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The restorative benefits of walking in urban and rural settings in adults with good and poor mental health

Jenny Roe ^{a,*}, Peter Aspinall ^b

^a OPENspace, Edinburgh College of Art, Lauriston Place, Edinburgh EH3 9DF, UK

^b VisionCentre3 & OPENspace, School of Built Environment, Heriot Watt University, Riccarton, Edinburgh EH14 4AS

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ABSTRACT

People differ in their potential for psychological restoration but there is little evidence on the role of varying mental health state or settings in the process. This paper reports two quasi-experiments which compare the restorative benefits of walking in urban and rural settings in two groups of adults with good and poor mental health. Two aspects of restoration are examined, firstly mood, the other using personal project techniques (Little, 1983) to capture an under-explored aspect of cognitive restoration through reflection on everyday life tasks. Results are consistent with a restorative effect of landscape: the rural walk was advantageous to affective and cognitive restoration in both health groups when compared to an urban walk. However, beneficial change took place to a greater extent in the poor health group. Differential outcomes between health groups were found in the urban setting, which was most advantageous to restoration in the poor mental health group. This study extends restorative environments research by showing that the amount of change and context for restoration can differ amongst adults with variable mental health.

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1. Introduction

This paper focuses on psychological restoration and the ability of different settings to promote recovery of cognitive and emotional resources in people with varying mental health. Restoration has been defined as the process of recovery from a depleted psychological, physiological or social resource (Hartig, 2007). In order for restoration to take place, the possibility for restoration must exist in the first place, i.e. there must be a depleted resource. Two theories currently dominate the literature on restorative environments, each one dealing with different forms of resource depletion. Firstly, we briefly overview these two theories before presenting some of the empirical research they have generated, focusing on research most relevant to the experiments in this study, i.e. restorative outcomes in different environmental settings. Secondly, we set out the mental health framework for this study and explore concepts of coping and how they are related to emotional health. Thirdly, we introduce the framework for this particular study and introduce the concept of personal project analysis, a method for capturing aspects of reflection on personal goals.

1.1. Restorative environments theory

Firstly, we outline attention restoration theory (ART) which deals with attention fatigue, or the depleted capacity to direct

attention (Kaplan and Kaplan, 1989). In the ART model, Kaplan and Kaplan posit that natural settings, inherently rich in fascinating stimuli, invoke *involuntary* attention which supports restoration from mental fatigue. These settings, high in 'soft' fascination, have just sufficient enough interest in the surroundings to hold attention but not so much to as to exclude room for reflection. By contrast, urban environments (built, entertainment and sport settings, for instance) are rich in 'hard' fascination which grabs the attention dramatically, leaving no room for reflective thought and requiring directed attention to overcome the stimulation. In addition to *fascination*, natural settings are believed to promote restoration, owing to their ability to promote a sense of *being away* (psychological and/or geographical distance from routines that impose demands on directed attention), *extent* (a setting 'rich enough and coherent enough so that it constitutes a whole other world' with sufficient scope to engage the mind (Kaplan, 1995, p. 173) and *compatibility* (a good fit between an individual's purposes or inclinations and the kinds of activities, supported, encouraged or demanded by the setting). Whilst settings other than nature can promote restoration, ART proposes that natural settings have a greater proportion of these four qualities than urban environments.

The ART model proposes four successive stages in a restorative experience (Kaplan and Kaplan, 1989, pp. 196–197): firstly, 'clearing the head' of distracting thoughts; secondly, recovery of directed attention capacity; thirdly, a process of contemplation or 'cognitive quiet'; fourthly, a deeper state of restoration, reflection on one's life, priorities, possibilities, actions and goals. This latter process of reflection is defined as 'the most demanding of all in terms of both

* Corresponding author. Tel.: +44 131 221 6192.

E-mail address: j.roe@eca.ac.uk (J. Roe).

quality of the environment and duration required' (Kaplan and Kaplan, 1989, p. 197). Subsequently, Herzog et al. (1997) have grouped these processes into two stages: attentional recovery and reflection.

The second theory, psychoevolutionary theory (Ulrich et al., 1991; Ulrich, 1983) focuses on stress reduction rather than attention restoration. Parsons (1991) defines this model as "first and foremost an attempt to deal with affective responses" (p. 5) in that stress reduction arises from an affective *and* aesthetic response to the environment. The affective response is evoked immediately by the visual stimulus array and involves like-dislike affect accompanied by change in psycho-physiological activation. For a person already experiencing stress, this might help promote a degree of recovery from stress. According to Ulrich, the initial perception of an environment is of its 'preferenda', a term coined by Zajonc (1980) to describe the features of the visual stimulus array which promote affective reactions in people. In natural environments, the 'preferenda' believed to promote positive affective responses are moderate depth, moderate complexity, and the presence of a focal point. The restorative effects of such settings are proposed to have an innate, evolutionary basis, i.e. we are drawn to settings that have been significant for survival in the past (e.g. water bodies). Ulrich conceives restoration in a broader context than ART arguing it is potentially feasible in any stressful situation and in people not just attentionally fatigued.

Now we turn to the empirical evidence supporting these two theoretical frameworks. Firstly, in healthy adults, experimental research has shown that some natural settings are advantageous over urban settings to restoration including cognitive, affective and physiological restoration (Ulrich et al., 1991; Van den Berg et al., 2003; Hartig et al., 1996; Tennesson and Cimprich, 1995). This research has shown that restoration is a multi-faceted process and that different aspects of restoration can accompany each other (for example, affective restoration and stress reduction, Ulrich et al., 1991). But evidence of a relationship between attention restoration and reflection, or evidence that the processes operate sequentially, is limited. Herzog et al. (1997) has shown, using attentional recovery and reflection goal scenarios, how settings impact on these two processes differently: settings high on hard fascination (sports settings) were found to promote attentional recovery but not reflection; natural settings offering soft fascination were higher in overall restorative effectiveness, including reflection. Exploring the actual effects of nearby green space in residential settings, Kuo (2001) found a link between reflection on life tasks (using personal project analysis) and attention restoration with higher levels of nearby green space. Mediation tests and tests for confounding variables supported the notion that green space could enhance residents' reflection on life goals by reducing mental fatigue. But other research using scenario methodology has shown contrary patterns, i.e. reflection outcomes were more positive in people who assumed an absence of attentional fatigue (Staats and Hartig, 2004; Staats et al., 2003). It is suggested in the literature that reflection can either be an aspect of restoration or an activity which is enabled by restoration of directed attention capacity. This distinction seems to be reinforced with Herzog et al. (1997) supporting the former and Staats and colleagues supporting the latter view. We are aware, however, that a limitation of the studies of both Herzog et al. and Staats and colleagues is the use of a scenario method rather than measured effects on reflection from different actual settings. In addition, Kuo's discovered link between attentional capacity and reflection on life tasks is compatible with both views on the role of reflection. To summarise, evidence that reflection is part of the restoration process is limited but we have held with the Kaplan and Kaplan (1989) concept that restoration is a phenomenon that includes reflection.

