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The measurement and role of ecological resilience systems theory across domain-specific outcomes: The Domain-Specific Resilient Systems Scales

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Abstract

Research suggests that trait resilience may be best understood within an ecological resilient systems theory, comprising engineering, ecological and adaptive capacity resilience. However, there is no evidence as to how this theory translates to specific life domains. Data from two samples (USA, n = 1278; UK, n = 211) facilitated five studies that introduce the Domain-Specific Resilient Systems Scales for assessing ecological resilient systems theory within work, health, marriage, friendships, and education. The Domain-Specific Resilient Systems Scales are found to predict unique variance in job satisfaction, lower job burnout, quality-of-life following illness, marriage commitment and educational engagement, whilst controlling for factors including sex, age, personality, cognitive ability, and trait resilience. The findings also suggest a distinction between the three resilience dimensions in terms of the types of systems to which they contribute. Engineering resilience may contribute most to life domains where an established system needs to be maintained, e.g., one's health. Ecological resilience may contribute most to life domains where the system needs sustainability in terms of present and future goal orientation, e.g., one's work. Adaptive Capacity may contribute most to life domains where the system needs to retained, preventing it from reaching a crisis state, e.g., work burnout.

Keywords. resilience; measurement; health; work; education; marriage; friendship.

The measurement and role of ecological resilience systems theory across domain-specific outcomes: The Domain-Specific Resilient Systems Scales

The importance of resilience to effective functioning is recognised in numerous domains, with relevance to a number of clinical and applied psychological contexts, including stress and burnout in work (Matheson, Robertson, Elliott, Iversen, & Murchie, 2016; Vanhove, Herian, Perez, Harms, & Lester, 2016), social care with children in education (South, Jones, Creith, & Simonds, 2015; Wald, 2015), stress and dissolution in marriage (Neff & Broady, 2011), support seeking and active coping in friendships (Graber, Turner, & Madill, 2016) and key determinants of health status (Smith et al., 2016; Taylor & Distelberg, 2016). However, there is considerable disparity in defining what is meant by resilience; this prevents cohesiveness in how best to measure resilience and therefore the implementation of effective strategies to improve resilience in at-risk groups. Current definitions of resilience are often either ubiquitous, for example defining any variable as a resilience factor so long as it alleviates the impact of a negative event (see buffering hypothesis; Johnson, Wood, Gooding, Taylor, & Tarrier, 2011), or ambiguous, with recent reviews suggesting there are over 25 resilience measures, encompassing the measurement of hardiness, coping, optimism, perseverance, impulse control and self-efficacy (Pangallo, Zibarras, & Lewis, 2015; Windle, Bennett, & Noyes, 2011), and eight conceptual approaches that encompass childhood resilience, including risk, inoculation effects of risk, mental attributes, biological features and the effects of social relationships (Rutter, 2013).

Recent attempts to refine the conceptualisation and measurement of trait resilience have revealed that considering resilience through an ecological systems resilience framework (Holling, 1973, 1978, 2006; Walker, Holling, Carpenter, & Kinzig, 2004), comprising engineering, ecological and adaptive capacity (EEA) systems, may have considerable merit (Maltby, Day, & Hall, 2015). Within this framework, engineering resilience is considered to

be the ability, in terms of ease and speed, of the resilient system to recover to a stable or optimal equilibrium during or following disturbance. Ecological resilience is the ability of the resilient system to absorb or prevent disturbance, demonstrating a capability for supporting a stable state, whilst making necessary changes to its own functions. Adaptive capacity is considered to be the ability to incorporate new, and to vary existing, processes continually, so as to naturally adapt to disturbance. Maltby et al. (2015) found that these three resilience systems (the EEA model) emerged as the strongest latent factors among the five currently most cited resilience scales in the psychological literature (the Connor-Davidson Resilience Scale [Connor & Davidson, 2003], the Psychological Resilience Scale [Wagnild & Young, 1993], the Ego Resiliency Scale [Block & Kremen, 1996], the Hardiness Scale [Bartone, Ursano, Wright, & Ingraham, 1989], and the Brief Resilience Scale [Smith et al., 2008]). Therefore, in terms of identifying latent factors underpinning a number of models of resilience, the EEA resilience model sits within the nomothetic tradition of personality research (e.g. Allport, 1937; Costa, McCrae, & Odessa, 1992), conceptualising resilience traits within an adaptive trait landscape of social problem solving (Buss, 1991). Evidence in support of this interpretation is demonstrated for all three latent factors, as they are shown to exhibit positive relationships with adaptive expressions of the traits of the five-factor personality model, and make a positive contribution to clinical and non-clinical psychological health states, after controlling for personality and coping, or over time (Maltby, Day, & Hall, 2015; Maltby et al., 2016).

Currently, the measurement of these three systems is obtained via a 12-item measure, using the items from five existing resilience scale that load most highly on latent factors (Maltby, Day, & Hall, 2015; Maltby et al., 2016). However, it is not necessarily the case that trait measures of resilience will automatically translate into specific domains, such as work, education, health, marriage and friendships. Individuals will make different assessments of

their level of resilience in different domains (Vanderbilt-Adriance & Shaw, 2008). For example, an individual may be particularly resilient in terms of their family, but less so when it comes to work. Moreover, the recognition that traits and abilities emerge specific to, and across, domains has been shown to be useful in measuring constructs accurately and effectively (Oswald, McAbee, Redick, & Hambrick, 2015), for properly understanding physiological and cognitive adaptations to human systems (e.g. Spelke & Kinzler, 2007), and for targeting changes in behaviours (Capron, 2015).

For this study, we identify five possible domain-specific contexts in order to consider resilience: work, health, marriage, friendships and education. Whilst resilience could impact on many outcome variables associated with these contexts, we specify several well-recognised variables. Within the work literature, (lack of) *job satisfaction* and *burnout* are key predictors of absenteeism, loss of productivity and a need for healthcare, representing huge costs to economies, estimated in the hundreds of billions of dollars for US and European employers (EU-OSHA, 2014; Spielberger, Vagg, & Wasala, 2003), with research suggesting resilience plays a role in job satisfaction and burnout (Meneghel, Borgogni, Miraglia, Salanova, & Martínez, 2016; Treglown, Palaiou, Zarola, & Furnham, 2016). Within the health literature, *health-related quality-of-life* is seen as a primary outcome variable related to a number of health states, including general physical health, injury, older age, disease, critical illness and palliative care (Fineblit, Selci, Loewen, Ellis, & Russell, 2016; Guo et al., 2016; Kojima, Iliffe, Jivraj, & Walters, 2016), with resilience linked to quality-of-life within many of these contexts (e.g. Moreira, Bouissou Morais Soares, Teixeira, Simões e Silva, & Kummer, 2015; Rosenberg et al., 2015). Within the marriage literature, *commitment to marriage* has been found to be the most important predictor of relationship dissolution (Rusbult, Martz, & Agnew, 1998; Rusbult, Kumashiro, Kubacka, & Finkel, 2009), with resilience forming a conceptual and empirical framework that can be used to consider

marriage commitment ranging from adjusting to marriage to various outcomes of divorce (Frisby, Booth-Butterfield, Dillow, Martin, & Weber, 2012; Neff & Broady, 2011). In terms of the friendship literature, the continuum between social support and *social isolation* is a key factor in the determination of individuals' health status and well-being across the life span (Franck, Molyneux, & Parkinson, 2016; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016), with resilience inversely linked to social isolation across the spectrum from young to old age (Adams, Sanders, & Auth, 2004; Ai & Hu, 2016). Finally, within the education literature, *educational engagement* is related to higher academic achievement, student satisfaction and retention (Christenson, Reschly, & Wylie, 2012; Maroco et al., 2016), with resilience linked to educational engagement within school, university and alternative education settings (Cotton, Nash, & Kneale, 2017; Rodríguez-Fernández, Ramos-Díaz, Ros, Fernández-Zabala, & Revuelta, 2015; Zolkoski, Bullock, & Gable, 2016).

