Investigating the Effects of Conscientiousness on Daily Stress, Affect and Physical Symptom

Processes: A Daily Diary Study

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Abstract

Objectives: Higher conscientiousness (C) predicts better health outcomes. Recent research suggests stress may play an important role in explaining this relationship. The current study aimed to establish whether C moderates the relationship between daily hassle appraisals, daily affect and physical symptoms.

Design and Methods: A daily diary design was used, where participants (N=103) completed a baseline measure of C followed by a 14-day daily diary, providing daily details of hassles (primary & secondary appraisals) experienced as well as positive and negative affect and physical symptoms.

Results: Hierarchical linear modelling revealed that Total C (as well as two facets of C: Order and Industriousness) moderated the relationship between stress appraisals and positive affect. Specifically, the negative association between the daily appraisal of hassles as stressful (i.e., where perceived demands outweighed perceived resources) and positive affect was stronger for lower and average levels of C, Order and Industriousness. No significant moderated effects were found for negative affect or physical symptoms. The Order facet was found to be an important factor predicting attrition.

Conclusions: The current study provided evidence that C and two of its facets can moderate the relationship between hassle appraisal and positive affect. C may exert part of its influence on health by modifying the effects of daily stressors.

Keywords: Stress, Hassles, Personality, Affect, Daily Diaries, Multi-level modelling, Attrition

INTRODUCTION

Conscientiousness (C) is characterised by a propensity to follow socially prescribed norms, control impulses, delay gratification, be planful, and to be both task- and goal-directed (John & Srivastava, 1999). The evidence for a positive relationship between C and longevity is accumulating (Bogg & Roberts, 2004; Friedman et al., 1993; Hagger-Johnson et al., 2012; Hampson, Goldberg, Vogt, & Dubanoski, 2006; Kern & Friedman, 2008; Roberts & Bogg, 2004; Takahashi, Roberts & Hoshino, 2012). For example, data from the Terman Life Cycle Study have shown that people high in C have a significantly reduced risk of dying in any given year (Friedman et al., 1993). C has also been found to be associated with better health status (Goodwin & Friedman, 2006), greater adherence to medication (Molloy, O'Carroll & Ferguson, in press) and lower obesity risk across populations (Jokela et al., 2013a). Most recently, in the largest study of its kind, C has been shown to be the only higher-order personality trait to be related to mortality risk across populations (Jokela et al., 2013b). The role of health behaviours in this relationship has been studied (Bogg & Roberts, 2013; Roberts, Walton, & Bogg, 2005b); however, evidence suggests that health behaviours only partially account for the relationship with longevity (Friedman et al., 1995a; Hagger-Johnson et al., 2012). Ferguson (2013a) has proposed a theoretical model for the role of personality in the illness process and identified six routes through which personality can have an influence on health (see also Bogg & Roberts, 2013 with a specific emphasis on C and the health process). One is via the stress process - the focus of this study – the prediction being that the effects of stress are more damaging for lower C individuals compared to higher C individuals (Ferguson, 2013a; O'Connor, Conner, Jones, McMillan, & Ferguson, 2009; O'Connor & O'Connor, 2004; Penley & Tomaka, 2002).

The negative impact of stress on health and well-being has received a lot of research attention, providing evidence that it is detrimental to the immune system (Segerstrom & Miller, 2004) and can influence the development of disease (Cohen et al., 1998). In addition, the health benefits of positive affect are being established (Chida & Steptoe, 2008; Howell, Kern, & Lyubomirsky, 2007; Steptoe, Dockray, & Wardle, 2009), and evidence to suggest that C may be positively related to positive affect is emerging (Besser & Shackelford, 2007; Nater, Hoppmann, & Klumb, 2010; Zellars, Perrewe, Hochwarter & Anderson, 2006). Therefore, it is possible that C could exert its protective

effect through either the experience of fewer negative health outcomes or the experience of more positive health outcomes.

Research into the factor structure of C provides evidence for six lower order facets: Order, Virtue, Traditionalism, Self-control, Responsibility, and Industriousness (Roberts, Chernyshenko, Stark, & Goldberg, 2005a). The latest work has emphasised the importance of examining facet effects in the study of C (see Roberts, Lejuez, Krueger, Richards & Hill, in press). Responsibility, Self-control, Self-discipline (strongly related to Self-control), and Order have been identified as important positive predictors of health behaviours, and Self-discipline has been shown to be associated with reporting of fewer daily hassles per day over a 4-week study (Bogg & Roberts, 2004; O'Connor et al., 2009) and lower mortality in the elderly (Weiss & Costa, 2005). Different facets have also been shown to have differential associations with stress appraisals (and will be discussed in detail below), thereby emphasising the importance of studying facets (Gartland, O'Connor & Lawton, 2012).