Research conducted in the field (as opposed to the laboratory) has shown a walk in a natural setting is advantageous to aspects of restoration when compared to an urban walk (Hartig et al., 2003; Berman et al., 2008); and when compared to a control day (i.e. no walk) (Morita et al., 2007). Time spent outdoors (in a garden context) has also been shown to be advantageous to restoration in older adults when compared to time spent indoors (Ottosson and Grahn, 2005). Secondly, in adults with mental health problems, a rural walk has been found to be advantageous to mood and self-esteem when compared to walking in an indoor shopping centre (Peacock et al., 2007); and in adults with psychosis, an urban walk was disadvantageous to mood compared to an indoor relaxation task (Ellett et al., 2008). Elsewhere research points to the substantial therapeutic benefits of green activity in people with mental health problems, particularly in relation to building coping resources and as a buffer to stress (Ottosson, 2007; Ottosson and Grahn, 2008), in improving belonging and self-identity (Parr, 2005) and in improving social cohesion and meaningful occupation (Townsend, 2006).

It is generally recognised people's needs for restoration can vary (Hartig, 2007) but a significant gap in the research field is in empirical evidence showing how the experience varies in subsections of the population. Scopelliti and Giuliani (2004) have shown how the potential for restoration varies across the age span, both in relation to social context and the amount of time available for restoration. The potential for differential capacities for restoration has been explored in several experimental studies in healthy student populations (Hartig et al., 1996, 2003). In Hartig et al.'s (2003) study, to ensure a potential for restoration prior to an environmental 'treatment', a series of psychological demands were imposed on subjects (e.g. tasks requiring focused attention, such as driving) in varying degrees of intensity. Following these demands, natural settings were found to have more positive effects on restoration. Subjects with seemingly differently psychological points of departure showed similar patterns of change (i.e. outcomes converged between groups subjected to a pre-task stressor and those unexposed to a pre-task stressor). These experiments generated a transient state of attention deficiency; but it is not known if the same patterns would hold in a variety of daily living situations.

In the mental health context, it has been suggested the intensity of a restorative experience may be influenced by the degree of stress or crisis a person experiences (Korpela et al., 2008; Ottosson and Grahn, 2008). However, as far as we are aware, no studies to date have explored differential capacities for restoration in people with varying mental health states in different settings. Would, for instance, a depressed individual experience similar levels of restoration to a non-depressed person, and how would the setting interact with such individual differences? Or again, would the process be more, or less, intense? These are some of the questions this paper explores, using the activity of a walk in urban versus rural settings to explore restorative outcomes between two groups with different mental health status. There were two reasons for the inclusion of subjects with good and poor mental health. Firstly, little evidence is currently available on possible benefits to those with poor mental health. Secondly, it is possible that a poor mental health group would already suffer from depleted resources in coping prior to any experimental intervention. This would be a natural equivalent to introducing a pre-walk stressor and would give greater opportunity for any recovery to show itself from a different and lower starting point on the mood scales, in this case the anticipated change following forest intervention would be greater. (We were also aware of the counter argument that people with major problems of whatever kind might be so internally focused that there would be little likelihood of external (i.e. environmental) benefits.)

1.2. The mental health framework

For the purpose of this study a simple division is made between good and poor mental health. Poor mental health is defined as having a clinically diagnosed mental health problem (depression, anxiety, bi-polar disorder or psychotic illness); conversely, good mental health is defined as having no clinically defined disorder. However, we recognise concepts of mental health are significantly more complex than this, i.e. health is more than the absence of disease, and may have something to do with day-to-day level of functional ability (WHO, 2007). Definitions of mental illness in the UK are shifting away from categorizing mental health by type of illness, towards defining mental health as a spectrum of coping abilities, ranging from coping well to coping poorly. Within this spectrum, a person suffering from schizophrenia, say, and managing well on medication, may be coping better than an individual, as yet undiagnosed, with anxiety. However, following advice from clinicians at the time, our split of good and poor mental health based on clinical diagnoses was considered appropriate.

In the past, mental health promotion has focused on strategies that aid psychological relaxation and reduce tension, taking the view that excessive arousal (physiological or psychological) is harmful to health. Recently, the focus has shifted towards strategies that can help build coping resources for dealing with life's day-to-day challenges. This notion of coping and resource building is integral to the theoretical framework directing this study and, in particular, ideas linking mood with coping and manageability of life tasks. Folkman and Lazarus (1988) have shown how coping can mediate emotions during stressful encounters. For instance, coping with life tasks ('planful problem-solving') was associated with more positive emotion. This idea is also reflected in Fredrickson's (2004) 'broaden and build' hypothesis, which posits that positive emotion *broadens* cognition (defined as 'mindset'), widening thought-action repertoires and in turn helping to build personal resources for coping in the future. The theory suggests an *upward spiral* in which positive emotions and subsequent broadened thinking influence one another reciprocally, a process that leads to improved mental well-being. In this way positive emotion *produces* good mental health as opposed to simply *signalling* or *marking* it, the traditional perspective. Empirical support for this proposition is provided by Isen et al. (1987), Folkman and Lazarus (1988) and Fredrickson and Branigan (2005).

1.3. Developing the framework for the study

Using the above framework, this study focuses on two dependent variables linked in the literature with coping: mood and reflection of life-tasks. Using similar methods to Kuo (2001) we have explored reflection using personal project techniques (Little, 1983) as a framework for capturing aspects of reflection in relation to project planning. This is a technique whereby participants list their personal projects and assess or characterize them according to 18 dimensions exploring what they think and feel about them in relation to their goals. The dimensions have been subject to factor analysis which has identified five core dimensions from the original framework (Little, 2007; Chambers, 1997; Meyer et al., 2004). Firstly, affective dimensions of project appraisal: (1) positive affect (*enjoyment* from the domain of meaning) and (2) negative affect (*stress*). Secondly, cognitive aspects of project appraisal including (3) project mastery (*efficacy*, i.e. the anticipated success of achieving the project goal); (4) project manageability (degree of individual *control* over a project); and (5) degree of difficulty in perceived implementation of a project (*challenge*) which also factors with negative affect dimensions such as stress. In discussion with Little

(2006) we selected the italicised dimensions from each of these domains as appropriate measures for this study. Our aim was to relate aspects of reflection on project planning to positive well-being, as well as affective (rather than attention) restoration. In the literature, positive well-being is associated with projects that are enjoyable, manageable, controllable, and neither too difficult nor too stressful (Little, 2007).

Previous research supported the hypothesis that interactions with nature could improve mood and reflection. The present study aimed to extend this research by asking whether outcomes would vary between two mental health groups, firstly, when walking within a rural setting and, secondly, when directly compared with a walk in an urban setting. Two studies are presented here. In the first ($n=123$), a combined data set of adults with good mental health (GMH) ($n=83$) and poor mental health (PMH) ($n=40$) walked in a rural setting. The purpose was to assess the effect of the walk and possible differences between the two health groups. A second study explored the differential effects of rural versus urban settings in a smaller mixed health group ($n=24$).

2. Study 1, restorative outcomes of rural settings in adults with good and poor mental health

This study explored the outcomes of walking in a rural setting within two different mental health groups. Two hypotheses were proposed. Firstly, that a walk in a rural setting would result in a positive shift in mood and mindset in relation to personal projects. Secondly, that the poor mental health group would show a greater positive shift in mood and in mindset from pre to post walk than the good mental health group (at the time of the data collection there was no evidence based information on the possible direction of an effect between health groups).