It is important that any consideration of the EEA model in a domain-specific context examines the incremental value of such an assessment, in terms of increasing knowledge beyond extant theory and research (Smith, Fischer, & Fister, 2003). Firstly, it is important to demonstrate incremental validity by showing that EEA domain-specific measures are distinct from the general trait assessment of EEA resilience. Secondly, it is necessary to determine that EEA domain-specific measures demonstrate incremental validity in terms of alternative predictors of outcome variables. In particular, sex and age are related to a number of life and health outcomes (Hagger, 2009), the five-factor model of personality is considered an important predictor of work, educational, health and life outcomes (Hakulinen et al., 2015; Judge, Heller, & Mount, 2002; Poropat, 2009), and cognitive ability is a main predictor of work and health outcomes (Bertua, Anderson, & Salgado, 2005; Jokela et al., 2010). Further, in particular domains, context-specific variables are important to life outcomes. For example,

in terms of health-related quality of life, increased seriousness or duration of an illness, or injury, is associated with poorer health-related quality of life during and after treatment (e.g. (National Institute for Health and Care Excellence, 2009, 2015, 2017). Similarly, in terms of marriage commitment, research suggests that length of marriage is related to marriage commitment (Booth, 2009). Therefore, to provide incremental validity of the domain-specific resilience scales, there is a need to examine whether these scales predict life outcomes, above assessments of trait resilience, sex, age, personality, intelligence, and context-specific variables (e.g. length of marriage in health outcomes).

In summary, there is a need to develop domain-specific scales to assess the effectiveness of an EEA resilience model at predicting positive outcomes in several life domains; work, health, marriage, friendships and education. The development of these scales would improve the current assessment of resilience within specific life-domains, reducing the ubiquitous and ambiguous way resilience is currently framed in the literature by focusing on three established general resilience systems. The ecological systems model of trait resilience is aligned with biological and ecological resilient systems representing the manifestation of positive survival traits. Therefore, it is predicted that the EEA resilience model will predict a series of positive life outcomes in specific-domains, and will demonstrate incremental validity by predicting positive life outcomes in specific-domains after controlling for extant or relevant variables. Specifically:

1) Higher levels of EEA model resilience in the domains of (i) work, (ii) health, (iii) marriage, (iv) friendship and (v) education will be significantly associated with a series of positive life outcomes, (i) higher job satisfaction and lower burnout, (ii) higher health-related quality-of-life after treatment, (iii) higher commitment to marriage, (iv) lower levels of social isolation, and (v) higher educational engagement respectively.

2) Higher levels of EEA model resilience in these domains will be significantly associated with their respective positive life outcomes after (i) controlling for sex, age, income, personality, cognitive ability, and general trait resilience, and (ii) context-specific variables, such as seriousness and duration of illness in the health domain, and length of marriage in the marriage domain.

Method

Sample

Two samples of data were collected: Sample 1 was used for four studies exploring the association between domain-specific resilience and outcomes related to work, health, marriage and friendship respectively; Sample 2 was used to explore the association between domain-specific resilience and outcomes related to studying at university (education).

Sample 1. The first sample comprised a total of 1278 US adult respondents (653 men, 625 women), aged 19 to 78 years (M = 36.07 years, SD = 11.53, with one respondent declining to give their age), recruited using MTurk. Table 1 provides a summary of other demographic data relating to ethnicity, annual income, highest qualification, and employment status. In this study we used educational level as a proxy for cognitive ability (Kaufman, Reynolds, Liu, Kaufman, & McGrew, 2012; Naglieri & Bornstein, 2003).

- Insert Table 1 about here -

This sample was used for recruiting to four studies reported in this paper: a Work Study (n = 312; 170 men, 142 women, M age = 38.56, SD = 11.89), a Health Treatment Study (n = 354; 173 men, 181 women, M age = 34.99, SD = 10.71), a Marriage Study (n = 189; 91 men, 98 women, M age = 35.77, SD = 9.61) and a Friendship Study (n = 173; 114 men, 59 women, M age = 34.07, SD = 11.13). For constituting the studies, we adopted the criterion that any sample over n = 150 would be sufficient, as this is the minimum number required for factor analysis work (Gorsuch & Hillsdale, 1983), and sufficient for testing multiple regression models of up to 18

variables, with an anticipated medium effect size ($f2$ = .15, as a medium effect size is where relationships become observable [Cohen, 1992]), a statistical power level of .8 and a probability level of .05).

However, two challenges occur with sampling via MTurk. First, it is difficult to assess the likely demographic make-up of the sample so as to populate studies with appropriate participants across the domains (i.e. respondents who are employed, respondents who are married). Second, respondents complete studies for which they are paid. Therefore, if a researcher asks for "married people only", there is an incentive for non-married individuals to sign up and provide false or imagined answers. To avoid this happening, we carried out two administrations (First administration, n = 401; Second administration, n = 877), within which we employed several screening questions that led participants through certain routes through the administered questionnaires, as detailed in Figure 1. In the first administration (n = 401), we primarily recruited to the work study, through a screening question of whether individuals were employed full-time or part-time (n = 312) or not at all (n = 89). Having then reached n > 150 for employed individuals, in the second administration we recruited to the three other studies (health, marriage and friendship), routing individuals who were employed into one of three studies based on two screening questions. Respondents who had visited the doctor (or a similar qualified health professional) for treatment in the previous three months were entered into the Health Treatment Study (n = 354). Those who had not received any health treatment in the previous three months (n = 362) were asked a further question relating to their marital status. Those who confirmed they were married (or in a relationship that could be described as a marriage) went into the Marriage Study (n = 189). Finally, those who were not married were entered into the Friendship Study (n = 173) (1).

- Insert Figure 1 about here –

Screening and routing the participants in this manner allowed us to control for several variables across studies. For the Health Treatment Study, knowing that respondents were employed, means that this may be a good sample by which to consider resilience and quality-of-life when recovering from health problems, since the whole sample were currently considered fit for work, and unemployment, illness and health-related quality-of-life are intertwined (McKee-Ryan, Song, Wanberg, & Kinicki, 2005; Norman et al., 2016; Vancea & Utzet, 2017). For the Marriage Study, the routing of participants meant that not only was this a sample of married people, but that they were also employed and not suffering from an existing health condition. Therefore, this was a good sample with which to consider resilience and marriage, as both unemployment and major health issues have previously been found to be possible confounding variables in participants' assessments of the quality of their marriage (Kaya & Yurtseven, 2016; Lester, 1996; Lim & Raymo, 2016). For the Friendship Study, the routing of participants meant that this sample was employed; not suffering health issues, and not married. Therefore, this was a good sample for assessing resilience within friendships, as health, unemployment issues, and being involved in a marriage have all been reported as possible confounding factors in the quality of friendships (Almquist, 2012; Helms, Crouter, & McHale, 2003; Smart, 2007).

Sample 2. The second sample comprised 211 respondents (36 men, 175 women), aged 18 to 40 years (M = 19.93, SD = 2.5, with one respondent declining to give their age), who were either undergraduates or postgraduates enrolled on psychology courses at UK universities. This sample was used for recruiting to one study reported in this paper, an Education Study. The most frequently reported ethnicities were Caucasian (n = 116), Asian (n = 53), Black (n = 23), Middle Eastern (n = 3), Mixed Race (n = 10), and Other (n = 6). The sample comprised participants in a university experiment participation scheme, whereby students were given the choice to take part in experiments in return for being able to recruit

participants to their own research projects in their final year. The study was advertised and volunteers signed up and completed the study online via an electronic survey system. If participants withdrew from a single study or multiple studies under the scheme, they did not jeopardise the reward (recruiting participants to their own research projects).

We present five studies exploring resilience in five domains: Work, Health Treatment, Marriage, Friendship and Education.

Questionnaires

Development of domain-specific measures. To develop the domain-specific resilience measures, we initially developed lists of items that formed the basis of each of the domain-specific scales. This was achieved through focus group work across two sessions with eight psychology students (two males, six females) aged 20 to 25 years (M = 20.87, SD = 1.7). All the students were enrolled on a research project module, at either a final-year undergraduate or postgraduate level, and were attending classes on item writing and psychometrics relating to their project (Maltby, Day, & Macaskill, 2013). This group were chosen to allow us to write items that could be understood by a large number of people (Kline, 1999), without over-using technical or scholastic language.