O'Connor et al. (2009) employed a daily diary design in a study of the moderating role of C in the daily stress-health behaviour pathway. High C was found to be associated with more adaptive health behaviours in response to daily hassles. Moreover, these findings were consistent with a stress buffering hypothesis and suggested that (aspects of) C may exert part of its positive influence on health by modifying the effects of daily stressors, such that conscientious individuals respond to stress by engaging in more health-enhancing behaviours. The study also observed a direct effect of C on daily hassles, such that higher levels of the Self-discipline facet of C were associated with the experience of fewer overall daily hassles. Though the impact on long-term health remains to be seen, it can be concluded that C may exert protective influences through these direct and moderated pathways. However, this research is still limited to the investigation of health behaviours, which have been shown to provide an incomplete explanation for the influence of C on health and longevity (Friedman et al., 1995a; Friedman et al., 1995b). The current study aimed to explore the moderation effect further, by looking at the extent to which C has the capacity to moderate the relationships between daily hassles and daily positive and negative affect and physical symptoms.

A recent study by Gartland, O'Connor and Lawton (2012) showed, for the first time, that the appraisals of daily hassles are influenced by C. Appraisals are the interpretations of events in terms of

their benefit or harm for the individual; the transactional model of stress posits two dimensions: primary and secondary appraisals (Lazarus & Folkman, 1984). Primary appraisal involves the evaluation of the risks, demands or challenges of a situation (i.e., high versus low), while secondary appraisal evaluates the availability of perceived resources and whether anything can be done to alter the outcome of the situation. In the Gartland, O'Connor and Lawton (2012) study, the facets of C were found to be associated with primary and secondary appraisals, such that high scores on Order and Industriousness were associated with reporting more demanding hassles (higher primary appraisal), and high Responsibility with reporting more perceived resources (higher secondary appraisal). However, the findings were limited to a single daily hassle experienced any time in the previous 7 days with no measurement of any stress outcome variables, therefore the moderating influence of C on the stress appraisal – outcome relationship could not be explored. Furthermore, this study investigated primary and secondary appraisal as separate variables. In previous research, a ratio of primary to secondary appraisal has been calculated, which reflects the extent to which these appraisals match one another (Schneider, 2008; Tomaka, Blascovich, Kibler, & Ernst, 1997), and is consistent with the theory of primary and secondary appraisal interplay (Lazarus & Folkman, 1984). Crucially, this ratio provides a way of looking at appraisals which accounts for the specific match between one's perceived demands and perceived resources at the point of a single stressor, based on the premise that it is only when perceived demands outweigh perceived resources that a hassle will be experienced as stressful (i.e., a high ratio appraisal). Therefore, the current study aimed to extend the study of appraisals by collecting data on multiple hassles over a 14 day period and to test the extent to which the effects of daily stress appraisal ratio on daily positive and negative affect and physical symptoms are moderated by C.

Affect is a measure of emotional well-being, and is also related to a variety of health measures, including physical symptoms, immune-function, hypertension, biological functioning and mortality (De Gucht, Fischler, & Heiser, 2004; Jonas & Lando, 2000; Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002; Pressman & Cohen, 2005; Steptoe et al., 2009; Wilson, Bienias, de Leon, Evans, & Bennett, 2003). There is also evidence indicating that naturally occurring and induced mood states influence immune function (Cohen & Herbert, 1996; Stone et al., 1994), but also that state

measures of negative mood can predict physical symptoms at 3-year follow up (Steptoe & Wardle, 2005). In line with the positive psychology movement (Seligman & Csikszentmihalyi, 2000), attention has also focussed on the possible health benefits of positive affect. At the daily level, positive affect has been shown to have a beneficial influence on physiological processes such as cortisol levels and ambulatory blood pressure (Steptoe & Wardle, 2005). Recent reviews suggest that positive affect can have significant effects on health both at the daily level and in the longer term with an effect size comparable to negative affect (Chida & Steptoe, 2008; Howell et al., 2007; Steptoe et al., 2009). Therefore, affect may represent an important additional mechanism through which C may influence both ongoing and future health; if daily hassles lead low C individuals to experience more negative affect or less positive affect, these individuals may experience ill-health consequences of negative affect, and/or fail to experience the health benefits of positive affect.

In addition to daily affect, there is evidence that daily stressors can increase the experience of daily physical symptoms (Dancey, Taghavi, & Fox, 1998). Non-specific physical symptoms are regularly experienced by the general population (Rief, Hessel, & Braehler, 2001), and represent a measure of current ongoing physical health below the threshold of disease (Ferguson, Cassaday, Erskind, & Delahaye, 2004). DeLongis and colleagues found that daily stressors influenced both somatic symptoms and mood when measured at the daily level (Delongis, Folkman, & Lazarus, 1988). C has also been investigated in the study of symptom reporting, and evidence suggests that those low on C report the experience of more severe symptoms (Ferguson et al., 2004). Therefore, self-reported physical symptoms provided a useful daily measure of ongoing health.

In summary, the primary aim of this study was to test the extent to which C and its facets moderate the effects of the daily stress appraisal ratio on daily positive and negative affect and physical symptoms over a 14 day period. It is hypothesised that the relationship between a high appraisal ratio of hassles (where perceived demands outweigh perceived resources) and more symptoms or fewer positive daily health outcomes will be stronger in lower C individuals compared to higher C individuals.

