



Nature's broken path to restoration. A critical look at Attention Restoration Theory



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ARTICLE INFO

Handling Editor; Prof. Harry Heft

1. Introduction

In their influential 2008 article, Berman, Jonides and Kaplan ask their readers to “(i)magine a therapy that had no known side effects, was readily available, and could improve your cognitive functioning at zero cost” (Berman, Jonides, & Kaplan, 2008, p. 1207). The therapy they have in mind, and for which they hope to gather empirical support, is to go out into nature. While beliefs about nature's healing potential are part and parcel of many current and past cultures, and will, for many, resonate with personal experience, the last three decades a growing body of environmental psychology research has sought to confirm this notion.

But whence this apparently unique capacity of nature to mentally invigorate and sooth us? Is it because (being in) nature invites physical exercise, provides us with opportunities for social contact, or reminds us of relaxing times and activities (e.g., holidays)? Is it because nature, more so than urban and/or indoor environments, offers us fresh air and daylight? While these and other factors have indeed been shown to contribute to nature's salutogenic effects (for a review: Hartig, Mitchell, de Vries, & Frumkin, 2014), environmental psychology research demonstrates that already the direct perceptual (i.e., visual) experience of nature scenes and elements – especially vegetation and water features – can positively impact individuals, by counteracting stress (Ulrich et al., 1991) and facilitating the recovery from mental fatigue (Berman et al., 2008; Kaplan, 1995). Such effects are commonly labelled as “restorative” nature experiences, as they seemingly involve a recovery from depleted cognitive resources and/or undo negative psychophysiological states.

In research on restorative experiences, two important theoretical frameworks have been proposed to explain nature's restorative effects, namely Stress Recovery Theory (SRT; Ulrich, 1983; Ulrich et al., 1991) and Attention Restoration Theory (ART; Kaplan & Kaplan, 1989;

Kaplan, 1995; Kaplan & Berman, 2010). SRT especially aims to elucidate how contact with nature can reduce (psychophysiological) stress in individuals. Drawing on evolutionary psychology (e.g., Tooby & Cosmides, 1992), SRT specifically assumes that the human species is biologically prepared to rapidly display positive affect towards natural, vegetation-rich environments (Parsons, Tassinari, Ulrich, Hebl, & Grossman-Alexander, 1998; Ulrich, 1983, 1993; Ulrich et al., 1991). The argument goes that such a response was adaptive for ancestral humans, because it facilitated their quest for food, water, and places to shelter (see especially Ulrich, 1993). Based on the evolutionary psychology hypothesis that the modern human brain is wired for the Stone-Age (Tooby & Cosmides, 1997), SRT assumes that in our modern era natural settings and elements still produce positive affect in individuals, which may consequently reduce, or even buffer psychophysiological stress.

Where SRT zooms in on people's immediate affective responses to nature as a driver of restoration, ART focuses on the potential *cognitive* benefits that can derive from interactions with natural environments (Kaplan & Berman, 2010; Kaplan & Kaplan, 1989; Kaplan, 1995). A central notion in ART is “directed attention”, which can be defined as the effortful process to focus or concentrate on objects or events, while at the same time blocking out distracting stimulation. While ART considers directed attention to be a limited resource that can be depleted after long and/or intensive use, it also claims that certain environments – especially *natural* environments – are able to facilitate/support the recovery from a state of attentional depletion. According to ART, the reason is that nature is often rife with (soft) fascinating stimuli that capture one's attention in an automatic, bottom-up way. This minimizes the demands on (effortful) directed attention, and consequently allows this capacity to rest and restore itself.

Over the last three decades empirical evidence for nature's restorative benefits has been steadily accumulating. Restoration

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researchers have – amongst others – attempted to chart the positive cognitive (for a review: Ohly et al., 2016), affective (for a review: McMahan & Estes, 2015) and psychophysiological effects of nature contact (e.g., Chang, Hammitt, Chen, Machnik, & Su, 2008; Hartig, Evans, Jamner, Davis, & Gärling, 2003; Ulrich et al., 1991; Van den Berg & Custers, 2011). Efforts have been made to determine the optimal dose (Barton & Pretty, 2010; Shanahan et al., 2016) and modality (e.g., virtual versus real nature; Pals, Steg, Dontje, Siero, & van Der Zee, 2014) of nature for restoration, while research has also demonstrated how restorative nature effects can depend on group characteristics (e.g., elderly: Ottosson & Grahn, 2005; children: Taylor & Kuo, 2008; Ulset, Vitaro, Brendgen, Bekkhus, & Borge, 2017), on individuals' salient identities (e.g., Morton, van der Bles, & Haslam, 2017) or on the life stage one is in (Scopelliti & Giuliani, 2004).

While nature restoration has occasionally been studied from a qualitative perspective – for example by taking interviews on nature experiences and activities (cfr., Hawkins, Mercer, Thirlaway, & Clayton, 2013) – the majority of restoration studies are quantitative. Such quantitative studies have made use of secondary data to establish a link between restoration and access to natural environments (White, Pahl, Ashbullby, Herbert, & Depledge, 2013), but oftentimes nature's restorative benefits are experimentally researched within lab or field settings, using both subjective (i.e., self-report) and objective measures of emotional and attentional/cognitive functioning (e.g., Joye, Pals, Steg, & Lewis-Evans, 2013). Key findings and reviews on restoration have been published in highly prestigious academic journals (e.g., *Science*: Ulrich, 1984; Hartig & Kahn, 2016; *The Lancet*: Hartig & Marcus, 2006), have become highly cited,¹ and have received ample media coverage – all of which testifies to the importance of this research field, within academia and beyond.