In the first session, the focus group was provided with definitions of the three EEA resilience systems and asked to develop the items for a series of domains (e.g. work, education, health, marriage, and friendships) in such a way that they would map onto the theoretical descriptions of the three dimensions and seem sensible when applied to a particular domain. The focus group were also given the items reported by Maltby et al. (2015) to introduce key phrases and keep the focus on conceptual development. The focus group met again two weeks later (though one of the respondents could not attend through illness) to further develop the wording so that the scales could be applied to a number of different domains identified in this study. Items were taken forward from the focus group

when there was agreement among at least 7 out of 8 participants (87.5% agreement; session 1) or 6 out of 7 participants (85.7% agreement; session 2), as an overall percentage agreement of 80% or higher in focus group work is considered "good" agreement (Hennink, 2014).

This development work led to the creation of items for Domain-Specific Resilient Systems Scales (DRSS), DRSS-Work, DRSS-Education, DRSS-Health, DRSS-Marriage and DRSS-Friendship. These scales are presented in Figure 2, with two separate sets of wording applying to two different sets of domains as they were deemed the most sensible. A five-point response format was used, with anchor points "1 = Strongly Disagree" and "5 = Strongly Agree".

- Insert Figure 2 here -

The following materials were then presented within each of the five studies.

Work Study (*n* = 312). Respondents were administered the DRSS-Work (detailed in Figure 2, Set 1). Two measures were administered to assess job satisfaction and work-based burnout. Job satisfaction was assessed using the Andrews and Withey (1976) Job Satisfaction Questionnaire (Andrews & Withey, 1976; Rentsch & Steel, 1992), which is a five-item scale that measures overall job satisfaction (e.g. "How do you feel about your job?"), scored on a seven-point Likert-type scale ranging from "1 = Terrible" to "7 = Delighted". Therefore, higher scores on this scale represent greater job satisfaction. To assess job burnout we administered the Maslach Burnout Inventory - General Survey (Schaufeli, Leiter, Maslach, & Jackson, 1996), which comprises 16 items forming three subscales around employment burnout: exhaustion (5 items; e.g. "I feel emotionally drained by my work"), cynicism (6 items; e.g. "I doubt the significance of my work") and professional efficacy (5 items; e.g. "I have accomplished many worthwhile things in this job"). Responses are scored on a Likert-type scale that ranges from "0 = Never" to "6 = Daily". We computed the scores of these scales so that higher scores always represented higher levels of burnout. Both the Job

Satisfaction Questionnaire and Maslach Burnout Inventory - General Survey demonstrate adequate internal reliability and construct and concurrent validity with a number of other work-based outcomes (Bauer, 2009; Rentsch & Steel, 1992).

Health Treatment Study (*n* = 354). Respondents were administered the DRSS-Health (detailed in Figure 2, Set 2). Respondents were also administered the Quality-of-life EQ-5D-5L measure (The EuroQol Group, 1990). The EQ-5D-5L can be used to assess quality-of-life on two dimensions. The first is a quality-of-life descriptive system based on five sets of five statements around mobility, self-care, activity, pain, and anxiety and depression, the five statements representing increasing or decreasing quality-of-life. Higher scores on this scale represent poorer quality-of-life. The second is a visual analogue scale, based on a self-rating within 0-100 of how good or bad the respondent feels their health is, 0 being "the worst health you can imagine" and 100 "the best health you can imagine". Higher scores on this scale represent higher quality-of-life. The reliability, discriminatory power and convergent validity of the EQ-5D-5L has been validated in diverse patient populations in six countries, for various health conditions including cancer, chronic conditions, and personality disorders (The EuroQol Group, 1990; van Hout et al., 2012). In addition, we asked two further questions about their reported illness. We asked respondents to rate the seriousness of the reported illness ("1 = Not at all", "2 = A little", "3 = Somewhat", "4 = Reasonably", and "5 = Very") and the recency of the illness ("4 = Ongoing", "3 = Within the last week", "2 = Within the last month", and "1 = Within the last 3 months").

Marriage Study (*n* = 189). Respondents were administered the DRSS-Marriage (detailed in Figure 2, Set 2). Respondents were also administered the 15-item Commitment Measure (Rusbult, Martz, & Agnew, 1998; Rusbult, Kumashiro, Kubacka, & Finkel, 2009), which comprises three subscales assessing intent to persist (5 items; e.g. "I am completely committed to maintaining our relationship"), attachment (5 items; e.g. "I feel completely

attached to my partner and our relationship"), and long-term orientation in marriage (5 items; e.g. "I frequently imagine life with my partner in the distant future"). Responses are scored on a nine-point Likert-type scale in which responses range from "1 = Do not agree at all" to "9 = Agree completely". Higher scores on these scales represent higher levels of commitment to the marriage. The Commitment measure has shown acceptable internal reliability and predictive validity in terms of relationship dissolution two to five months later (Rusbult et al., 1998). Also, consistent with study aims and that length of marriage may be related to commitment (Booth, 2009), respondents were asked to indicate when their marriage began ("1 = Within the last year", "2 = Within the last 3 years", "3 = Within the last 5 years", "4 = Within the last 10 years", and "5 = Over 10 years ago").

Friendship Study (*n* = 173). Respondents were administered the DRSS-Friendship (detailed in Figure 2, Set 1). Respondents were also administered the five-item Friendship Scale (Hawthorne & Griffith, 2000) that assesses the extent to which an individual has experienced social isolation within the past four weeks (e.g. "I felt lonely"). Responses are scored on a five-point Likert-type scale in which responses range from "1 = Not at all" to "5 = Almost always". Higher scores on this scale represent higher levels of social isolation. The scale shows acceptable internal reliability and convergent and discriminant validity against a number of social, economic and physical health variables (Hawthorne & Griffith, 2000).

Education Study (*n* = 211). Respondents were administered the DRSS-Education (detailed in Figure 2, Set 1). Responses were scored on a five-point scale, with anchor points "1 = Strongly Disagree" and "5 = Strongly Agree". In addition, respondents were administered the 15-item University Student Engagement Inventory (Maroco et al., 2016), which comprises three subscales that assess university students' cognitive (5 items; e.g. "I try to integrate the acquired knowledge in solving new problems"), behavioural (5 items; e.g. "I pay attention in class") and affective (5 items; e.g. "My classroom is an interesting place to

be") engagement with university studies. Responses are scored on a seven-point Likert-type scale in which responses range from "1 = Never" to "7 = Always". Higher scores on these scales represent higher levels of engagement with one's studies.

Additional measures. In addition, all respondents were given two further measures. Both were administered so that we could control for trait influences when examining the relationship between domain-specific resilience and life outcomes. The first consisted of the 12-item EEA Trait Resilience Scales that were reported by Maltby et al. (2015). Responses to items were scored on a five-point scale ("1 = Strongly Disagree" to "5 = Strongly Agree") comprising three four-item assessments of EEA resilience traits. The EEA Trait Resilience Scales have been shown to demonstrate adequate internal and test-retest reliability, a stable factor structure cross-culturally, and convergent and construct validity in terms of associations with personality and positive contribution to clinical and non-clinical psychological health states (Maltby et al., 2016, 2015). The second measure was the Ten Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003) that comprises ten items for assessing the five-factor model of personality via neuroticism, extraversion, conscientiousness, agreeableness and openness to experience. Responses to these items are scored on a seven-point scale ("1 = Strongly Disagree" to "7 = Strongly Agree"). The TIPI has been shown to demonstrate reliability through inter-item correlations, test-retest reliability, and convergent validity with other measures of the five-factor model of personality and with self and observer ratings (Gosling et al., 2003).

Results

Confirmatory Factor Analysis (CFA)

To test for the structural validity (Messick, 1995) of the domain-specific resilience scales developed for the work, health, marriage, friendship and education studies, we performed CFA.

It is necessary to demonstrate the incremental value of proposed CFA models (Barrett, 2007). Therefore, we tested three models – (i) a unidimensional model, proposing that all 12 items from the respective scale could load on one factor, reflecting an underlying latent factor of resilience, (ii) a three-factor model suggesting that the 12 items would form EEA trait resilience factors and (iii) a bi-factor model, which was reported as the best fit of the original resilience scale among US, European and Japanese samples (Maltby et al., 2016) – to allow for the identification of a single common construct (e.g. "general resilience"), while also recognising multidimensionality (three group factors of engineering, ecological and adaptive capacity resilience). To assess each of the proposed models, we used standard goodness-of-fit indices recommended by Hu and Bentler (1999) and Kline (2005): the relative chi-square (CMIN/DF), alongside the chi-square and degrees of freedom, comparative fit index (CFI), non-normed fit index (NNFI), root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMR). Statistics that represent an "acceptable" fit are indicated by a CMIN/DF of less than 3, CFI and NNFI of greater than .90, RMSEA of less than .08 and SRMR of less than .08 (Browne & Cudeck, 1993; Hu & Bentler, 1999; Tabachnick & Fidell, 2007), with an improved model indicated by a change in CFI (ΔCFI) greater than .01 (Cheung & Rensvold, 2002).