2.1. Method

2.1.1. Subjects

A total of 123 adults participated (40 males and 83 females), 83 with good mental health and 40 with poor mental health. The two health groups differed significantly on age ($p=0.03$) and gender ($p=0.001$), variables inserted as covariates in the repeated measure ANOVA: the mean age of the good health group was 50 years compared to a mean age of 44 in the poor health group; the good health group comprised 25% males and 75% females, the poor health group had a more even gender balance comprising 55% males and 45% females. Participants in good mental health were recruited from existing walking groups in the central belt of Scotland. Participants in poor mental health were recruited via specialist mental health service providers facilitating walking programmes in the same locations. All participants were self-selected to the walk, but it proved more difficult to recruit adults with mental health problems, hence the lower sample size in this study. The individual mental health problem of a subject remained confidential; appropriate subjects for the study were identified by facilitators who aimed to recruit to the study participants experiencing either stress or depression. Based upon the conceptualization of mental health as a coping spectrum (identified in the introduction) a key criterion was simply the ability to take part (i.e. understand the aims and objectives of the study, commit to walking on a particular date and complete a pre and post questionnaire unaided). Signed consent to take part in the study was a requirement for all participants, and, in addition, where participants were National Health Service (NHS) recommended, additional ethical approval was applied for via the Central Office for Research Ethics Committees (COREC).

2.1.2. Measures

Mood was measured using a shortened version of the University of Wales Institute of Science and Technology (UWIST) Mood Adjective Checklist (MACL) (Mathews et al., 1990; Schultheiss and Brunstein, 1999) to measure participants' hedonic tone, energy and stress (tense arousal (TA)). Hedonic tone measures a person's affective state (degree of happiness and sadness).

Reflection was measured using a 5-item personal project scale outlined in the Introduction measuring three core cognitive dimensions of project planning (challenge, efficacy and control) and two core affective dimensions: enjoyment and stress. Self-esteem was measured using a shortened version of the Rosenberg Self-Esteem scale (Rosenberg, 1989; House, 1986; Schnittker, 2001). It was incorporated as an additional well-being scale and because it is a well-used measure within this research context (Peacock et al., 2007; Pretty et al., 2005). All three scales are validated instruments with known test-retest reliability. The instruments were rated by participants on a scale ranging from 1 to 4 (from 1 = *definitely* to 4 = *definitely not*). The maximum score for any mood variable (energy, hedonic tone, stress) is 16, the maximum for self-esteem is 24 and the maximum for any project scale (enjoyment, control, stress, efficacy, challenge) is 8; the lowest score on any variable is 0. A lower score in stress (mood scale) and stress and challenge (project scale) is advantageous; a higher score on all other variables is advantageous.

2.1.3. Procedure

The data were gathered in Spring 2007. Participants completed a questionnaire in the field immediately before taking part in an one-hour, guided, group walk in a rural setting. Participants were taken by mini-bus to the location. Immediately after the walk, participants repeated the questionnaire, also in the field.

Owing to methodological and practical limitations in carrying out this research with large participant numbers, the data were collected in several phases; the two health groups walked separately in groups of around 10, at the same time of year, and in similar rural settings. The walk route was decided upon by the facilitator with an understanding of our research aims and objectives. The rural walk in this study was of one-hour duration, designed for all abilities (i.e. not strenuous) and across similar terrain (woods and open countryside) in the central belt of Scotland. Some subjects were familiar with the walk route; others not. We could not stipulate, nor had the resources, to specify a route unknown to all subjects. The weather, on all walk days, was fine, with no significant variance (rain for example). The data was combined in one data set using Non Equivalent Group Design (NEGD).

2.2. Results

2.2.1. Pre-walk situation

Before the walk took place the participants were asked to complete a questionnaire which covered a number of demographic variables, in addition to the mood and personal project related scales. A summary of the two health groups emotional and cognitive scale results before walking is shown in Fig. 1a and b.

There is clear evidence that the two health groups had very different emotional and cognitive scores on the tests prior to walking. The good health group scored higher on all mood, self-esteem and project scales and lower on stress variables prior to walking than the poor health group. The groups were most similar on the stress dimension of their personal projects. Some of these differences were statistically significant as confirmed by a series of Mann-Whitney *U*-tests as shown in Table 1. Direct norms for emotional state scale comparison are unavailable and any existing data is problematic because it differs for the shorter scale in context, age and nationality. What limited data does exist suggests our good health group is slightly higher in mood and lower in stress.

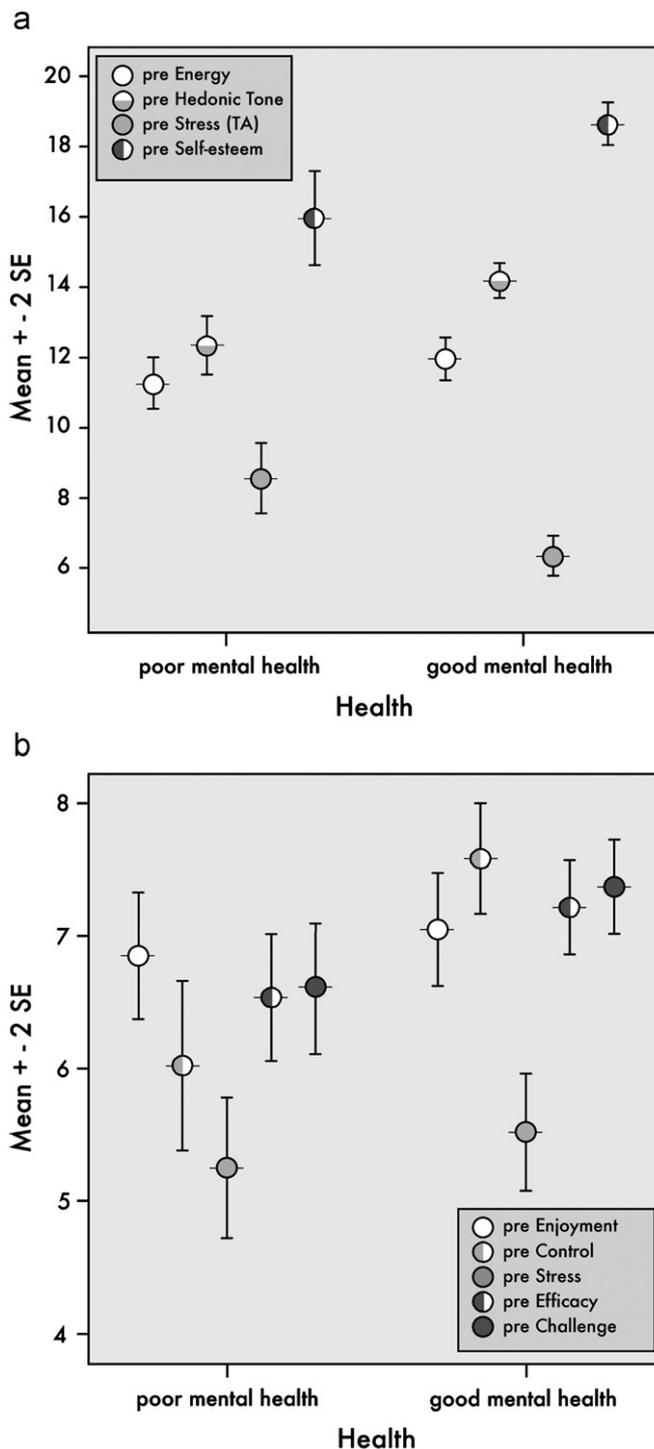


Fig. 1. (a) Descriptive statistics for measures of mood in the poor and good mental health groups before the walk. Note: the range of possible scores on mood (energy, hedonic tone and stress) is 0–16 and on self-esteem 0–24. A low stress score is advantageous; on all other variables a high score is advantageous (b) Descriptive statistics for project scales for poor and good mental health groups before walking. Note: the range of possible scores on project dimensions is 0–8; a low stress score is advantageous; on all other variables a high score is advantageous.

