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Does perceived restorativeness mediate the effects of perceived biodiversity and perceived naturalness on emotional well-being following group walks in nature?

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ABSTRACT

Natural environments are associated with positive health and well-being. However, little is known about the influence of environmental qualities on well-being and the mechanisms underlying this association. This study explored whether perceived restorativeness and it subscales would mediate the effects of perceived biodiversity, perceived naturalness, walk duration and perceived intensity on emotional well-being.

Participants (n = 127) of a national walking program in England completed pre- and post-walk questionnaires (n = 1009) for each group walk attended within a 13-week period. Multilevel mediation examined the hypothesised indirect effects.

Perceived restorativeness mediated the effects of perceived bird biodiversity, perceived naturalness, and perceived walk intensity on positive affect, happiness and negative affect. The effect of walk duration on happiness was also mediated by perceived restorativeness. Perceived walk intensity had a direct effect on positive affect and happiness.

Findings have implications for theory development, future biodiversity-health research and practitioners interested in designing restorative environments.

1. Introduction

Interaction with natural environments has diverse health and well-being benefits (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Frumkin, 2001; Hartig, Mitchell, de Vries, & Frumkin, 2014; Irvine & Warber, 2002; Keniger, Gaston, Irvine, & Fuller, 2013). However, little is known about the contribution that different qualities of natural environments have on well-being – and even less is known about the mechanisms through which this relationship occurs. Previous researchers have called for mediation analyses to explain how different environmental qualities affect well-being (Clark et al., 2014; Hartig, 2011; Lovell, Wheeler, Higgins, Irvine, & Depledge, 2014; Sandifer, Sutton-Grier, & Ward, 2015). As the effect of natural environment qualities on well-being is a developing area for nature and health research, this gap is important to address.

In their review of green exercise, Thompson Coon et al. (2011) suggest "future studies might consider the impact of the perceived quality of the environment on mental and physical wellbeing outcomes" (p. 1771). Whilst environmental quality is often discussed in terms of the "aesthetics or attractiveness" of the natural environment (de Vries, van Dillen, Groenewegen, & Spreeuwenberg, 2013) (p. 27), two alternative indicators of environmental quality – ones that begin to acknowledge ecological quality – are the degree of naturalness (Carrus et al., 2013; van Dillen, de Vries, Groenewegen, & Spreeuwenberg,

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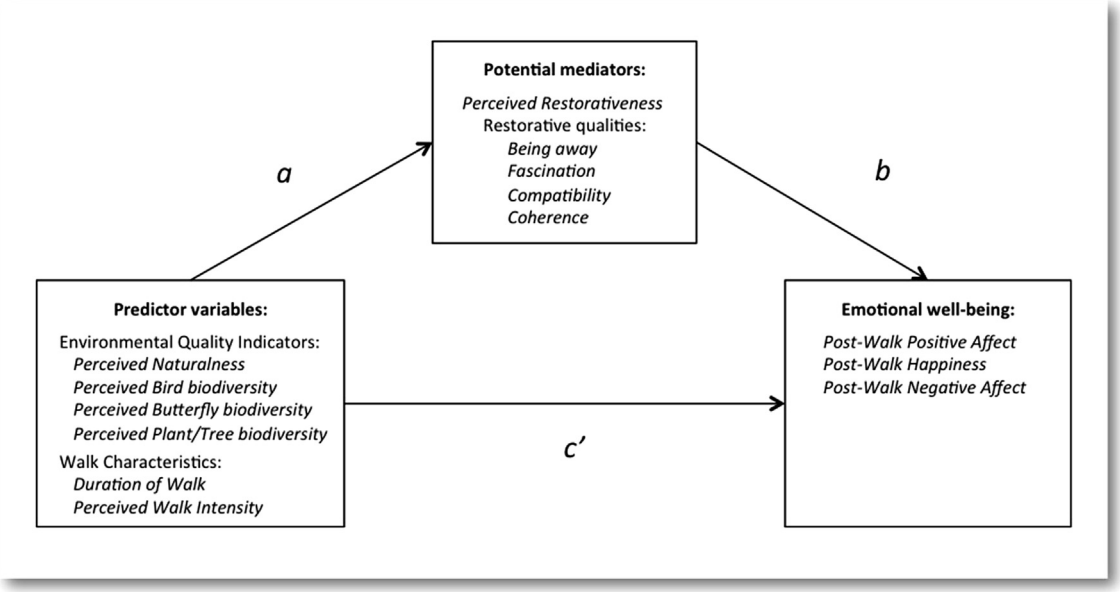