The goodness-of-fit statistics for the three models are presented in Table 2. The three-factor and the bi-factor model both demonstrated acceptable fit, with improved goodness-of-fit statistics over the unidimensional model (ΔCFI > .01). Furthermore, the bi-factor model showed an improved fit over the three-factor, for health and marriage (ΔCFI > .01), with equivalence between the two models founds for work, friendship and education.

- Insert Table 2 here –

Following these results, we examined where the emphasis should be placed in terms of the data best fitting a three-factor or bi-factor model. We include an analysis for all the

scales, not just when there was a reported improved fit of ΔCFI>.01, for a full consideration. Table 3 shows the common variance and mean loadings accounted for by the general and group factors within the bi-factor model. Among these scales, with the one exception being for the Friendship Study (though the general factor accounted for less than 53% of the common variance), the group factors accounted for higher common variance and mean loadings. Based on these findings, even when there are improved goodness-of-fit indices for the bi-factor model as the group factors account for higher common variance, separate engineering, ecological and adaptive capacity scales should be used to assess resilience across the work, education, health, marriage, and friendship domains. Table 3 provides the reliability statistics for all the scales, with the alpha statistics demonstrating adequate reliabilities due to being higher than the aforementioned .7 criterion for "good" reliability (Kline, 1999; Nunnally, 1978).

- Insert Table 3 here -

Levels of Disturbance and Adversity, and Internal Reliability, of Outcome Variables. Ecological systems resilience is discussed within the context of environmental disturbance, which psychologically might best be referred to as adversity (Luthar et al., 2015), that is, to experience difficult or unpleasant situations (consequently, this is the term we use henceforth). Therefore, across the five studies, it is necessary to report on the extent to which adversity was being experienced for each outcome measure. Though arbitrary, for the multi-item measures (job satisfaction, burnout, marital commitment, social isolation and educational engagement) we computed what percentage of the sample fell below/above the theoretical midpoint for the scale (i.e. number of items multiplied by the midpoint option on the response scale), so as to indicate a degree of adversity ranging from a possible minimum to a possible maximum as determined by the measure scores. For the EQ-5D-5L descriptive system, as the responses to the five items are statements, we document the percentage of

participants who reported moderate or greater problems in each of the quality-of-life domains. For the visual analogue scale of the EQ-5D-5L, we provide a mean score for self-rated health. We also provide a combined percentage for respondents who reported (i) the seriousness of their illness as "somewhat" or greater, and (ii) the occurrence of their illness as either "ongoing" or "in the last week". Table 4 outlines these "adversity" statistics among the current sample, noting the following: those participants in the Health Treatment Study were considered long-term fit for work; those participants in the Marriage Study were both employed and not suffering from existing health issues; those participants in the Friendship Study were not married, were not suffering from an existing health issue, and were not unemployed. Table 4 also provides the reliability statistics for all the multi-item scales, with the alpha statistics demonstrating adequate reliabilities due to being higher than the aforementioned .7 criterion for "good" reliability (Kline, 1999; Nunnally, 1978).

- Insert Table 4 here -

Multiple Regression Analysis

We examined the extent to which the DRSS demonstrated incremental value in terms of predicting work, health, marriage, friendship and education outcomes. We ran a series of two-step multiple regressions, with the dependent variables mapped onto the five studies: (i) the Work Study comprising outcomes for job satisfaction and three dimensions of burnout (exhaustion, cynicism and low professional efficacy); (ii) the Health Treatment Study comprising outcomes for overall scores on the EQ-5D-5L and self-rated wellbeing; (iii) the Marriage Study containing outcomes for marital commitment; (iv) the Friendship Study with the outcome variable of social isolation; (v) the Education Study in which the outcomes were cognitive, behavioural and emotional engagement at university. In terms of predictor variables, as a general approach, we entered both the EEA Trait Resilience Scales and the DRSS in Step 2, after controlling for sex, age, personality and education level (predictor

variables in Step 1). With the aim of testing the extent to which domain-specific aspects of resilience accounted for unique variance in predicting outcomes we included the trait resilience alongside the domain-specific resilience. There were exceptions and additions to this general approach. For the education study model, we excluded the educational level because all participants had achieved at least some university education. For the health treatment study model, we included seriousness of illness and recency of illness variables. For the marriage study model, we included length of marriage variable. Variance inflation factors (VIFs) and tolerance factors for the predictor variables are no larger than 4.52 and no smaller than .221 respectively, across the models. Therefore, they do not contravene a threshold value for VIFs of at least 5 and tolerance statistics of less than .2, which are used to suggest multicollinearity (Kutner, Nachtsheim, Neter, & Li, 2004).

Work Study. Table 5 shows the results of the multiple regression for the Work Study. The variables entered in Step 1 demonstrated statistical significance in predicting each type of work outcome (work satisfaction, F [9,302] = 9.875, r = .48, r^2 = .23, adj r^2 = .20, $p <$ .001; exhaustion, F [9,302] = 10.01, r = .48, r^2 = .23, adj r^2 = .21, $p <$ .001; cynicism, F [9,302] = 9.32, r = .47, r^2 = .22, adj r^2 = .19, $p <$ .001; low professional efficacy, F [9,320] = 15.17, r = .56, r^2 = .31, adj r^2 = .29, $p <$ .001). Higher income and higher extraversion, agreeableness, conscientiousness and emotional stability accounted for unique variance in job satisfaction. Extraversion and emotional stability accounted for unique variance in lower levels of exhaustion. Extraversion, conscientiousness and emotional stability accounted for unique variance in lower levels of cynicism burnout. Age, extraversion and conscientiousness accounted for unique variance in lower levels of professional efficacy burnout.

- Insert Table 5 here -

Table 5 also shows the results for Step 2, with the inclusion of both resilience measures demonstrating a statistically significant change in R^2 for all aspects of work

outcomes (job satisfaction, $\Delta R = .15$, $p < .001$; exhaustion, $\Delta R = .07$, $p < .001$; cynicism, $\Delta R = .10$, $p < .001$; low professional efficacy, $\Delta R = .19$, $p < .001$). In terms of trait resilience, adaptive capacity resilience traits accounted for unique variance in cynicism burnout. In terms of the DRSS-Work, higher scores on all three resilience scales predicted unique variance in higher job satisfaction. Higher scores on the DRSS-Work ecological scale accounted for unique variance in higher levels of exhaustion, cynicism and low professional efficacy burnout. In addition, higher scores on the DRSS-Work adaptive capacity scale accounted for unique variance in higher levels of exhaustion and cynicism burnout, and higher scores on the DRSS-Work engineering scale accounted for unique variance in higher low professional efficacy burnout.

Health Treatment Study. Table 6 shows the results of the multiple regression for the Health Treatment Study. In Step 1, sex, age, income, educational level, personality, along with recency and seriousness of illness demonstrated statistical significance in predicting each type of outcome (quality-of-life, F [11,342] = 13.884, $r = .56$, $r^2 = .31$, adj $r^2 = .29$, $p < .001$; health rating, F [11,342] = 10.28, $r = .50$, $r^2 = .25$, adj $r^2 = .22$, $p < .001$). Lower emotional stability and recency and seriousness of health issues predicted lower quality-of-life scores. Lower conscientiousness scores and greater recency and seriousness of illness predicted lower levels of self-rated health.

- Insert Table 6 here -

Table 6 also shows the results for Step 2, with the inclusion of both resilience measures caused a statistically significant change in R^2 for all outcomes (quality-of-life, $\Delta R = .08$, $p < .001$; health rating, $\Delta R = .07$, $p < .001$). Higher scores on the DRSS-Health engineering scale accounted for unique variance in higher levels of the quality-of-life descriptive system and higher self-ratings for good health.