2.2.2. Descriptive summary of walking in a rural setting

Outcomes are shown in Fig. 2 for changes to emotional scales and in Fig. 3 for changes to project data. The vertical axis in the figure is a measure of change or difference in pre minus post walk. For all emotional variables across both health groups there was

Table 1
Pre-walk differences (Mann–Whitney *U*) between health groups, study 1, *n* = 123.

Demographic	
Age	<i>p</i> < 0.05
Gender	<i>p</i> < 0.01
Mood scales	
Energy	ns
Hedonic tone	<i>p</i> < 0.001
Stress	<i>p</i> < 0.001
Self-esteem	<i>p</i> < 0.001
Projects	
Enjoyment	ns
Control	<i>p</i> < 0.001
Stress	ns
Efficacy	<i>p</i> < 0.05
Challenge	<i>p</i> < 0.05

ns, non-significant outcome.

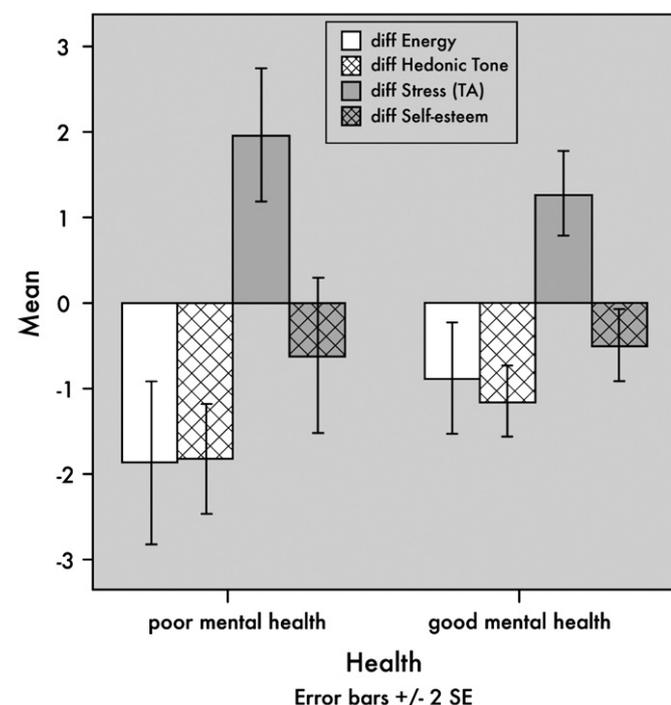


Fig. 2. Differences in pre–post change on emotional scales in poor and good mental health groups. Note: a bar above the line denotes positive change in stress, and below the line denotes positive change in all other variables.

evidence for an improvement in emotional state following walking. (Note that the improvement from a reduction in stress corresponds to a bar above the horizontal line.) The vertical lines in the figure indicate 2 standard errors about the mean (95% confidence intervals) and give an approximate measure of significance for those lines which do not cross the horizontal zero line. It is apparent that with the exception of ‘self-esteem’ in the poor mental health group all changes in emotional state are significant.

In Fig. 3 the similar measure of change in project thinking is shown. In this case, a reduction in both stress and challenge (i.e. a bar above the horizontal line) indicates an improvement. Here the trend is similar for both groups with the exception of ‘challenge’, in which there is a significant opposite influence between groups as shown in Fig. 3. For the good mental health group (pre–post) challenge is positive whereas for the poor mental health group it is negative. In addition, inspection of the standard error bars shows that in Fig. 2 (emotional scales), 7 out of 8 changes due to walking

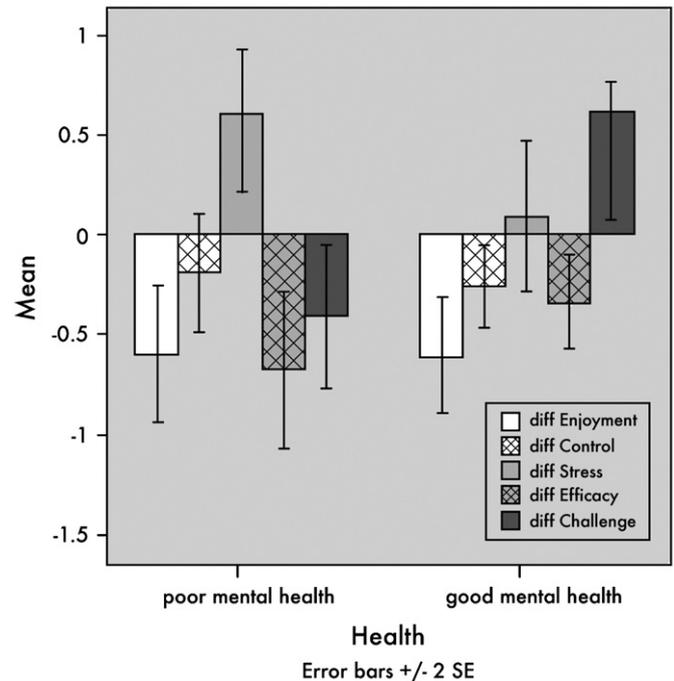


Fig. 3. Difference between pre–post change on personal project scales in poor and good mental health groups. Note: a bar above the line denotes positive change in stress and challenge, and below the line denotes positive change in all other variables.

are significant, whereas in Fig. 3 (project scales), 8 out of 10 measures are significant.

It is noticeable in Fig. 2 that the difference between pre and post walk mood scales is greater for the poor mental health group than for the good mental health group for all 4 scales. This is less marked in Fig. 3 for the personal project scales where only 3 of the 5 scales show the same trend. Nonetheless, while not all are independent measures, 7 out of 9 scales are in this direction. This gives some indicative support to the idea that the poor mental health group, through its different pre walk starting point, may have more opportunity for change.

