responsible for the environment means, first, realizing that we have *caused* it to become what it is now and, second, *taking ownership* of it and managing it in light of the knowledge that, even if we can never bring nature back to some pristine state, we can make life better for ourselves and others we share the environment with. This in turn motivates more research in environmental psychology toward a better understanding of how to design the built environment and societal systems so that they *afford* behavior that is environmentally sustainable rather than (self)destructive.

References

Araújo, D., & Davids, K. (2011). What exactly is acquired during skill acquisition? *Journal of Consciousness Studies*, *18*(3-4), 7–23.

Bratman, G. N., Daily, G. C., Levy, B. J., & Gross, J. J. (2015). The benefits of nature experience: Improved affect and cognition. *Landscape and Urban Planning*, *138*, 41–50.

Callicott, J. B. (1987). *Companion to a sand county almanac: Interpretive and critical essays*. Univ of Wisconsin Press.

Callicott, J. B. (1999). *Beyond the land ethic: more essays in environmental philosophy*. SUNY Press.

Casey, E. S. (2003). Taking a glance at the environment: Preliminary thoughts on a promising topic. In C. S. Brown & T. Toadvine (Eds.), *Eco-phenomenology: Back to the earth itself* (p. 187-210). State University of New York Press, Albany.

Chemero, A. (2003). An outline of a theory of affordances. *Ecological Psychology*, *15*(2), 181–195.

Chemero, A. (2009). *Radical embodied cognitive science*. MIT press.

Cheng, J. C.-H., & Monroe, M. C. (2012). Connection to nature: Childrens affective attitude toward nature. *Environment and Behavior*, *44*(1), 31–49.

Elliot, R. (1982). Faking nature. *Inquiry*, *25*(1), 81–93.

FAO. (2016). *Global forest resources assessment 2015* (Tech. Rep.). Food and Agriculture Organization of the United Nations.

Gibson, J. J. (1966). *The senses considered as perceptual systems*. Houghton Mifflin.

Gibson, J. J. (1979). *The ecological approach to visual perception*. Houghton Mifflin.

Heft, H. (2001). *Ecological psychology in context: James gibson, roger barker, and the legacy of william james's radical empiricism*. Lawrence Erlbaum Associates Publishers.

Jacobs, D. M., & Michaels, C. F. (2007). Direct learning. *Ecological psychology*, *19*(4), 321–349.

Katz, E. (1992). The big lie: Human restoration of nature. *Research in Philosophy and Technology*, *12*, 231-241.

Leopold, A. (1949). *Sand county almanac, and sketches here and there*. Oxford University Press.

Lucas, K., Brooks, M., Darnton, A., & Jones, J. E. (2008). Promoting pro-environmental behaviour: existing evidence and policy implications. *Environmental Science & Policy*, *11*(5), 456–466.

Reed, E. S. (1996). *Encountering the world: Toward an ecological psychology*. Oxford University Press.

Rogers, B. (2017). *Perception: A very short introduction*. Oxford University Press.

Russell, R., Guerry, A. D., Balvanera, P., Gould, R. K., Basurto, X., Chan, K. M., ... Tam, J. (2013). Humans and nature: how knowing and experiencing nature affect wellbeing. *Annual Review of Environment and Resources*, *38*, 473–502.

Scarantino, A. (2003). Affordances explained. *Philosophy of Science*, *70*(5), 949–961.

Turvey, M. T. (1992). Affordances and prospective control: An outline of the ontology. *Ecological psychology*, *4*(3), 173–187.

Turvey, M. T., & Carello, C. (1986). The ecological approach to perceiving-acting: A pictorial essay. *Acta Psychologica*, *63*(1-3), 133–155.

Tyrväinen, L., Ojala, A., Korpela, K., Lanki, T., Tsunetsugu, Y., & Kagawa, T. (2014). The influence of urban green environments on stress relief measures: A field experiment. *Journal of Environmental Psychology*, *38*, 1–9.

UNEP. (2017). *Towards a pollution-free planet background report* (Tech. Rep.). United Nations Environment Programme.

Vining, J., & Ebreo, A. (1992). Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities. *Journal of applied social psychology*, *22*(20), 1580–1607.

Vogel, S. (2015). *Thinking like a mall: Environmental philosophy after the end of nature*. MIT Press.

Wells, N. M. (2000). At home with nature: Effects of greenness on childrens cognitive functioning. *Environment and Behavior*, *32*(6), 775–795.

White Jr, L. (1967). The historical roots of our ecologic crisis. *Science*, *155*(3767), 1203–1207.

WHO. (2017). *World health statistics 2017: monitoring health for the sdgs, sustainable development goals* (Tech. Rep.). World Health Organization.

WWF. (2016). *Living planet report 2016: Risk and resilience in a new era* (Tech. Rep.). World Wide Fund For Nature.

Zelenski, J. M., Dopko, R. L., & Capaldi, C. A. (2015). Cooperation is in our nature: Nature exposure may promote cooperative and environmentally sustainable behavior. *Journal of Environmental Psychology*, *42*, 24–31.