Marriage Study. Table 7 shows the results of the multiple regression for commitment to marriage. In Step 1, sex, age, income, educational level, length of relationship and personality demonstrated statistical significance in predicting each type of marriage outcome (intent to persist, F [10,178] = 2.06, r = .32, r^2 = .10, adj r^2 = .05, p = .030; attachment, F [10,178] = 1.46, r = .28, r^2 = .08, adj r^2 = .02, p = .158; long-term orientation, F [10,178] = 1.94, r = .31, r^2 = .10, adj r^2 = .05, p = .043). Lower levels of education accounted for unique variance in intent to persist and attachment, while no single variable accounted for unique variance in long-term orientation.

- Insert Table 7 here -

Table 7 also shows the results for Step 2, with the inclusion of the resilience measures caused a statistically significant change in R^2 for all aspects of marriage commitment (intent to persist, ΔR = .14, p < .001; attachment, ΔR = .10, p = .002; long-term orientation, ΔR = .14, p < .001). In terms of trait resilience, lower levels of adaptive capacity resilience traits predicted higher attachment commitment. In terms of the DRSS-Marriage scales, higher scores on the DRSS-Marriage engineering scale accounted for unique variance in higher levels of all three marriage commitment variables. In addition, higher scores on the DRSS-Marriage adaptive capacity scale accounted for unique variance in higher levels of long-term orientation in marriage.

Friendship Study. Table 8 shows the results of the multiple regression for social isolation outcomes. In Step 1, sex, age, income, educational level and personality demonstrated statistical significance in predicting levels of social isolation (F [9,163] = 21.14, r = .73, r^2 = .54, adj r^2 = .51, p < .001). Being female, higher extraversion, agreeableness, conscientiousness and emotional stability, accounted for unique variance in lower levels of social isolation.

- Insert Table 8 here -

Table 8 also shows the results for Step 2, with the inclusion of the resilience measures caused a statistically significant change in R^2 for social isolation ($\Delta R = .08$, $p < .001$). Higher levels of ecological resilience traits accounted for unique variance in lower levels of social isolation. Therefore, none of the DRSS-Friendship scales accounted for unique variance in level of social isolation.

Education Study. Table 9 shows the results of the multiple regression for university student engagement outcomes. In Step 1, sex, age and personality demonstrated statistical significance in predicting each type of educational engagement (behavioural educational engagement, F [7,203] = 10.03, $r = .51$, $r^2 = .26$, adj $r^2 = .23$, $p < .001$; emotional educational engagement, F [7,203] = 8.28, $r = .47$, $r^2 = .22$, adj $r^2 = .20$, $p < .001$; cognitive educational engagement, F [7,203] = 7.76, $r = .46$, $r^2 = .21$, adj $r^2 = .18$, $p < .001$). Higher agreeableness, conscientiousness and openness to experience accounted for unique variance in higher levels of behavioural engagement. Higher conscientiousness and openness to experience accounted for unique variance in emotional and cognitive engagement in education.

- Insert Table 9 here -

Table 9 also shows the results for Step 2, with the inclusion of both resilience measures caused a statistically significant change in R^2 for all aspects of engagement (behavioural educational engagement, $\Delta R = .14$, $p < .001$; emotional educational engagement, $\Delta R = .12$, $p < .001$; cognitive educational engagement, $\Delta R = .07$, $p < .001$). In terms of general resilience, higher levels of adaptive capacity predicted lower emotional educational engagement. In terms of the DRSS-Education scales, higher scores on the DRSS-Education ecological scales accounted for unique variance in higher levels of behavioural and emotional educational engagement. Higher scores on the DRSS-Education adaptive capacity scales accounted for unique variance in higher levels of emotional engagement. However, none of

the scales from either resilience measure accounted for unique variance in cognitive engagement.

Discussion

Our findings generally confirm the assessment of three resilience systems at a domain-specific level that reflect Holling's ecological systems model of resilience, comprising engineering, ecological and adaptive capacity resilience (Holling, 1973, 2006). The evidence for this is first demonstrated by the DRSS scales demonstrating acceptable reliability and a three-factor structure across the work, health, marriage, friendship, and education domains. Even though a proposed bi-factor model showed improved fit for the DRSS-Health and -Marriage (ΔCFI > .01; Cheung & Rensvold, 2002), the group factors in this model still account for most variance in the model. These findings suggest support for a three-factor structure for each version of the DRSS.

The findings demonstrate how domain-specific engineering, ecological, and adaptive capacity resilience incrementally predicted several positive life outcomes across work, health, marriage, and education (but not friendship and social isolation), while controlling for sex, age, personality, cognitive ability (when appropriate), general trait resilience, and context-specific variables (when appropriate). To summarise, the domain-specific engineering resilience predicts improved quality-of-life scores following the onset of illness (DRSS-Health) and marriage commitment (DRSS-Marriage) outcomes. The domain-specific ecological resilience dimension predicts improved work outcomes (DRSS-Work) and two of the three educational (behavioural and emotional educational engagement) outcomes (DRSS-Education). Adaptive capacity resilience predicts three aspects (satisfaction, lower exhaustion, and lower cynicism) of work outcomes (DRSS-Work) and long-term orientation in marriage (DRSS-Marriage) outcomes.

There is a pattern among these associations that suggest that specific types of resilience might be important for specific types of situations. Where disturbances relate to the *maintenance* of an *established* system (e.g. one's health or marriage), and in which there may be unknown and unexpected threats to that system (e.g. becoming ill, or having an argument), then engineering resilience (the speed and ease of the system to recover to a stable equilibrium) is most important. Where disturbances relate to a system that needs to be sustainable and propelled by set goals (i.e. work or education), and in which the system's ability to present and future goals is under threat (e.g. meeting job roles and targets, getting a degree), ecological resilience (the ability to absorb disturbance, maintain stability, and make changes to improve functioning) is most important. Finally, where disturbances may represent a crisis (such as burnout or cynicism in work, or no longer thinking of a marriage as long term), and in which the *retention* of the system is under threat (e.g. the system breaking down), adaptive capacity resilience (a preference for new processes and change so one naturally adapts to disturbance) is important.

These distinctions create a series of hypotheses that suggests engineering, ecological and adaptive capacity resilience map onto specific system contexts; i.e. maintenance (engineering), sustainability (ecological), and retention (adaptive capacity) of systems under disturbance. The mapping of the resilience and systems contexts in this way is consistent with theoretical descriptions of resilient systems and offers an intuitive way to apply these ideas and take them forward. For example, it is not new to learn that recovering quickly from an argument may be a predictor of a successful marriage (e.g. Selcuk, Stanton, Slatcher, & Ong, 2017), or that being able to maintain stability in a difficult job leads to successful work outcomes (e.g. Mortensen, 2014), or that being able to introduce new things to incorporate into a work role or marriage may prevent disillusionment with that job or relationship (e.g. Nieß & Zacher, 2015). What is new is that no previous study has suggested a link between

these observations across domains, linking it to specific resilient behaviours. Nonetheless, the ecological systems theory of resilience has been successfully applied to simply describing resilience in human psychology at a trait level (Maltby et al., 2015). The current findings extend this approach, emphasising how human resilience might be well understood in everyday domains such as work, marriage, or health, aligned with biological, ecological, and social systems literature.

The contrast between continuing versus maintaining, sustaining, and retaining systems may also explain why none of the DRSS-Friendship scales predicted unique variance in social isolation. This study focused on resilience around friendships, and it may be that friendships do not represent an easily identifiable system to be maintained, sustained, or retained, such as a marriage or a job. For example, there is arguably greater flexibility in friendships (e.g. exiting or make choices around a friendship) than in employment, a marriage, or an education course, or to avoid an illness. It may be that EEA resilience is an important outcome in friendships when friendships are an easily identifiable system; for example, when friendship are at a premium to the individual maintenance (for example, someone who relies on friends as their only mean of social support), or when an individual is asked about a 'best' friend. These are situations where there may be more benefits for the individual when those friendship(s) are maintained, sustained, or retained. A further consideration is that social isolation may not have been the best outcome measure for assessing the value of resilience in friendships, with friendship quality or length perhaps being better outcome indicators. Notwithstanding, the findings suggest that resilience in friendships does not account for unique variance in social isolation.

The finding that domain-specific resilience measures predict a range of outcome domains, whilst controlling for sex, age, personality and proxies for intelligence, and simultaneously for trait resilience, suggests that translating the ecological systems model of

resilience into measuring resilience at domain levels has a great degree of professional efficacy. In terms of future research, the studies described here present a number of scales, a general trait measure, and five domain-specific scales that could be employed across a number of psychological literatures. We also envisage that the template we have provided for the domain-specific scales could easily be adapted for other domains in which resilience has been considered, such as home, school, disability, specific illnesses and older age (Alschuler, Kratz, & Ehde, 2016; Manning, Carr, & Kail, 2016; Mechling, 2016; Sandoval-Hernández & Białowolski, 2016).