2.2.3. Repeated measures analysis of variance (ANOVA) for between group differences

Before carrying out the ANOVAs the data structure of all 9 measured variables was simplified using principal axis factoring with varimax rotation. For the pre walk data, the determinant was not significant (0.07); Bartlett's test of sphericity was significant and the Kaiser–Meyer–Olkin measure of sampling adequacy was acceptable at 0.7. 52% of non-redundant residuals had values greater than 0.05 which is at the borderline of acceptability. Three factors were extracted meeting the conventional eigen criterion of 1.0 and accounting for 66% of the variance in the data. High loadings on each factor were:

- Factor 1 hedonic tone (0.87) and stress (–0.84) (note, negatively related)
- Factor 2 efficacy (0.80) and control (0.72)
- Factor 3 challenge (0.86) and project related stress (0.84)

For the post walk data the determinant was 0.07; Bartlett's test of sphericity was significant and Kaiser–Meyer–Olkin sampling adequacy was 0.63. 51% of non-redundant residuals had values greater than 0.05. Three factors were extracted at an eigen criterion = 1.0

accounting for 65% of the variance in the data. The structure of the post walk data had the same loadings as the pre walk data:

- Factor 1 hedonic tone (0.85) and stress (−0.91)
- Factor 2 efficacy (0.87) and control (0.73)
- Factor 3 challenge (0.82) and project stress (0.83)

As a consequence the three variables chosen for the repeat ANOVAs were the variables with highest pre walk loadings, i.e. hedonic tone, efficacy, and challenge. Each of these variables had no more than 0.2 loading on any other factor ensuring both independence in subsequent anovas and relative simplicity in meaning. In addition the stress variable was included because of its central role in health related studies of this kind. Since the two groups showed significant differences on age and gender, these variables were included as covariates in the ANOVA. Results involving age and gender are only reported if they show a significant effect on the main variables under study.

In summary, the chosen measures (with the exception of hedonic tone and stress) are independent of each other because of varimax rotation, and a separate ANOVA is calculated for each. In the analysis of study 1 a mixed design is used with 2 levels of the repeated variable and a Bonferroni correction applied to the post hoc tests.

In reporting results we flag, firstly, any main effect of the walk on a factor variable (i.e. showing a significant change on a variable during the walk) and, secondly, any interaction effect between health group and the walk (i.e. whether a variable changed to a different degree in the poor versus good health group during the course of the walk). Levene's test results for heterogeneity of variance are reported for each variable. Where this test was significant specific contrasts were checked (and confirmed) by non-parametric tests.

2.2.3.1. Hedonic tone. Multivariate analysis and tests of within subject contrasts showed a significant main effect of the walk on hedonic tone: $F=18.3$, $df=1,108$, $p<0.001$, partial eta squared (η^2)=0.15. There was no interaction effect of health and walk; hedonic tone increased in both groups but the change from the walk was greater in the poor health group ($F=9.4$, $p=0.003$) as shown by greater vertical change in the bar in Fig. 2. Levene's test was significant for pre walk data at 0.05 and post walk data at 0.01.

2.2.3.2. Efficacy. very similar results were obtained for efficacy with multivariate and within subject contrast showing a main effect of the walk on efficacy of projects: $F=8.5$, $df=1,102$, $p=0.004$, partial $\eta^2=0.08$. There was no interaction effect of health and walk; efficacy in relation to project goals improved in both groups although the change from the walk was greater in the poor health group ($F=4.9$, $p=0.02$) and shown in Fig. 3. Levene's test was not significant for pre walk data but was significant at 0.05 for post walk data.

2.2.3.3. Stress. A significant main effect of the walk on stress was found with lower scores after the walk: $F=9.7$, $df=1,107$, $p=0.002$, partial $\eta^2=0.08$. There was no interaction effect of health and walk; both health groups benefited but again the change from the walk was greater in the poor health group ($F=12.4$, $p=0.001$, see Fig. 2) where an improvement from a reduction in stress corresponds to a bar above the horizontal line. Levene's test was not significant for pre walk data but significant at 0.01 for post walk data.

2.2.3.4. Challenge. The multivariate analysis showed no main effect on the challenge dimension from the walk but a significant health and walk interaction indicating the health groups behaved

differently on this variable ($F=6.5$, $df=1,102$, $p=0.012$, partial $\eta^2=0.06$). Fig. 3 shows that the perceived challenge of projects increased in the poor health group and decreased in the good mental health group (an improvement from a reduction in challenge corresponds to a bar above the horizontal line). Levene's test was not significant for pre walk data but was significant at 0.05 for post walk data.

In addition there was a marginal age effect on stress ($F=4.0$, $p=0.049$) and an age interaction effect on hedonic tone ($F=4$, $p=0.047$). Stress and hedonic tone are highly negatively correlated with the younger group being more susceptible to change than the older.

In summary, the analysis across the 4 selected measures showed a main effect for walking in all variables, except challenge, for which there was a significant walk \times health interaction effect. Figs. 2 and 3 show the extent of positive change was greatest in the poor mental health group on a number of variables, including efficacy, stress and hedonic tone.

3. Study 2: restorative outcomes of rural versus urban settings in adults with good and poor mental health

This study aimed to explore differences in restorative outcomes between two mental health groups in two different settings, urban vs. rural. Firstly, we hypothesised that a walk in a rural setting would result in greater positive shift in mood and in mindset to personal projects than a walk in an urban setting. Secondly, we hypothesised that this effect would be greater for the poor mental health group.

3.1. Method

3.1.1. Subjects

A total of 24 participants took part comprising 11 adults with good mental health and 13 adults with poor mental health. There were no significant differences between health groups on age or gender; mean age for the good health group was 46 and for the poor mental health group was 35. The good health group comprised 36% males and 64% female, the poor health group, 58% male and 42% female. The two health groups were established specifically for the purpose of this study with recruitment facilitated by Stirlingshire's physical activity development organisation, Active Stirling, in conjunction with a training centre for people with mental health problems.

3.1.2. Measures

The UWIST MACL, self-esteem, and personal project scales were used as in study 1.

3.1.3. Procedure

Participants completed a questionnaire in the field immediately before and after an one-hour guided, group walk in a rural setting, followed one-week later by an one-hour guided, group walk in an urban setting. The rural walk took place in Pleun Country Park, Stirlingshire (Fig. 4); the urban walk was a one-hour walk in Stirling town centre with some greenery (street trees) and some historic interest (see Fig. 5). Neither of the walks was strenuous and both took place on similar (mostly flat) terrain. The data collection was carried out in Spring 2007 over two consecutive weeks with similar weather conditions (fair, no rain) on each occasion.¹ As in study 1, the two health groups walked on separate occasions and signed

¹ Owing to heavy rain on one walk, one sample of data was excluded from the analysis.



Fig. 4. Rural walk.



Fig. 5. Urban walk.

consent was a requirement to take part. Participants travelled by car to the start point for each walk and participants in each group participated on the same occasion in each environment (where a participant walked in one setting only, the data was excluded from the study).