METHODS

Participants

The present study utilised an adult sample, recruited through emails sent to University staff based in a University in the North of England together with advertisements sent to local organisations and businesses. The sample consisted of 73 females and 30 males (N=103), with an average age of 35 years (ranging from 20 to 75 years). The sample was mainly of white ethnicity (90.3%). The majority of the sample was employed (58.3%) or in full-time education (27.2%). The remaining participants were retired (7.8%), housewives/husbands (3.9%), or unemployed (2.9%).

Design

A daily diary questionnaire design was utilised, in which participants responded to a baseline questionnaire followed by a 14-day daily diary. Daily diaries allow frequent measurement of both within-person daily variables as well as between-person variables, thereby permitting participants to act as their own controls, and additionally reducing recall bias (O'Connor et al., 2009). The questionnaires were administered online using an in-house software package (successfully used in numerous previous studies), but paper copies were available for respondents without access to a computer in the evening. Approval from the University Department ethics committee was established before commencement of data collection. Participants were entered into a prize draw to win three cash prizes of £25, £50 and £100.

Measures and Procedure

Baseline Questionnaire

Participants were asked to complete a short demographics questionnaire, followed by the Chernyshenko Conscientiousness Scale measure of C (CCS; Hill & Roberts, 2011), which reflects 6 facets of C: Order, Virtue, Traditionalism, Self-control, Responsibility, and Industriousness. Roberts et al. (2005a) described these facets: Order deals with the ability to organise and plan tasks and activities (example item: I need a neat environment in order to work well). Virtue reflects adherence to moral standards, honesty, and "good Samaritan" behaviour (example item: If I find money laying around, I'll keep it to myself). Traditionalism is concerned with compliance with rules, customs, and expectations (example item: I have the highest respect for authorities and assist them whenever I can). Self-Control relates to being cautious, patient, and able to delay gratification (example item: I rarely jump into something without first thinking about it). Responsibility reflects a tendency to be

cooperative and dependable, and gain enjoyment from being of service (example item: I go out of my way to keep my promises). Industriousness is concerned with being hard-working, ambitious, and resourceful (example item: I have high standards and work toward them). Each facet scale consisted of 10 items, rated on a 5-point Likert scale ranging from 1 (Very Inaccurate) to 5 (Very Accurate). Internal consistency for each of the facets of C in the present sample was good, with the exception of Responsibility which demonstrated a Cronbach's $\alpha < 0.70$ (Order $\alpha = .86$, Virtue $\alpha = .80$, Traditionalism $\alpha = .81$, Self-control $\alpha = .84$, Responsibility $\alpha = .63$ & Industriousness $\alpha = .86$). Item analysis indicated that the low internal consistency of the Responsibility scale could not be improved through the removal of items; therefore, as this was an established scale, analysis was carried out with the full scale.

Daily Diary

Participants completed the first daily diary on the same day as the baseline questionnaire. An interval-contingent method was employed, where participants completed the diary at the end of each day for 14 consecutive days. The on-line diary software allowed participants to complete their daily diaries before going to bed with a cut-off of 3am each day. A total of 1093 days of data were collected.

Participants provided a brief description of all of the daily hassles experienced throughout the day (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008). A total of 1968 hassles were reported by participants, with an average of 1.8 hassles reported each day. The cognitive appraisals of each hassle were measured using the modified Stressor Appraisal Scale (SAS; Gartland et al., 2012); this is an 8-item scale with 5 primary appraisal items (e.g. 'How threatening did you find the daily hassle to be?'; Cronbach's $\alpha = .94$) and 3 secondary appraisal items (e.g. 'Before the hassle was resolved, how well did you think you could manage the demands imposed on you by the daily hassle?'; Cronbach's $\alpha = .94$). Appraisals are rated on a scale from 1 (Not at all) to 7 (To a very large extent) and the mean score for each scale calculated. The appraisal ratio was calculated by dividing the primary appraisal by the secondary appraisal and a high score (i.e., high ratio) is indicative of where perceived demands outweigh perceived resources.

A 10-item measure of daily affect was taken (Mackinnon et al., 1999), which included 5 positive affect items (e.g. excited, alert; Cronbach's α = .83) and 5 negative affect items (e.g. nervous, distressed; Cronbach's α = .86). Participants were asked to indicate the extent to which they felt each item today, generally. The positive and negative items were averaged to give daily positive and negative affect scores.

A 12-item measure of physical symptom experience was also taken (Ferguson et al., 2004). This scale asks to what extent participants have experienced a range of physical symptoms during the past 24 hours (e.g. headache, breathlessness), on a scale from 1 (did not experience the symptom) to 6 (experienced the symptom very severely). Frequency was a dichotomised score, calculated by counting the number of symptoms for which a rating of greater than 1 was given.