There are two considerations to the current findings. First, our theorising that EEA resilience within domain-specific situations map into processes that maintain, sustain, and retain systems is a post-hoc formulation. A real test would be to make a-priori statements regarding each of the domains and link engineering, ecological and adaptive capacity to specific processes in the domains that more accurately define processes that maintain (e.g. use of recovery strategies), sustain (focus on goal-orientated behaviour), or retain (ability to not experience crisis points) systems. This could be examined using finer grained outcomes in the domains identified here; for example, better indicators of work outcomes representing maintenance (e.g. working with established teams and projects), sustainability (e.g. reaching targets) or retention (e.g. long-term absence and sickness) of systems. Alternatively, it may best to test the theory by making predictions using the distinction between maintaining, sustaining, and retaining systems within other domains; for example, finances. Second, the studies herein only consider resilience at one-time point. Though this is a weakness in terms of attributing the contributing effects of resilience to particular outcomes over time (though previous studies have confirmed this in terms of resilience predicting better mental health [Maltby et al., 2015]), and of drawing any causal inferences, it is important, given the focus of the nomothetic tradition of personality research (e.g. Allport, 1937; Costa, McCrae, &

Odessa, 1992) of first conceptualising traits within an adaptive landscape (Buss, 1991). That is, we first fully describe how these resilience traits are mapped (i) in terms of their influence among a number of important domain-specific levels, and (ii) relative to a number of the main individual difference constructs, such as sex, age, personality and intelligence. The current evidence suggests that the ecological systems model of resilience, as measured by the DRSS, has relevance to human psychology.

In summary, the current findings suggest the identification of five three-factor resilience scales, which can be shown to be related to a number of positive outcomes across a number of life domains. The findings also suggest a distinction between the different aspects of resilience in terms of the types of outcomes they predict, and the systems they might be described therein. Engineering resilience may contribute most to life domains where an established system needs to be maintained (e.g. one's health or marriage). Ecological resilience may contribute most to life domains where the system needs sustainability in terms of present and future goal orientation (e.g. one's work or education). Adaptive capacity may contribute most to life domains where the system needs to retained, preventing it from reaching a crisis state. Together these findings suggest that EEA resilience may merit serious consideration – alongside other variables relevant to clinical and applied psychology, such as personality and intelligence – in attempts to understand positive adaptation across several life domains.

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Tables

Table 1

Demographic Data Relating to Ethnicity, Household Income, Highest Qualification, and Employment Status.

Demographic Variable	Frequency
Ethnicity	Caucasian (*n* =975)
	Black (*n* = 104)
	Asian (*n* = 92)
	Hispanic (*n* = 68)
	Arabic (*n* = 1)
	Other (*n* = 38)
Annual Income	$0 - $9,999 (*n* = 134)
	$10,000 - $19,999 (*n* = 176)
	$20,000 - $29,999 (*n* = 182)
	$30,000 - $39,999 (*n* = 201)
	$40,000 - $49,999 (*n* = 150)
	$50,000 - $59,999 (*n* = 147)
	$60,000 - $69,999 (*n* = 94)
	$70,000 - $79,999 (*n* = 72)
	$80,000 - $89,999 (*n* = 32)
	$90,000 - $99,999 (*n* = 35)
	More than $100,000 (*n* = 55)
Highest Qualification	No Qualification (*n* = 6)
	High School Diploma (*n* = 349)
	Associate Degree or Certificate (*n* = 254)
	Bachelor's Degree (*n* = 510)
	Master's Degree (*n* = 126)
	PhD or Advanced Professional Degree (*n* = 33)
Employment Status	Employed, working 40 or more hours per week (*n* = 741)
	Employed, working 1-39 or more hours per week (*n* = 321)
	Not employed, looking for work (*n* = 78)
	Not employed, not looking for work (*n* = 82)
	Retired (*n* = 23)
	Disabled, not able to work (*n* = 33)

Table 2

Confirmatory Factor Analysis Fit Statistics for the Different Models Proposed for the Domain-Specific Resilient Systems Scales across Five Domains.

	*x*2	*df*	*p* =<	CMIN/DF	CFI	NNFI	RMSEA	SRMR
Study/Sample				Unidimensional				
Work	898.726	54	.001	16.643	.607	.520	.224	.177
Health Treatment	1008.140	54	.001	18.669	.548	.448	.224	.171
Marriage	754.582	54	.001	13.974	.529	.424	.263	.196
Friends	658.045	54	.001	12.186	.651	.573	.255	.181
Education	559.275	54	.001	10.357	.618	.533	.211	.168
				Three-factor				
Work	141.778	51	.001	2.780	.958	.945	.076	.052
Health Treatment	146.850	51	.001	2.879	.955	.941	.073	.054
Marriage	177.810	51	.001	3.486	.915	.890	.115	.060
Friends	123.802	51	.001	2.427	.958	.946	.091	.052
Education	71.463	51	.001	1.401	.985	.980	.044	.044
				Bifactor				
Work	109.755	42	.001	2.613	.968	.950	.072	.071
Health Treatment	74.348	42	.002	1.770	.985	.976	.047	.028
Marriage	120.761	42	.001	2.875	.947	.917	.100	.042
Friends	99.716	42	.001	2.374	.967	.948	.089	.029
Education	49.198	42	.207	1.130	.991	.995	.0290	.037

Key: CMIN/DF = relative chi-square; CFI = Comparative Fit Index; NNFI = Non-normed Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual

Table 3

Common Variance and Mean Loadings Accounted for by the General and Group Factors of the Domain-Specific Resilient Systems Scales across Five Life Domains.

	General factor			Group factors							
	General resilience			Engineering		Ecological		Adaptive Capacity			
Study/Sample	Common variance	α	Mean loading	Common variance	α	Common variance	α	Common variance	α	Mean loading	
Work	38.7%	.86	.42	27.3%	.93	7.5%	.81	26.5%	.86	.67	
Health Treatment	43.5%	.86	.50	22.7%	.88	9.2%	.82	24.6%	.85	.56	
Marriage	44.4%	.84	.48	11.7%	.93	14.7%	.77	29.2%	.88	.53	
Friends	52.5%	.91	.61	19.4%	.96	9.4%	.85	18.7%	.88	.56	
Education	48.7%	.86	.52	9.0%	.90	15.1%	.85	27.3%	.85	.54	

Table 4

Adversity Scores of the Outcome Variables Across the Work, Health, Marriage, Friendship and Education Studies.

Outcome Variable	Minimum score	Maximum score	Criteria score for identifying adversity.	%	α
		Work Study (*n* = 312)			
Low Job Satisfaction	1	35	Scores below midpoint of 20	15.1%	.87
Exhaustion	0	30	Scores above midpoint of 15	46.2%	.86
Cynicism	0	36	Scores above midpoint of 18	33.1%	.89
Low Professional Efficacy	0	25	Scores below midpoint of 15	32.4%	.78
		Health Treatment Study (*n* = 354)			
EQ-D5L	5	21			.80
Mobility (EQ-D5L)	1	5	Moderate/severe/extreme problems	12.4%	N/A
Self-care (EQ-D5L)	1	5	Moderate/severe/extreme problems	8.5%	N/A
Activity (EQ-D5L)	1	5	Moderate/severe/extreme problems	13.8%	N/A
Pain (EQ-D5L)	1	5	Moderate/severe/extreme problems	26.6%	N/A
Anxiety/Depression (EQ-D5L)	1	5	Moderate/severe/extreme problems	29.7%	N/A

Seriousness of Illness	1	5	Somewhat/a lot/extremely serious	46.9%	N/A
Recency of Illness	1	4	On-going or within last week	50.6%	N/A
		Marriage Study (n = 189)			
Low intent to persist	1	45	Scores below midpoint of 25	6.9%	.92
Low attachment	1	45	Scores below midpoint of 25	8.5%	.80
Low long-term orientation	1	45	Scores below midpoint of 25	9.0%	.88
		Friendship Study (n = 173)			
Social Isolation	1	25	Scores above midpoint of 15	22.0%	.80
		Education Study (n = 211)			
Low cognitive engagement	1	35	Scores below midpoint of 20	4.3%	.73
Low behavioral engagement	1	35	Scores below midpoint of 20	2.8%	.80
Low affective engagement	1	35	Scores below midpoint of 20	10.0%	.79

Key: N/A = Not applicable.