3.2. Results

3.2.1. Pre-walk situation

Since this is a small study, we applied the same factor structure as study 1 and here report findings for the core variables from the factor structure: hedonic tone, stress, efficacy and challenge. A summary of the pre walk means before walking in either settings is illustrated in Fig. 6a (urban setting) and b (rural setting). These show significant differences between groups in the urban setting pre walk on three variables (hedonic tone, stress and efficacy), but not in the rural setting. This is confirmed by Mann–Whitney *U*-tests and these are reported in Table 2. Although the difference was not significant, the pre-walk means in the poor mental health group were still lower than the good health group pre walk in the rural setting. We could speculate the rural setting was already having a positive effect on mood in the poor mental health group

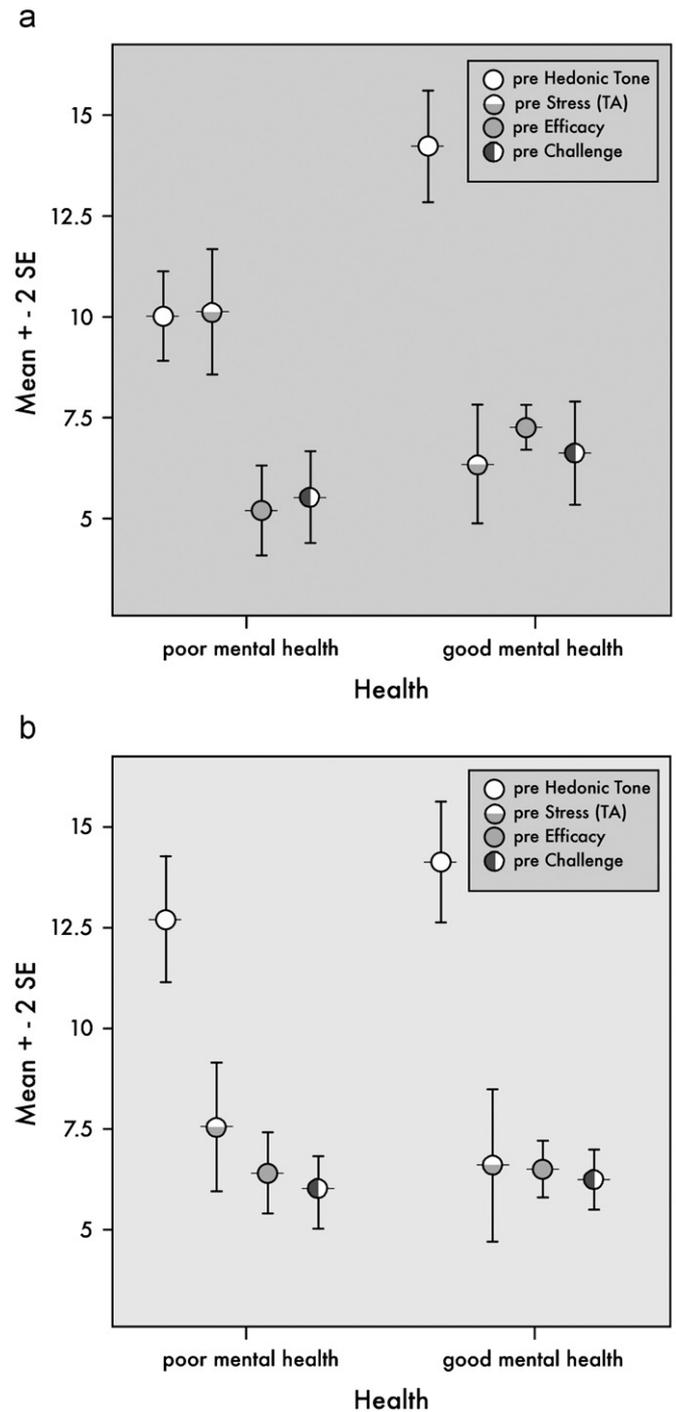


Fig. 6. Descriptive statistics for measures of mood and project scales in both health groups: (a) before walking in an urban setting. Note: the range of possible scores on mood (hedonic tone and stress) is 0–16 and on project dimensions (efficacy and challenge) is 0–8. A lower stress score is advantageous. on all other variables a higher score is advantageous and (b) before walking in a rural setting. Note: the range of possible scores on mood (hedonic tone and stress) is 0–16 and on project dimensions (efficacy and challenge) is 0–8. A lower stress score is advantageous; on all other variables a higher score is advantageous.

since the pre-walk questionnaire was administered in the car park of a rural setting prior to the walk. Anticipation of the walk in this setting may also have positively affected pre walk mood scores in this health group to bring them closer in range to the good health group.

Table 2
Pre-walk differences (Mann–Whitney *U*) between health groups, study 2, *n*=24.

	Urban	Rural
Demographic		
Age	ns	$p < 0.05$ on hedonic tone only
Gender	ns	$p < 0.05$ on challenge only
Mood scales		
Hedonic tone	$p < 0.01$	ns
Stress	$p < 0.01$	ns
Projects		
Efficacy	$p < 0.01$	ns
Challenge	ns	ns

ns, non-significant outcome.

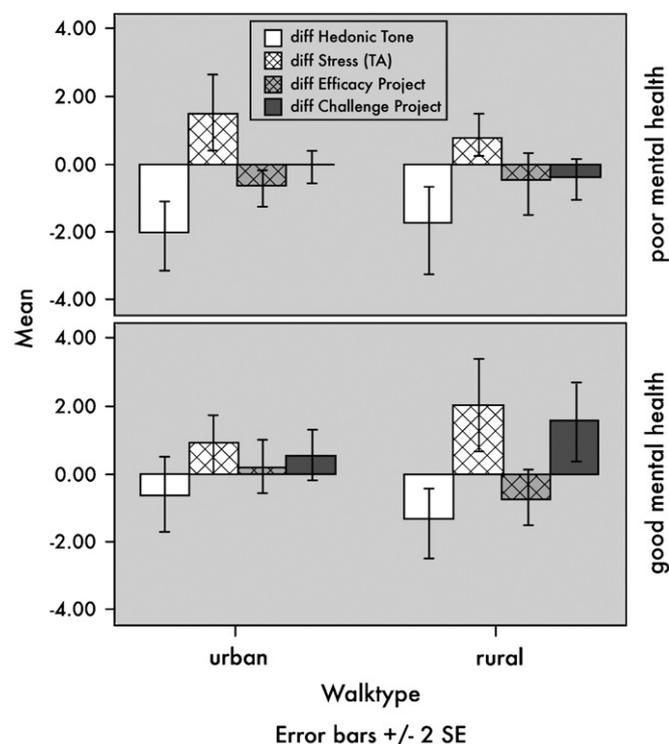


Fig. 7. Walking in urban vs. rural settings: differences in pre–post change by health group on key variables. Note: a bar above the line denotes positive change in stress and challenge; a bar below the line denotes positive change in all other variables.

3.2.2. Descriptive summary of walking in a rural versus urban setting by health group

Outcomes by setting are shown in Fig. 7 for the four key factor variables. As before, the vertical axis in the figure is a measure of change or difference in pre minus post walk scores. For all variables, error bars (95% confidence intervals) in the figures provide an approximate measure of significance for those lines which do not cross the horizontal zero line. The pattern shows stronger indications of positive change in the poor mental health group from walking in an urban setting, i.e. on stress, hedonic tone and efficacy. In the rural setting, the patterns between health groups are similar, with positive change in stress, hedonic tone and efficacy but, as in study 1, the groups differ on challenge, and the pattern is the same (an increase in challenge in the poor mental health group). Inspection of the standard error bars show that 4 out of 8 changes from walking in an urban setting were significant, and 5 out of 8 measures were significant from walking in a rural setting.

3.2.3. Repeated measures ANOVAs for setting and between group differences

In study 2 a mixed analysis of variance design was also used but in this case there were two repeated measures—one for the difference between pre and post walk scores, and one for the urban and the rural environment. The between group measure was health. The measures related to the stable factors in study 1 were used for analysis—i.e. hedonic tone and stress, efficacy and challenge. Homogeneity of variance was not assumed and the Games–Howell test was applied to all contrasts. As in study 1, age and gender were entered as covariates in the analysis but showed no modification on effects of the environment.