Removal of Data

One hundred and seventy five people completed the baseline questionnaire. Of these, 136 went on to complete the first daily diary (attrition rate 22.3%). All participants who completed 4 or more days were included in the analysis. This number of days provided a sufficient range of hassles to be meaningful and captured 76% of the participants who completed part of the diary leaving a sample of 103 participants for analysis, completing an average of 10.61 days each. The threshold was set relatively low as it was thought that low C individuals may be less likely to continue with the daily diary, and therefore setting a high threshold would exclude a disproportionate number of low C participants (number of days completed moderately correlated with the Total C score; r = .20, p = .009). There was no significant difference between the included and excluded daily diary participants with the threshold set at 4 days completion in terms of Total C score. Furthermore, the range of C scores for participants included in the study did not differ from the range of scores for those completing the baseline questionnaire. However, it is worth noting that independent samples t-tests revealed that scores on the Order facet were significantly lower in the completers compared to the non-completers (t = 2.47, p < 0.05) indicating that Order is an important factor in predicting attrition. No other facets differed in this respect.

Before analysis, all variables were screened for outliers by inspecting boxplots and none were identified. The personality variables were checked for skewness. Industriousness approached a level

of skewness which may be a cause for concern (-0.77). However, no discernible differences were found between analyses carried out with the original and log transformed variable, thus the original data were used in all subsequent analyses. In preliminary analyses, we controlled for the effects of neuroticism (using the 10-item neuroticism from the International Personality Item Pool, Goldberg, 1999) given the well-established moderate relationship with C and ill health (cf., Ferguson, 2000; McCrae & Costa, 1985). The results did not different substantively from the results presented here, and unsurprisingly, neuroticism was found to predict daily positive and negative affect and physical symptoms. However, importantly, the observed effects of C remained statistically significant. Therefore, in order to be parsimonious, we have not reported these additional analyses in the current paper.

Analytic Method

The data was analysed using HLM6 (Raudenbush, Bryk, Cheong, & Congdon, 2004). The data contained a two-level hierarchical structure; Level 1 representing within-person variation (e.g., daily variation in affect), and Level 2 representing between-person variability (e.g., C). Level 1 predictors were group mean centred. At Level 2, age was grand mean centred and gender was uncentred. However, note that in the multi-level modelling analyses Total C and its facets were converted to z-scores such that coefficients refer to 1 standard deviation change in C and these were uncentred at Level 2. This will facilitate comparisons with related studies using different measures of C. The data was modelled initially for the total C score, and then subsequently modelled for each of the six C facets. In the case of frequency of physical symptoms experienced, as it was a count variable, it was modelled as a Poisson (Raudenbush, Bryk, Cheong & Congdon, 2004). In the Level 1 and 2 data files 0.01% of the data was missing. Missing data in the Level 1 file was removed at the point of analysis and in the Level 2 file it was replaced with the column mean.

RESULTS

Descriptive Statistics and Baseline Analysis

Descriptive statistics were calculated for all main Level 1 and Level 2 variables. Table 1 shows the descriptive statistics for age and the C variables, and the correlations between C and its

facets (Level 2). As expected, all the facets of C were significantly positively correlated with one another and total C. Table 2 provides descriptive statistics for the daily diary variables (Level 1).

Preliminary Analyses

Age was positively correlated with C ($r = .29$, $p < .01$) and females had higher C scores compared to males ($r_{pb} = .22$, $p < .05$). Additional analyses were performed with age and gender to determine their effect on the appraisal and outcome variables. HLM6 was used to model the effect of age and gender separately as Level 2 variables on the individual Level 1 variables. No effects of gender on appraisal and outcome variables were found. The analysis of age revealed that older individuals reported lower average primary appraisals. Older individuals also reported lower physical symptom frequency scores. These main effects were investigated further to determine whether age interacted with C. Testing the effects of the age-C interaction term revealed no significant effects. Age and gender were entered into further models at Level 2 given their main effects on C and/or on the outcome variables, but no interaction terms were entered.

Testing the direct effect of C on primary and secondary appraisal and the appraisal ratio of daily hassles

The main effects of C on the primary, secondary and ratio appraisals of hassles were tested. Age and gender were controlled for, so the general form of each model in this analysis is expressed by the following equation:

$$\text{Appraisal} = \beta_{00} + \beta_{01}(\text{Age}) + \beta_{02}(\text{Gender}) + \beta_{03}(\text{C}) + r_0 + \varepsilon$$

where β_{00} indicates the mean level of appraisal; β_{01} indicates the effect of age on appraisals, β_{02} the effect of gender, β_{03} the effect of C, and ε is the error term.

First, Total C was entered at Level 2. Total C was not found to affect overall primary appraisal, secondary appraisal or the appraisal ratio. Second, each of the 6 facets of C were entered independently at Level 2 in separate analyses. No effects were observed for the facets on primary appraisals, secondary appraisals or the appraisal ratio.