Table 5

Regression Analysis with Job Satisfaction, Exhaustion, Cynicism and Professional Efficacy Burnout Used as Dependent Variables, Sex, Age, Income, Education Level, Personality, Used as Predictor Variables in Step 1, and EEA Trait Resilience and DRSS-Work Scales Used as Predictor Variables in Step 2

	Job satisfaction				Exhaustion			
Predictor variables	B	β	t	Sig	B	β	t	Sig
Step 1								
Sex	.50	.05	.87	.386	.37	.03	.59	.558
Age	-.03	-.08	-1.41	.160	-.01	-.02	-.32	.753
Income	.32	.16	2.73	.007	-.18	-.08	-1.42	.156
Educational level	.09	.02	.35	.725	-.16	-.03	-.54	.591
Extraversion	.32	.21	3.84	.000	-.27	-.16	-3.00	.003
Agreeableness	.36	.16	2.73	.007	-.12	-.05	-.85	.394
Conscientiousness	.27	.13	2.20	.029	-.25	-.11	-1.81	.071
Emotional stability	.25	.14	2.19	.029	-.55	-.28	-4.49	.000
Openness	-.15	-.08	-1.41	.160	-.03	-.02	-.29	.772
Step 2								
Engineering (EEA trait)	-.16	-.10	-1.08	.281	.09	.05	.53	.599
Ecological (EEA trait)	-.27	-.14	-1.66	.098	.32	.15	1.66	.099
Adaptive Capacity (EEA trait)	-.20	-.14	-1.58	.116	.17	.11	1.14	.254
Engineering (DRSS-Work)	.37	.22	2.48	.014	-.30	-.17	-1.77	.077

Ecological (DRSS-Work)	.76	.39	5.00	.000	-.54	-.26	-3.12	.002
Adaptive Capacity (DRSS-Work)	.33	.22	2.73	.007	-.32	-.19	-2.29	.023
	Cynicism				Low professional efficacy			
	B	β	t	Sig	B	β	t	Sig
Step 1								
Sex	-1.28	-.09	-1.68	.093	-.99	-.10	-1.89	.059
Age	.01	.01	.18	.854	-.07	-.16	-3.12	.002
Income	-.10	-.04	-.65	.520	-.14	-.07	-1.33	.185
Educational level	-.05	-.01	-.13	.894	-.08	-.02	-.35	.728
Extraversion	-.38	-.19	-3.43	.001	-.19	-.13	-2.53	.012
Agreeableness	-.34	-.12	-1.96	.051	-.18	-.08	-1.50	.134
Conscientiousness	-.44	-.16	-2.70	.007	-.59	-.29	-5.17	.000
Emotional stability	-.46	-.19	-3.09	.002	-.18	-.10	-1.76	.080
Openness	.11	.04	.77	.441	-.08	-.04	-.80	.426
Step 2								
Engineering (EEA trait)	.24	.12	1.17	.243	.15	.10	1.20	.232
Ecological (EEA trait)	.16	.06	.73	.469	.06	.03	.39	.698
Adaptive Capacity (EEA trait)	.42	.22	2.40	.017	.16	.11	1.44	.150
Engineering (DRSS-Work)	-.35	-.16	-1.73	.085	-.39	-.25	-3.06	.002
Ecological (DRSS-Work)	-.71	-.28	-3.44	.001	-.78	-.42	-5.98	.000
Adaptive Capacity (DRSS-Work)	-.55	-.28	-3.34	.001	-.13	-.09	-1.21	.228

Key: EEA = EEA Trait Resilience Scales; DRSS = Domain-Specific Resilient Systems Scales.

Table 6

Regression Analysis with Quality-of-Life Descriptive System and Quality-of-Life Visual Analogue Scale Used as Dependent Variables, and Sex, Age, Income, Education Level, Personality, Recency of Illness and Seriousness of Illness Used as Predictor Variables in Step 1, and EEA Trait Resilience and DRSS-Health Scales Used as Predictor Variables in Step 2

	Quality-of-life descriptive system				Health rating visual analogue			
Predictor variables	B	β	t	Sig	B	β	t	Sig
Step 1								
Sex	-.29	-.04	-.93	.354	.92	.02	.50	.621
Age	-.02	-.05	-1.07	.284	-.03	-.02	-.37	.710
Income	-.11	-.03	-.71	.482	.89	.05	.94	.348
Educational level	-.12	-.09	-1.84	.066	.69	.10	1.85	.065
Extraversion	.03	.03	.52	.601	.04	.01	.14	.890
Agreeableness	-.09	-.07	-1.35	.177	.12	.02	.31	.753
Conscientiousness	-.13	-.10	-1.92	.056	.93	.12	2.27	.024
Emotional stability	-.21	-.18	-3.41	.001	.36	.06	1.01	.312

Openness	-.02	-.02	-.30	.766	.21	.03	.57	.567
Recency of illness	.32	.13	2.62	.009	-2.62	-.18	-3.63	.000
Seriousness of illness	1.17	.37	7.64	.000	-6.01	-.33	-6.62	.000
Step 2								
Engineering (EEA trait)	-.02	-.03	-.35	.725	.27	.05	.66	.512
Ecological (EEA trait)	-.14	-.11	-1.46	.144	.12	.02	.21	.835
Adaptive Capacity (EEA trait)	.11	.11	1.57	.119	-.38	-.07	-.94	.350
Engineering (DRSS-Health)	-.31	-.30	-4.66	.000	1.51	.26	3.82	.000
Ecological (DRSS-Health)	.04	.03	.43	.671	.56	.08	1.05	.294
Adaptive Capacity (DRSS-Health)	-.01	-.01	-.12	.902	-.08	-.01	-.20	.840

Key: EEA = EEA Trait Resilience Scales. DRSS = Domain-Specific Resilient Systems Scales.

Table 7

Regression Analysis with Intent to Persist, Attachment and Long-term Orientation Commitment towards Marriage as Dependent Variables, and Sex, Age, Income, Education Level and Personality Used as Predictor Variables in Step 1, and EEA Trait Resilience and DRSS-Marriage Scales Used as Predictor Variables in Step 2

	Intent to persist				Attachment				Long-term orientation			
Predictor variables	B	β	t	Sig	B	β	t	Sig	B	β	t	Sig
Step 1												
Sex	-2.10	-.14	-1.79	.075	-1.38	-.09	-1.22	.225	.05	.01	.04	.967
Age	.03	.04	.38	.704	-.11	-.15	-1.44	.151	-.13	-.15	-1.51	.134
Income	-.09	-.03	-.36	.718	.05	.02	.21	.832	.17	.06	.65	.518
Educational level	-1.45	-.20	-2.61	.010	-1.21	-.17	-2.23	.027	-1.06	-.14	-1.78	.077
Length of marriage	.56	.10	1.05	.298	.63	.12	1.23	.221	.44	.07	.77	.444
Extraversion	.64	.14	1.78	.078	.45	.10	1.28	.203	.72	.15	1.88	.062
Agreeableness	-.14	-.03	-.44	.663	.18	.05	.58	.562	.15	.04	.46	.649
Conscientiousness	-.28	-.06	-.76	.448	-.25	-.05	-.70	.487	.01	.01	.01	.995
Emotional stability	.72	.13	1.60	.111	.40	.07	.92	.360	.93	.16	1.95	.053

Openness	.07	.02	.22	.829	-.03	-.01	-.09	.930	-.13	-.03	-.39	.697
Step 2												
Engineering (EEA trait)	-.35	-.15	-1.44	.151	-.45	-.20	-1.88	.062	-.45	-.18	-1.75	.082
Ecological (EEA trait)	.58	.20	1.82	.071	.57	.21	1.79	.075	.48	.16	1.41	.160
Adaptive Capacity (EEA trait)	-.39	-.18	-1.69	.093	-.47	-.23	-2.06	.041	-.31	-.14	-1.26	.209
Engineering (DRSS-Marriage)	.89	.35	3.42	.001	.79	.33	3.05	.003	.80	.30	2.90	.004
Ecological (DRSS-Marriage)	-.04	-.01	-.12	.904	-.18	-.06	-.53	.597	.31	.10	.86	.392
Adaptive Capacity (DRSS-Marriage)	.42	.20	1.84	.067	.33	.16	1.47	.144	.48	.21	1.99	.048

Key: EEA = EEA Trait Resilience Scales. DRSS = Domain-Specific Resilient Systems Scales.