3.3. Hedonic tone

Results showed significant main effects for environment ($F(1,17)=5.885, p=0.027, \text{partial } \eta^2=0.26$) and for pre–post walk ($F(1,17)=29.173, p < 0.001, \text{partial } \eta^2=0.63$) measures. There were no significant differences for between subject nor were there any significant interaction effects in the data. Levene's test for homogeneity of variance was not significant pre walk but was significant post walk.

3.4. Stress

Very similar results were obtained for stress with multivariate and within subject contrasts showing main effects for the environment ($F(1,17)=5.702, p=0.028, ES=0.25$) and for pre to post walk ($F(1,17)=19.802, p < 0.001, \text{partial } \eta^2=0.54$). There were no significant differences between subjects nor significant interaction effects.

3.5. Efficacy

The multivariate analysis showed no significant differences. Nonetheless it is worth noting that this variable had 6 missing values.² Nonetheless the health effect; the pre–post walk effect; the environment and health interaction; and the walk and health interaction were all around $p=0.07$

3.6. Challenge

Multivariate analysis showed a significant difference for pre–post walk ($F(1,14)=4.756, p=0.047, \text{partial } \eta^2=0.25$), and a significant interaction effect between pre–post walk and health ($F(1,14)=6.707, p=0.021, \text{partial } \eta^2=0.32$). This shows challenge is clearly operating differently between health groups. It is again worth noting that challenge had 4 missing values. The significance values for environment, health, and health–environment interaction were all around $p=0.051$ with the environment effect $F=4.5, p=0.051$ and partial $\eta^2=0.25$.

To summarise, the analysis across the 4 selected measures showed a main effect of setting and walk (pre–post) on hedonic tone and stress (with marginal results in efficacy); this shows that the setting and the walk individually were having an effect on outcomes for each of these variables. There was a walk \times health interaction effect in challenge, which shows outcomes between health groups were variable across the walks. The error bars in Fig. 7 show outcomes changed significantly in 3 out of the 8 measures in the good health group, but only from the rural walk. By contrast, walking in both rural and urban settings produced

² Missing values were concentrated in the poor health group. Whilst we are aware of methods for dealing with missing values (e.g. inserting means for these cases to reclaim them for the analyses) we did not adjust the data in this instance.

significant outcomes in the poor health group, on 5 out of 8 measures. With the exception of challenge, these were all in a positive direction. As with study 1, the amount of change in hedonic tone and stress was greater in the poor health group in both settings. These results suggest restoration operates differently according to context and mental health condition.

3.7. General discussion

Results from study 1 support the hypothesis that a walk in a rural setting will result in positive change in mood and in mindset in relation to personal projects. We found consistent significant ($p < 0.05$) positive change from the walk across both health groups on the mood variables (energy, hedonic tone and stress) and in 4 of the project scales (enjoyment, control, stress and efficacy). Secondly, results from study 1 support the hypothesis that a walk in this context would be more advantageous to the poor mental health group; this was supported by results for hedonic tone, efficacy and stress.

Results from study 2 partially support the hypothesis that a walk in a rural setting is more advantageous to mood and in mindset to personal projects than a walk in an urban setting. Outcomes in the good health group were as expected with significant positive change to mood from the rural walk and, by contrast, no significant positive change from the urban walk. Contrary to our hypothesis, both an urban and rural walk produced significant positive change in the poor health group across a series of mood and mindset variables and this result is discussed further below. Secondly, in relation to study 2, we hypothesised the effect of the rural walk would result in greater positive change in the poor mental health group. This was supported by results for stress and hedonic tone.

Taken together, these two studies demonstrate the value of nature to promote restoration, irrespective of mental health state. A key finding was the ability of a rural walk to positively improve reflection on project planning, suggesting natural settings could potentially impact upon personal development in terms of goal implementation and manageability, but further research is needed to test this proposition.

Several interesting results were found. Firstly, across two studies, the rural walk promoted restoration at a greater amount of change in the poor mental health group. This supports findings by Korpela et al. (2008) and Ottosson and Grahn (2008) suggesting nature may have more impact on restoration in people experiencing greater emotional stress. This has important implications for developing recreational and health policy in mental health contexts, suggesting access to nature has a potential role to play in rehabilitation.

Secondly, differential outcomes were found between health groups in the urban setting (study 2). Healthy adults behaved as expected: the town walk did not promote restoration on any variable. The poor health group did not behave as expected: a town walk was advantageous to emotional restoration and reflection. This is contrary to Ellett et al.'s (2008) findings showing the detrimental effect of an urban environment (London shopping street) on anxiety and negative beliefs about others in people with diagnosed psychotic disorders. Our finding here is interesting, suggesting urban environments can be restorative in certain subsections of the population and, further, raises some questions. Firstly, was the built environment of more intrinsic interest to the poor mental health group, thereby promoting involuntary fascination, and if so, why were results only significant in this health group? Recently, it is reported that historic environments have restorative potential in healthy adults (Troffa and Fornara, 2008); the walk in Stirling comprised some elements of historic fascination but the restorative effect was only found in adults with mental health problems. Secondly, does this result have something to do

with facilitating a connection to the physical and social world in this health group? Poor mental health subjects report being physically dislocated from reality (Roe, 2008). It is possible, therefore, that any engagement with an external and intrinsically 'fascinating' context (urban or natural) would bring about positive change. Another possible explanation is the importance of the social context of the walk. Poor mental health participants also report extreme social isolation (Roe, 2008) and it is therefore possible, simply getting out walking in any context as a group outweighed any advantage of setting. This suggests a further study in which walking alone vs. walking as a group is compared in different settings with differing degrees of urbanity.

Thirdly, changes in self-esteem were mostly non-significant. Only the rural walk promoted positive change in self-esteem ($p < 0.05$) in the good mental health group. This confirms findings elsewhere (Pretty et al., 2005). However, neither a rural nor urban walk promoted positive change in self-esteem in the poor health group, contrary to Peacock et al.'s (2007) findings. This study suggests changing self-esteem in this sub-group is more difficult than bringing about short-term recovery in mood and cognitive thinking, i.e. it requires longer-term strategies. Since self-esteem is built by social interaction and defined by relationships to others, it is possible the walk facilitated greater increases in self-esteem in the good health group, possibly because they felt more at ease in conversation with other walkers in the group. This suggests a study exploring the social context of walking, as suggested above, in the two health groups.

Fourthly, one aspect of cognitive reflection was found to operate differently between mental health groups. Across a series of tests, the challenge variable repeatedly discriminated between health groups. In the good mental health group, a rural walk (study 1) was advantageous to the challenge dimension of projects (i.e. it reduced post walk), in the poor mental health group the challenge dimension of projects increased post walk. Interpretation of these results is complex. Within the personal project framework, challenge is associated with stress, and in our analysis, these two dimensions factored together. Since results showed positive change in stress from a rural walk, we would expect the challenge of project planning to also move in a positive direction, but it did not in the poor mental health group. We could speculate that challenge may feedback into inadequacies of self-esteem in this group (supported by the notion that self-esteem, similarly, did not shift in a positive direction). Contextual factors may also account for results, i.e. the context of the rural walk is so unusual that it bears no relevance to the everyday context of people with mental illness, and cannot therefore promote positive feedback. A stronger fear of failure in people with mental illness may also account for the differences, i.e. the additional challenge of daily tasks post walk is because they fear failure (further feedback for them on inadequacy and self-esteem).