Testing the cross-level effects of C on the relationships between hassle appraisals and daily outcome variables

The main effects of C and appraisals on the daily outcome variables, as well as the cross-level effects of C on the relationships between appraisals and outcomes, were tested. Primary appraisal, secondary appraisal and appraisal ratio were all entered in a single model to determine their relative effects on outcome variables. The general form of each model in this analysis is expressed by the following equation:

$$\text{Outcome variable} = \beta_{00} + \beta_{01}(\text{Age}) + \beta_{02}(\text{Gender}) + \beta_{03}(\text{C}) +$$
$$\beta_{10}(\text{Primary Appraisal}) + \beta_{11}(\text{C} \times \text{Primary Appraisal}) +$$
$$\beta_{20}(\text{Secondary Appraisal}) + \beta_{21}(\text{C} \times \text{Secondary Appraisal}) +$$
$$\beta_{30}(\text{Appraisal Ratio}) + \beta_{31}(\text{C} \times \text{Appraisal Ratio}) + \varepsilon$$

where β_{00} indicates the mean level of the outcome variable; β_{01} indicates the extent to which this is influenced by age, β_{02} indicates the extent to which the outcome is influenced by gender, β_{03} indicates the extent to which the outcome is influenced by C, β_{10} indicates the average size of the relationship between the primary appraisal and the outcome variable, β_{11} indicates the extent to which that relationship is conditional on the level of C, β_{20} indicates the average size of the relationship between secondary appraisal and the outcome variable, β_{21} indicates the extent to which that relationship is conditional on the level of C, β_{30} indicates the average size of the relationship between the appraisal ratio and the outcome variable, β_{31} indicates the extent to which that relationship is conditional on the level of C, and ε is the error term.

This analysis was initially carried out with Total C, and was then performed with each facet separately. The effects of appraisals on outcomes were assessed by looking at the Level 1 slopes (Table 3). The appraisal ratio was found to be negatively related to positive affect (i.e., when perceived demands outweigh perceived resources, less positive affect is reported) for average levels of C, and primary appraisal was found to significantly positively predict negative affect (i.e., higher appraisal associated with greater negative affect) when C is average. No significant relationships were found for physical symptoms.

The analysis for C also revealed that C moderated the relationship between the appraisal ratio and positive affect (Table 3). This indicated that hassles appraised as stressful negatively impacted

positive affect, but this effect is different at different levels of C. Simple slope analyses using the procedure described by Preacher, Curran and Bauer (2006) showed that for higher levels of C (+1SD) there was no significant association between appraisal ratio and positive affect. However, for mean and lower (-1SD) levels of C the negative effect is significant. This moderation effect and associated slope values is shown in Figure 1A.

This same analysis was then carried out for the facets separately. The results showed that Industriousness was positively related to positive affect (B = .03, SE = .01, p = .003) at average level of appraisal. However, with respect to the moderation effects, Order and Industriousness were found to moderate the appraisal ratio–positive affect relationship. These moderation effects were decomposed for higher (+1SD), mean and lower (-1SD) levels of the moderator using simple slope analyses (Preacher et al., 2006). These analyses showed that for higher levels of Order (+1SD) there was no significant association (B = 0.04 (SE = 0.09), p = .65) between appraisal ratio and positive affect, however, for mean (B = -0.206 (SE = 0.07), p = .007) and lower (B = -0.454 (SE = 0.12), p = .0002) levels of Order a negative effect is significant (See Figure 1B). A similar interaction was observed for Industriousness, with no significant association at higher levels (B = -0.014 (SE = 0.10), p = .88) between appraisal ratio and positive affect, with significant negative effects at mean (B = -0.211 (SE 0.07), p = .003) and lower (B = -0.408 (SE = 0.10), p = .001) levels (See Figure 1C). The interaction pattern is the same for Total C, Order and Industriousness.

DISCUSSION

The main finding of the current study was that total C and two of its facets have the capacity to moderate the relationship between hassle appraisals and well-being outcomes and suggest that (aspects of) C may exert part of its influence on health by modifying the daily stressors-health link. More specifically, it was shown that the daily negative association between the stressful experience of hassles and positive affect was stronger for lower and average levels of C, and two of its facets, Order and Industriousness, with no significant effects observed for the higher levels of C.

The moderation effect identified is important because it confirmed that having a high stress ratio appraisal (where perceived demands outweigh perceived resources) had a greater impact on outcomes when C and two of its facets are low. This relationship supports the hypothesis that stress

will have a differential impact depending on levels of C and is consistent with a recent study that demonstrated that C moderated the relationships between daily hassles and health behaviours (O'Connor et al., 2009). However, the current findings do not explain why those lower and average in C exhibit a negative appraisal-outcome link. One possibility is that lower C individuals are less likely to use problem-focused coping and to be less well organised to meet situation demands and, as result, they are more vulnerable to stress-induced changes in daily affect (as well as related negative health behaviours; O'Connor et al., 2009; Penley & Tomaka, 2002). Future research ought to attempt to identify the stress buffering factors that might help protect higher C individuals and/or the variables that may confer stress vulnerability in lower C individuals.