Table 8

Regression Analysis with Social Isolation Used as the Dependent Variable, and Sex, Age, Income, Education Level and Personality Used as Predictor Variables in Step 1, and EEA Trait Resilience and DRSS-Friendship Scales Used as Predictor Variables in Step 2

	Social isolation			
Predictor Variables	B	β	t	Sig
Step 1				
Sex	-1.28	-.14	-2.43	.016
Age	.02	.06	1.02	.312
Income	.10	.05	.80	.424
Educational level	-.19	-.04	-.73	.465
Extraversion	-.28	-.22	-3.63	.000
Agreeableness	-.22	-.13	-2.10	.037
Conscientiousness	-.25	-.15	-2.34	.020
Emotional stability	-.67	-.47	-6.59	.000
Openness	-.01	-.01	-.10	.919
Step 2				
Engineering (EEA trait)	-.09	-.08	-.86	.393
Ecological (EEA trait)	-.50	-.36	-3.45	.001
Adaptive Capacity (EEA trait)	.15	.11	1.28	.202
Engineering (DRSS-Friendship)	-.18	-.15	-1.90	.059
Ecological (DRSS-Friendship)	.16	.10	1.04	.301
Adaptive Capacity (DRSS-Friendship)	-.06	-.04	-.47	.637

Key: EEA = EEA Trait Resilience Scales. DRSS = Domain-Specific Resilient Systems Scales.

Table 9

Regression Analysis with Levels of Behavioral, Emotional and Cognitive Engagement in Education as the Dependent Variables, and Sex, Age and Personality Used as Predictor Variables in Step 1 and EEA Trait Resilience and DRSS-Education Scales Used as Predictor Variables in Step 2

	Behavioral				Emotional				Cognitive			
Predictor variables	B	β	t	Sig	B	β	t	Sig	B	β	t	Sig
Step 1												
Sex	.30	.03	.44	.661	1.00	.07	1.17	.246	.24	.02	.32	.751
Age	-.08	-.05	-.82	.413	.01	.01	.06	.954	-.06	-.04	-.56	.580
Extraversion	.06	.05	.73	.466	-.09	-.06	-.90	.368	-.12	-.09	-1.27	.207
Agreeableness	.33	.20	2.92	.004	.27	.13	1.89	.061	.13	.07	1.01	.316
Conscientiousness	.54	.34	5.34	.000	.50	.26	3.92	.000	.33	.19	2.89	.004
Emotional stability	.03	.02	.26	.796	.12	.07	.96	.338	.04	.03	.41	.682
Openness	.21	.14	2.09	.038	.49	.26	3.86	.000	.63	.38	5.57	.000
Step 2												
Engineering (EEA trait)	-.07	-.06	-.59	.559	-.12	-.08	-.76	.447	.06	.05	.42	.676

Ecological (EEA trait)	.20	.12	1.21	.229	.38	.19	1.83	.069	.26	.15	1.37	.174
Adaptive Capacity (EEA trait)	-.09	-.08	-.74	.458	-.37	-.26	-2.43	.016	.11	.09	.83	.411
Engineering (DRSS-Education)	-.06	-.05	-.45	.654	.04	.02	.23	.822	-.04	-.03	-.25	.804
Ecological (DRSS-Education)	.62	.40	4.45	.000	.48	.25	2.66	.008	.29	.18	1.81	.072
Adaptive Capacity (DRSS-Education)	.04	.04	.37	.713	.36	.24	2.32	.021	.01	.01	.01	.991

Key: EEA = EEA Trait Resilience Scales. DRSS = Domain-Specific Resilient Systems Scales.

Figure 1

Recruitment to studies across two sampling administrations

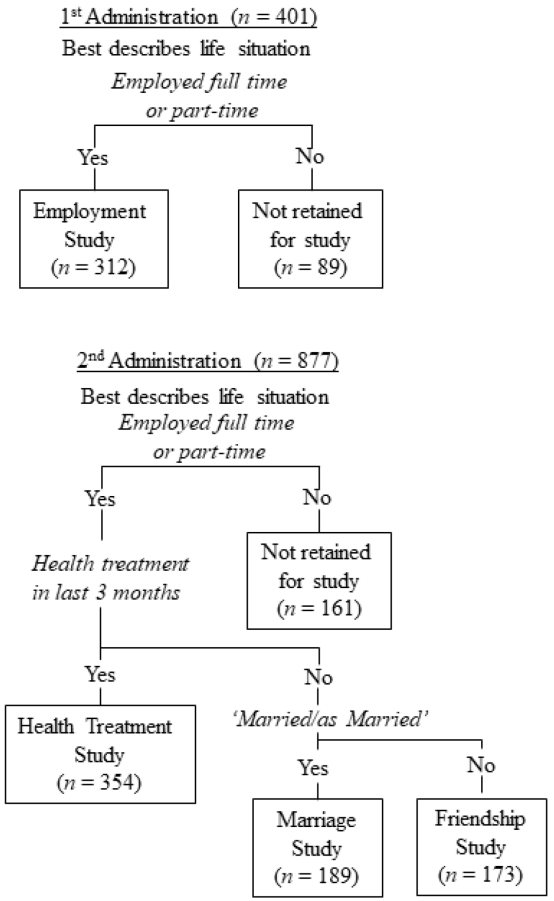

Figure 2

Items written for the Domain-Specific Resilient Systems Scales (Work and Education in Set 1; Health, Marriage and Friendship in Set 2).

Set 1

1. I recover from difficult situations at *work/college/school/university* with ease
2. I recover from a stressful time at *work/college/school/university* quickly
3. I quickly get back to my normal self at *work/college/school/university* following problems at *work/college/school/university*
4. I easily get back to my normal self at *work/college/school/university* after tough experiences at *work/college/school/university*
5. I am always able to give all I can at *work/college/school/university*, regardless of what may happen at *work/college/school/university*
6. I remain strong-willed at *work/college/school/university*, no matter what problems occur at *work/college/school/university*
7. Even with problems at *work/college/school/university*, I am able to function to achieve my goals at *work/college/school/university*
8. No matter what happens at *work/college/school/university*, I find ways to get things done at *work/college/school/university*
9. I like it when my *work/educational life* changes
10. I like coping with unpredictable situations at *work/college/school/university*
11. Uncertain situations at *work/college/school/university* interest me
12. I enjoy it when there are changes to my routine at *work/college/school/university*

Set 2

1. I recover from difficult situations with regards to my *health/marriage/friends* with ease
2. I recover from a stressful time with regards to my *health/marriage/friends* quickly
3. I quickly get back to my normal self following problems *with my health/marriage/friends*
4. I easily get back to my normal self after tough experiences *with my health/marriage/friends*
5. I am always able to give all I can with regards to my *health/marriage/friends*, regardless of what may happen *with my health/marriage/friends*
6. I remain strong-willed with regards to my *health/marriage/friends*, no matter what problems occur *with my health/marriage/friends*
7. Even when there are problems with my *health/marriage/friends*, I am able to function to achieve my goals *with regards to my health/marriage/friends*
8. No matter what happens with my *health/marriage/friends*, I find ways to get things done *in regards to my health/marriage/friends*
9. I like it when life changes with regards to my *health/marriage/friends*
10. I like coping with unpredictable situations with regards to my *health/marriage/friends*
11. Uncertain situations interest me with regards to my *health/marriage/friends*
12. I enjoy it when there are changes to my routine with regards to my *health/marriage/friends*

Note. Reponses use a 5-point scale: “1=Strongly Disagree”, “2=Disagree”, “3=Neither Agree nor Disagree”, “4=Agree”, “5=Strongly Agree.

Footnotes

(1) Those not used in either administration (1st administration, $n = 89$; 2nd administration, $n = 161$) were routed to other studies, for which we hoped to gain sufficient participant numbers. However, after two administrations, we were unable to recruit sufficient participants (i.e. $n < 150$) to these studies. Therefore, results for these respondents are not reported.