Alternatively, we could speculate that feeling more challenged by project planning after the experience is a positive outcome in the poor mental health group. This interpretation draws on positive conceptualisations of challenge as something that can help build personal resources (Patmore, 2006; Lazarus et al., 1980) and strong positive affect (Csikszentmihályi, 1990). As already noted, mental health patients report being disconnected from reality and sometimes lack insight into the challenges of life. Exposure to the walk and then feeling challenged may have awakened them to the challenge of everyday life, i.e. it is part of the process of re-connecting with reality. Clearly, it is important that restorative outcomes are considered within the context of the specific needs and behaviour patterns of particular sub-groups.

Theoretically, we were interested in the relationship between mood and coping resources, using personal projects as a means of exploring reflection on life-tasks. Our results reflect Kuo's findings

(2001) which showed a relationship between living in high green space residential areas and better manageability of personal projects amongst subjects. Kuo showed an association between the attention restoration properties of green space and reflection of personal projects. Whilst we cannot support this association, our results do lend support to Fredrickson's theoretical hypothesis (2004) suggesting positive emotion improves cognitive thinking (or mindset) in an upward spiral, each influencing the other reciprocally. In our study improved mood was accompanied by a reduction in stress, and improved manageability (control) and mastery (efficacy) of life-tasks. Our project scales factored exactly as we expected based on other factor studies: stress and hedonic tone (emotional scales) were negatively factored, project control factored with efficacy (cognitive dimensions), and project stress factored with project challenge (a cognitive and affective scale). Our subjects reported their projects were more enjoyable, more attainable, less stressful and more controllable after a walk in a rural setting. Since these indicators are all correlates of well-being (Little, 2007), we could conclude that being active in natural environments can help support, at least in the short-term, improved project thinking, and by association, improved well-being.

4. Limitations

The study of two mental health groups walking in different settings (urban vs. rural) was in a small sample only and requires replication in a larger sample of the population. Our definition of poor and good mental health (based on having – or not having – a clinically diagnosed mental health problem) has limitations since mental health is increasingly being defined in the UK across a coping spectrum (see Section 1.2). Paradoxically therefore, the 'healthy' sample in this study may have included some individuals less happy, less able to cope or less engaged in society than the 'unhealthy' group (i.e. with a clinically diagnosed mental health problem) coping comparatively well on treatment therapies/medication. However, until other categories of mental health definition are developed by the NHS, splitting samples based on specific clinical diagnoses seems most appropriate.

Recruitment in the poor health group was problematic; a far larger number of participants signed up for the research than actually took part and motivation to take part in the study 2 (where two walks were required) was problematic. However, a strength of the study is that it was carried out in real-life contexts, in hard-to-reach and under-researched sub-groups of the population. This context, however, poses problems in developing future research including the difficulty of recruiting sufficient adults with similar mental health problems to facilitate randomized trials. Research in this field therefore imposes methodological and practical problems. The evidence base is therefore likely to grow slowly, using small participant numbers, as in this study. This need not be a barrier, providing replication in methodology and comparable results can be achieved.

As with all quasi-experimental research, there is difficulty in controlling for the many confounding variables present in external settings. With respect to environmental variables, we controlled for the weather as best we could (see Section 1.3). The social context was partly controlled for by using the same group configurations in each setting, but attributing causal inference to one particular environmental attribute is not possible. Was the effect owing to the intrinsic fascination of the context? In the urban context, was the effect owing to elements of 'soft' (green) or 'hard' (built) fascination, or a combination of both? The urban walk in Stirling used in this study contained examples of both. This could be better controlled for in future by selecting locations with varying degrees

of urbanity. Another possible confounding variable is prior experience and knowledge of the walk setting. Some of our subjects were familiar with our locations, others were not. We did not have the resources to physically set our study in a far-removed context from everyday life. It is therefore possible that prior experience and memories could have influenced outcomes. This could be explored in future research by requesting information from participants on prior knowledge and experience of a location.

A further possible limitation of our research is that we did not experimentally manipulate the potential for restoration in either of our two health groups pre-test by the application of stressors. People came to the walk on a particular day in as natural state as possible. However, we thought it likely that the poor mental health group already suffered from some depleted resources affecting coping ability and we did not wish to impose further stressors on this group. The fact significant change took place suggests the potential for restoration already existed pre walk in both groups. However, it's important to bear in mind that not all positive change can be appropriately considered as 'restoration'; any change in a variable must be considered in light of the initial levels. The fact that pre-walk scores were higher on stress and lower on hedonic tone, for example, than post-walk scores in our two health groups suggests there was a potential for restoration.

It is clear from the literature that restoration takes on many forms: affective, cognitive (in terms of both reflection and attentional restoration) and physiological and that the interactions are complex. The trend to date has been to focus on attention restoration (Kaplan and Kaplan, 1989) but there is no clear consensus amongst researchers as to whether attention restoration precedes, or is indeed even necessary, for reflection. Kuo (2001) did find a link whereas Staats et al. (2003) found that people evaluated reflection less positively when assuming a condition of attentional fatigue. However, they explain that this is consistent with the idea that attentional recovery must take place before reflection can occur. A further limitation of our research, therefore, is in attributing the changes found here to attentional capacity. We might have included a measure of attention restoration in our dependent variables, however, given the quasi-experimental nature of this research and the limited cognitive abilities of some of the subjects, administering additional scales was not considered practical. Using the theoretical framework of Fredrickson (2004) we were interested in the link between affective restoration and reflection but future research might explore reflection within the context of ART.

5. Policy implications

It is known that exercise can help treat depression (Donaghy, 2007) and increasingly doctors in the UK are prescribing exercise for patients with mild to moderate depression (Mental Health Foundation, 2008). However, there is little evidence to guide doctors on what types of locations might maximize the mental health benefits of exercise. The study indicates that walking in green spaces is beneficial to mood in healthy adults, and extends that research by showing it is more advantageous over exercise in built settings.

This study also shows that a town walk can be restorative in adults with poor mental health but, since this was small sample, further research is needed to confirm these findings. This is an important area of research to develop, since getting mental health patients to walk locally in their urban environment is an essential component of community rehabilitation and potentially easier to facilitate than trips out-of-town. However, since this study has also indicated a rural walk can promote restoration at a greater amount of change in people with mental health problems, it is important policy also facilitates rural walking further a-field.

6. Conclusions

Firstly, we have shown that brief interactions with nature can positively improve mood and reflection on project planning, potentially impacting on personal development and coping resources. Secondly, we have shown that whilst these benefits are advantageous in adults with good and poor mental health, the restorative experience from walking in rural settings is potentially greater in adults with poor mental health. Thirdly, we have shown the potential of an urban walk to promote restoration in adults with poor mental health and have speculated that the social context may partly explain this relationship. Overall, the paper suggests people's potential for restoration varies and that this extends to different settings.

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