The appraisal ratio was only found to have a direct effect on positive affect, and not the other outcome measures. This could suggest the importance of positive affect in the transactional stress process, but further research with the measurement of other short- and long-term health outcome measures will be needed to determine the exact effects of appraisals on health. Nevertheless, the effect observed here indicates that appraising hassles as stressful has a specific effect on positive affect. Additional findings relating to positive affect indicated that higher C was associated with the experience of greater positive affect overall, but also that when stressful hassles occur, higher C individuals are able to maintain their levels of positive affect. This is contrary to lower C individuals, for whom stressful hassles reduce the amount of daily positive affect reported at the end of the day.

The beneficial effects of positive affect at the daily level as well as in the long-term are beginning to emerge. Positive affect has been proposed as an adaptational mechanism which may protect against the negative effects of stress on health (Folkman & Moskowitz, 2000; Ong, Bergeman, Bisconti, & Wallace, 2006). Ong and colleagues suggest that the ability to maintain positive emotions in the face of stress is one pathway through which people can successfully adapt to stress and experience better health outcomes. Folkman and Moskowitz suggested that in some cases stress can produce positive affect through benefit finding or mastery/gain, or (similar to Ong's proposal) the maintenance of positive affect during stress could buffer against the adverse physiological consequences of stress. In relation to the current findings, it is possible that those lower and average in C are more vulnerable because they do not experience the stress buffering effects of positive affect.

Within the facets of C, the same moderation effect was demonstrated for Order and Industriousness; the importance of these facets is supported by previous research demonstrating that Order and Industriousness are predictive of daily hassle appraisals (Gartland et al., 2012). While Gartland et al. demonstrated that Order and Industriousness positively predicted primary appraisals, it is likely that this counter-intuitive effect is explained by the use of the appraisal ratio in the current study; that is, for high Order and Industriousness higher primary appraisals are matched by higher secondary appraisals, thus negating any negative effects. In addition, Order has been shown to be functionally relevant in the study of stress and health behaviours, where Order moderates the relationship between daily hassles and exercise such that individuals high on Order were more likely to exercise on days when they experienced hassles (O'Connor et al., 2009). Therefore, these facets appear to be important in the regulation of health outcomes in the face of stress. Responsibility was also suggested as an important facet, based on previous research; however no significant effects of this facet were identified in this study. This may be because of the low internal consistency of the scale in this sample. Therefore, further research is required to determine the functionality of this facet.

One of the broader findings of this research is that the appraisals of daily hassles are of significance to the understanding of how personality interacts with stress to produce variable outcomes. Though appraisals have been studied widely, and there is growing literature to support the relationship between appraisals and stress outcome measures (Gildea, Schneider, & Shebilske, 2007; Schneider, 2004; Smith, Haynes, Lazarus, & Pope, 1993; Tomaka, Blascovich, Kelsey, & Leitten, 1993; Tomaka et al., 1997), this is the first study that we know of that concurrently measures personality, daily hassle appraisals, and outcome measures. Furthermore, the concurrent measurement of daily appraisals and positive affect is novel to this area of research. Nevertheless, it is important to recognise that the current design is essentially a cross-sectional analysis and as a result we cannot confirm the direction of the relationship between the study variables. For example, it is possible that lower C individuals create more stressful environments by being disorganised, impulsive and bad planners. Similarly, reverse causality cannot be ruled out as the current design does not allow us to discern whether the experience of more symptoms or poorer health leads to lower C (Ferguson 2013b). Indeed, there is some evidence that personality can change as a function of experience

(Jackson, Thoemmes, Jonkmann, Ludtke & Trautwein, 2012; Roberts & Jackson, 2008; Tang et al., 2009). Therefore, in order to fully elucidate how personality and stress processes interact over time, researchers ought to adopt life course approaches that assess multiple predictors and multiple outcomes across a large number of years (for more detail see Segerstrom & O'Connor, 2012; also Hagger-Johnson et al., 2012) or econometric approaches (Ferguson, 2013b; Ferguson, Heckman & Corr, 2011). The importance of adopting such approaches is underscored by the recent publication of the landmark study by Jokela et al. (2013b) that demonstrated that C was the only higher-order personality trait to be related to mortality risk across a staggering 7 different cohort studies.

The notion that personality is open to change has led authors like Bogg and Roberts (2013) to suggest the intriguing possibility that interventions can be developed to change traits like C that may have health benefits. Similarly, Ferguson (2013) has argued that traits should be routinely assessed as outcomes of interventions. Indeed, many health based behaviour change interventions are designed to increase purposeful and planned behaviour (implementation intentions, TPB based interventions) and may be effective by changing trait levels, hence the need to assess traits as part of intervention evaluations.

Finally, our finding that there was a relationship between C and attrition rates is worthy of some brief additional comment. Specifically, we found that the Total C score was moderately correlated with the number of days the daily diary was completed, but more importantly, we also found that the Order facet predicted attrition rates in the current study. These findings are noteworthy as they suggest that the current results may represent an under-estimation of the true size of the associations between C, its facets and positive affect. However, they also may have important implications for researchers conducting clinical trials and longitudinal studies in the future. Nevertheless, we would like to see this finding replicated before firm conclusions are drawn about the significance of personality traits in predicting drop-out rates.