Fig. 1. Conceptual diagram of the mediating effect of perceived restorative quality (perceived restorativeness, being away, fascination, compatibility and coherence) on the association between environmental quality indicators (perceived naturalness and perceived biodiversity), walk characteristics (duration and perceived walk intensity), and emotional well-being. *a* = associations between the predictor variables and the potential mediators. *b* = associations between the potential mediators and emotional well-being. *c′* = Direct association between predictor variables and emotional well-being, adjusted for mediators (Figure adapted from Tak et al. (2011).

2012) and level of biodiversity (Lovell et al., 2014) of the environment. To understand how these indicators might affect well-being, one can look to theories of restorative environments which identify salutogenic outcomes from interaction with, and the qualities of, environments that facilitate well-being (Kaplan, 1995; Kaplan & Kaplan, 1989; Ulrich, 1983; Ulrich et al., 1991). The perceived restorative quality of an environment has been associated with both the degree of naturalness (Carrus et al., 2013; Hartig, Korpela, Evans, & Gärling, 1997; Hipp, Gulwadi, Alves, & Sequeria, 2015; Hipp & Ogunseitan, 2011) and level of biodiversity (Carrus et al., 2013, 2015; Scopelliti et al., 2012) of that environment – as well as emotional well-being (Hartig, Korpela, et al., 1997; Korpela, Borodulin, Neuvonen, Paronen, & Tyrväinen, 2014; Marselle, Irvine, Lorenzo-Arribas, & Warber, 2015; Sato & Conner, 2013). Thus, perceived restorative quality may play a mediating role in the impact of environmental quality on emotional well-being. This study investigates whether perceived restorative quality mediates the relationship between the quality of the environment (perceived degree of naturalness and perceived level of biodiversity) and emotional well-being following the green exercise activity of outdoor group walks (see Fig. 1). Characteristics of a walk – duration and perceived walk intensity – were also tested as predictors.

1.1. Naturalness and biodiversity of the environment, and well-being

Seventy-three per cent of Britons believe that the environment is important to both personal and national well-being (Office for National Statistics, 2015). The degree of naturalness of an environment has been found to be associated with greater well-being. Recent reviews highlight that people report greater emotional well-being in natural environments compared to indoor (Thompson Coon et al., 2011) or outdoor, built environments (Bowler et al., 2010). For example, MacKerron and Mourato (2013) found that happiness varied by the type of natural environment in which people were located; compared to continuous urban environments, self-report happiness was greatest in coastal environments and lowest in floodplains and wetlands. Hinds and Sparks (2011) found that the perceived naturalness of an environment was positively associated with greater psychological well-being, specifically 'more natural' environments such as forests were associated with greater well-being than 'less natural' environments such as urban parks. Perceived naturalness of an environment has also been found to significantly predict a reduction in anxiety following green exercise (Mackay & Neill, 2010).

The measured level of actual biodiversity in the environment has been found to be positively associated with health (Hough, 2014; Jorgensen & Gobster, 2010; Lovell et al., 2014; Wheeler et al., 2015), psychological well-being (Carrus et al., 2015; Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007) and positive emotions (Cracknell, White, Pahl, Nichols, & Depledge, 2015; Johansson, Gyllin, Witzell, & Küller, 2014). Our review here focuses on perceived biodiversity – an individual's assessment of the species richness in an environment. People demonstrate a general belief that the perceived biodiversity of flowers, birds, and trees in an urban park improves their well-being (Shwartz, Turbé, Simon, & Julliard, 2014). In Dallimer et al.'s (2012) *in situ* study of riparian green spaces, psychological well-being was found to increase as the perceived species richness of birds, butterflies, trees/plants in the environment rose. In contrast, actual species richness in the environment showed inconsistent relationships; psychological well-being was positively associated with higher levels of bird species richness, but declined with higher levels of plant/tree biodiversity and was not related to butterfly species richness (Dallimer et al., 2012). That is, perceptions of biodiversity were consistently associated with positive psychological well-being whilst actual biodiversity's influence on well-being was mixed. There is some evidence to suggest that people are able to accurately perceive the level of actual species richness of some environments (Fuller et al., 2007;