The insight that nature can make people thrive is also increasingly applied to (different parts of) our daily lives. Based on restoration research, healthcare professionals and instances promote contact with natural environments as a means to bolster psychological health and wellbeing, or to reduce pain and stress during clinical interventions (Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003; Tanja-Dijkstra et al., 2017). Contact with greenery has been found to boost children's cognitive performance in the classroom (Van den Berg, Wesselius, Maas, & Tanja-Dijkstra, 2017), and to enhance workers' mood and productivity in office settings (Korpela, De Bloom, & Kinnunen, 2015; Steidle, Gonzalez-Morales, Hoppe, Michel, & O'shea, 2017). In the commercial sphere, retail environments are greened up to lift the mood of consumers, and to consequently boost their willingness to pay and/or buy (Bregman, Willems, & Joye, 2012; Joye, Willems, Bregman, & Wolf, 2010; Rosenbaum, Otorala, & Ramírez, 2016). Based on the various psychological benefits of nature contact, in some countries (governmental) campaigns have even been initiated to raise awareness of nature's soothing psychological effects (e.g., "green schoolyards" in the Netherlands).

While laudable, the search for further empirical confirmation and for promising applications of nature's salutogenic effects has – in our view – also come with a cost, in that the field of restoration studies has reached a theoretical standstill. Since already three decades SRT and ART have been standing as the main and seemingly undisputable explanatory frameworks for restorative nature experiences, despite some striking limitations and issues. In this paper, we aim to start overturning this theoretical *status quo*.² For this, we will review the main theoretical assumptions underlying the field of restoration research, and point to a number of important empirical and conceptual shortcomings. Note that

¹ For example, Kaplan and Kaplan (1989) receives 5915 citations on Google Scholar, whereas Ulrich (1984) receives 4422 citations (date: 6 June 2018).

² This theoretical standstill is probably also exacerbated by the fact that some restoration studies are only loosely based on ART or SRT, and are not particularly interested in rigorously testing ART's/SRT's highly specific assumptions.

with our critical review we will specifically target ART, rather than SRT, as the former theory has barely received any systematic criticism (for critiques on SRT, see e.g., Kaplan, 1995; Joye & Van den Berg, 2011).

2. General outline

In what follows, we critically examine the main theoretical and empirical assumptions of ART. In a nutshell, ART states that nature's soft fascinating characteristics (i.e., the independent variable) can lead to a recovery of directed attention (i.e., the dependent variable), and this effect is driven by the capacity of fascinating (natural) environments to trigger bottom-up involuntary attention (i.e., the mediator). In the ensuing critical review, we aim to pinpoint difficulties with all three elements of ART's basic model. In our first two criticisms, we address the DV side of the model, and ask whether there is currently sufficient evidence for the assumption that restorative nature effects are recovery effects (Assumption 1), and that a particular cognitive resource (i.e., directed attention) is replenished during this recovery process (Assumption 2). Next, we focus on the IV side of the model, and argue that the notion of soft fascination is vague and conceptually underdeveloped, and is currently lacking a clear operationalization (Assumption 3 and Assumption 4). We then move on to the proposed mediator for attention restoration, and point out that, besides being untested, it is far from even-handed that the (often mundane) natural settings used in restoration research are able to trigger bottom-up involuntary attention in the first place (Assumption 5). Following this, we zoom out, and question the broader evolutionary background of ART, i.e., the assumption that natural fascinations are restorative because they ultimately fulfilled an adaptive function in ancestral environments (Assumption 6). We close off with some outstanding questions, such as why being in a state of fascination is associated with cognitive effortlessness rather than effortfulness.

3. Questioning ART's central assumptions

Assumption 1. Restorative nature effects are recovery effects

One of ART's central assumptions is that when individuals are attentionally fatigued, contact with natural settings can relax the demands on directed attention, thereby giving this capacity an opportunity to recover and replenish itself (Kaplan & Berman, 2010; Kaplan & Kaplan, 1989; Kaplan, 1995). Because urban environments often contain dramatically distracting stimulation (e.g., car horns, billboards: Berman et al., 2008), in such settings directed attention may need to be further recruited to block out that stimulation, thereby potentially exacerbating directed attention fatigue. Thus, in the most common theoretical characterization of ART, restorative nature experiences are assumed to be *recovery* effects: nature facilitates the replenishment of an initially depleted resource, i.e., directed attention.

Several ART-based studies are aimed at testing whether restorative environments indeed foster a *recovery* from attentional fatigue (e.g., Berman et al., 2008; Berman et al., 2012; Berto, 2005; Bodin & Hartig, 2003; Hartig et al., 2003; Laumann, Gärling, & Stormark, 2003; Shin, Shin, Yeoun, & Kim, 2011). Such studies typically start off by administering participants a task that induces a state of attentional fatigue in them, which is then followed by an environmental treatment (often-times exposure to, or immersion in natural versus urban settings), and the target measurement of participants' attentional/cognitive functioning. Employing this experimental paradigm, several studies find that (fatigued) individuals who have subsequently been exposed to, or been immersed in natural/green environments (e.g., forests, parks) score better on the (target) attentional/cognitive task than individuals exposed to urban settings (Joye & Van den Berg, 2012).

While the results of such ART-based studies are often interpreted in terms of a (cognitive/attentional) recovery process, it is worth

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