A number of shortcomings of the current study ought to be briefly acknowledged. First, the Chernyshenko Conscientiousness Scale is a relatively new measure which has not been widely used in the United Kingdom (UK; for an exception see Gartland, O'Connor & Lawton, 2011). The original scale was developed in the United States (US), using an ideal-point approach in order to develop a

measure that captures the entire range of the trait continuum as well as the multi-faceted nature of conscientiousness (see Chernyshenko, Stark, Drasgow & Roberts, 2007; Hill & Roberts, 2011). Nevertheless, future research ought to confirm the underlying structure of the scale using confirmatory factor analyses in UK and US samples (particularly in light of the less than satisfactory Cronbach's alpha for the Responsibility facet observed in the current study). Second, the health and wellbeing outcome measures taken were from daily self-reported questionnaires. This limits the conclusions which can be made about general physical health; the measures could be improved by collecting longer term health data, or by the collection of some physiological measurement to provide an objective measure of health in both the short- and long-term. Recent research has begun to assess the potential relationships between C and cortisol (Nater et al., 2010). This is a promising new direction for this area of research, as cortisol is a hormone which has a diurnal secretory rhythm, can be measured with minimum disruption to participants, is a marker of hypothalamic-pituitary-adrenocortical axis function, and has been suggested as an indicator of well-being and health (Clow, Thorn, Evans, & Hucklebridge, 2004; O'Connor et al., 2013). Furthermore, evidence indicates that cortisol varies with positive affect, and has been suggested as a potential mediator between positive affect and health (Brummett, Boyle, Kuhn, Siegler, & Williams, 2009; Dockray & Steptoe, 2010). Future research using these methods could determine whether the observed differences in stress appraisals and positive affect have any physiological parallels (see also Segerstrom & O'Connor, 2012).

In conclusion, the current study provides evidence that C and two of its facets can moderate the relationship between hassle appraisal and positive affect. Specifically, the negative association between the daily appraisal of hassles as stressful (i.e., where perceived demands outweighed perceived resources) and positive affect was stronger for lower and average levels of C, Order and Industriousness. Conscientiousness may exert part of its influence on health by modifying the effects of daily stressors.

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Table 1. Descriptive statistics for Level 2 variables.

	Mean	SD	1	2	3	4	5	6	7	8
Age (1)	35.26	14.75	1							
Total C (2)	3.75	0.44	.29**	1						
Order (3)	3.64	0.73	.18	.75**	1					
Virtue (4)	3.8	0.68	.32**	.71**	.33**	1				
Traditionalism (5)	3.21	0.67	.30**	.71**	.41**	.55**	1			
Self-Control (6)	3.61	0.67	.14	.66**	.39**	.31**	.36**	1		
Responsibility (7)	4.03	0.47	.19	.70**	.51**	.40**	.28**	.36**	1	
Industriousness (8)	4.21	0.56	.07	.69**	.47**	.36**	.33**	.31**	.58**	1

*p < .05, **p < .01.

Table 2. Descriptive statistics for Level 1 daily diary variables.

	Mean (SD)	**Range**
Total number of hassles	1.80 (1.23)	0 - 8
Average primary appraisal	3.07 (1.68)	1 - 7
Average secondary appraisal	4.29 (1.98)	1 - 7
Average appraisal ratio	.88 (0.69)	0.14 - 7
Positive affect	2.67 (0.92)	1 - 5
Negative affect	1.63 (0.83)	1 - 5
PS frequency	1.91 (2.00)	0 - 12

Note: PS = physical symptom

Table 3. Moderation effects of Total C on the relationships between appraisals of all hassles and outcome variables.

MRCM effect	Symbol	Coeff	SE	p
Positive Affect				
Intercept	β_{00}	2.44	0.19	<.001
Level-1 slopes				
1^0 Appraisal - PA	β_{10}	0.03	0.03	0.30
2^0 Appraisal - PA	β_{20}	0.07	0.04	0.07
Appraisal Ratio - PA	β_{30}	-0.20	0.07	0.008
Cross-level effects				
Age - PA	β_{01}	0.003	0.004	0.57
Gender - PA	β_{02}	0.20	0.14	0.17
Total C - PA	β_{03}	0.09	0.07	0.19
Total C x 1^0 Appraisal - PA	β_{11}	-0.09	0.03	0.01
Total C x 2^0 Appraisal - PA	β_{21}	0.07	0.04	0.04
Total C x Appraisal Ratio - PA	β_{31}	0.26	0.08	0.002
Negative Affect				
Intercept	β_{00}	1.77	0.14	<.001
Level-1 slopes				
1^0 Appraisal - NA	β_{10}	0.22	0.03	<.001
2^0 Appraisal - NA	β_{20}	-0.01	0.03	0.57
Appraisal Ratio - NA	β_{30}	0.16	0.10	0.11
Cross-level effects				
Age - NA	β_{01}	-0.004	0.003	0.23
Gender - NA	β_{02}	-0.07	0.10	0.53
Total C - NA	β_{03}	-0.05	0.06	0.34
Total C x 1^0 Appraisal - NA	β_{11}	0.009	0.04	0.80
Total C x 2^0 Appraisal - NA	β_{21}	0.03	0.03	0.25
Total C x Appraisal Ratio - NA	β_{31}	0.04	0.10	0.69

PS Frequency

|				
Intercept	β_{00}	0.77	0.46	<.001
Level-1 slopes				
1^0 Appraisal - PS-F	β_{10}	0.07	0.03	0.05
2^0 Appraisal - PS-F	β_{20}	-0.02	0.04	0.54
Appraisal Ratio - PS-F	β_{30}	0.04	0.06	0.56
Cross-level effects				
Age - PS-F	β_{01}	-0.02	0.01	<0.01
Gender - PS-F	β_{02}	-0.28	0.19	0.14
Total C - PS-F	β_{03}	0.02	0.04	0.68
Total C x 1^0 Appraisal - PS-F	β_{11}	0.05	0.04	0.19
Total C x 2^0 Appraisal - PS-F	β_{21}	-0.02	0.04	0.68
Total C x Appraisal Ratio - PS-F	β_{31}	-0.04	0.06	0.56

Note: MRCM multilevel random coefficient modelling, Symbol hierarchical multilevel linear modelling symbol, Coeff unstandardised coefficient, SE standard error, PS physical symptom.

Figure 1. Moderation of the Appraisal Ratio-Positive Affect relationship by Conscientiousness, Industriousness and Order
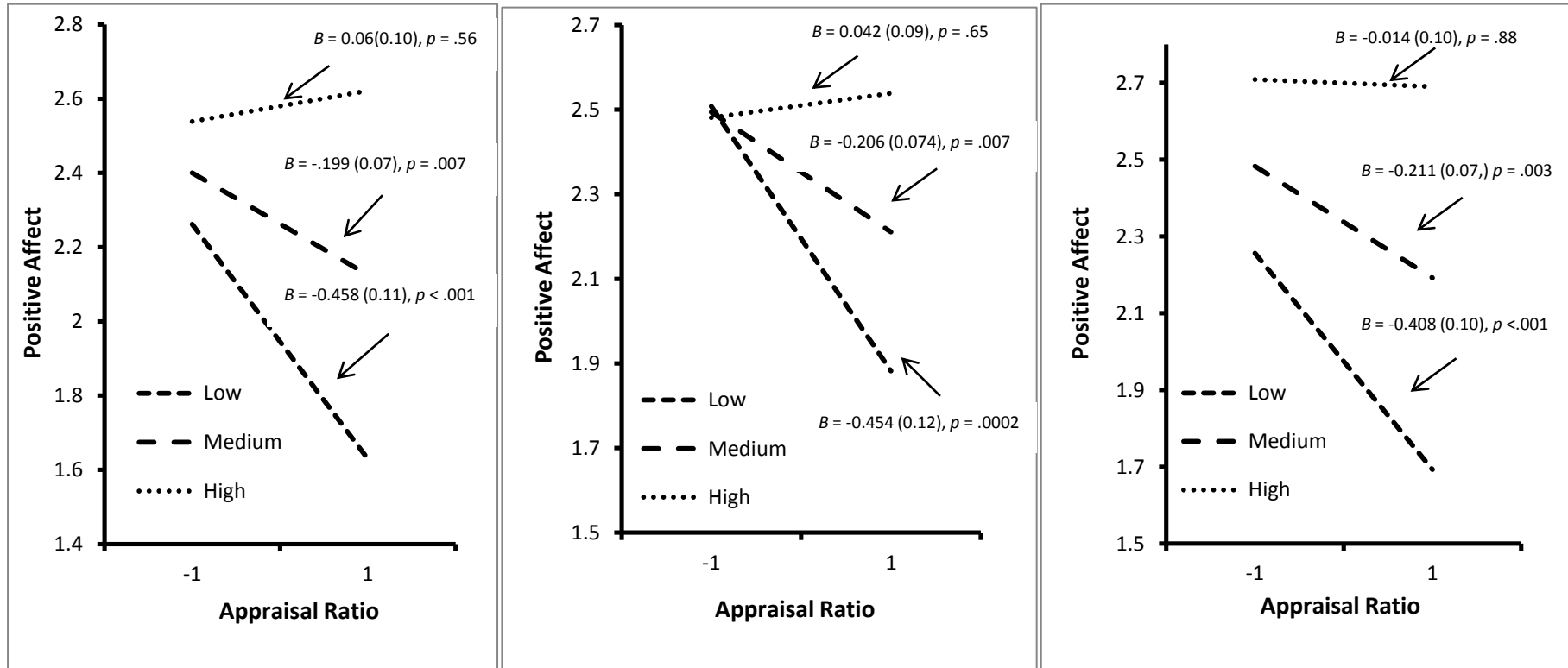
Note. Conscientiousness (Z-score) scored as Low (-1SD), Medium (Mean) and High (+1SD). Appraisal Ratio -1 (= - 1SD) and +1 (= + 1SD). Standard errors in parentheses.