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Health specific traits beyond the Five Factor Model, cognitive processes and trait expression: replies to Watson (2012), Matthews (2012) and Haslam, Jetten, Reynolds, and Reicher (2012)

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Health specific traits beyond the Five Factor Model, cognitive processes and trait expression: replies to Watson (2012), Matthews (2012) and Haslam, Jetten, Reynolds, and Reicher (2012)

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In this article we reply to the issues raised by the three commentaries on Ferguson's (2012) article. Watson argues that the four traits identified by Ferguson (2012) – health anxiety, alexithymia, empathy and Type D – do not lie outside the Five Factor Model (FFM). We present factor analytic data showing that health anxiety forms a separate factor from positive and negative affectivity, alexithymia forms a factor outside the FFM and while emotional empathy loads with agreeableness, cognitive empathy forms a separate factor outside the FFM. Across these analyses there was no evidence for a general factor of personality. We also show that health anxiety, empathic facets and alexithymia show incremental validity over FFM traits. However, the evidence that Type D lies outside the FFM is less clear. Matthews (2012) argues that traits have a more distributed influence on cognitions and that attention is not part of Ferguson's framework. We agree; but Ferguson's original statement concerned where traits have their maximal effect. Finally, Haslam et al. suggest that traits should be viewed from a dynamic interactionist perspective. This is in fact what Ferguson (2012) suggested and we go on to highlight that traits can also influence group processes.

Keywords: personality; health; factor analysis; determinism; empathy

The first author would like to thank all the commentators (Haslam, Jetten, Reynolds, & Reicher, 2012; Matthews, 2012; Watson, 2012) for their detailed, insightful and thought provoking commentaries on Ferguson's (2012) target article. In so doing, they highlight a number of key issues that require some further consideration and clarification, specifically: (1) Do the health specific traits detailed by Ferguson (2012) lie outside the Five Factor Model (FFM) (Watson, 2012)? (2) Are specific traits associated with specific cognitive processes (Matthews, 2012)? (3) Are traits simply deterministic, with group processes a more important influence on behaviour than traits (Haslam et al., 2012)? (4) Are biological and evolutionary models of trait expression too simplistic to explain the relationship between personality, culture and health (Matthews, 2012)?

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Do health anxiety, empathy, alexithymia and Type D lie outside the FFM?

In his commentary, Watson (2012) agrees that hierarchical personality models are important for the consideration of health effects and suggests that the FFM may be considered as an encompassing framework, arguing persuasively that the four traits – health anxiety, empathy, alexithymia and Type D – identified by Ferguson (2012) as of specific interest to health psychology, do not lie outside the FFM, but in fact are subsumed within the FFM framework. Specifically, Watson argues that these specific traits may represent either (1) facets of the FFM (empathy being a facet of agreeableness), (2) context specific instantiations of broader traits (health anxiety) (see also Matthews, 2012) or (3) blends of FFM traits (alexithymia and Type D). We agree that these are all possible. There are, however, two general tests we can apply to examine if these specific traits lie outside the FFM framework (Watson, 2012): (1) the traits can be identified as distinct factors lying outside the FFM framework using factor analytic procedures and (2) these traits show incremental validity over the FFM domains. Here we apply these tests to health anxiety, empathy and alexithymia, and review recent data on Type D with respect to the second test.

Factor analysis and incremental validity

Exploratory factor analyses were conducted in M*plus* 6 (Muthén & Muthén 1998–2010) to explore whether the health specific traits highlighted by Ferguson (2012) lie outside the FFM. When analyses were conducted at the item level the data were treated as ordered categorical variables with the models estimated using a weighted least squares estimator[1] (Wirth & Edwards, 2007). Models were rotated using GEOMIN. Full Information Maximum Likelihood (FIML) was used to estimate missing values. Loadings of 0.3 or greater were taken to define an item as loading on a factor.[2] The Scree test and Parallel analysis (based on a 100 replications) were used to identify the number of factors to extract and the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Residual (SRMR) fit statistics also used to judge the adequacy of the final model. The CFI should be close to 0.95, the RMSEA close to 0.06 and the RMSR close to 0.08 (Hu & Bentler, 1999). All models were specified at the item level if the *N*:*p* (number of subjects to number of item) ratio was greater than 10:1 (see Ferguson & Cox, 1993), otherwise scale level analyses were conducted. Item level, as opposed to scale level, analyses were preferred as they allow a test of trait overlap when the widest breadth of behaviours (items) is assessed.

Health anxiety

Watson (2012) argues that health anxiety can be subsumed specifically under neuroticism and that health anxiety is a situational instantiation of general anxiety/neuroticism. As such, it is necessary to show that health anxiety is a distinct factor from negative affectivity, but also that it shows incremental validity over neuroticism. To address this, data were analysed using a seven item index of health anxiety derived from the Whiteley Index and scored on a 5-point Likert type scale (1 = strongly disagree, 5 = strongly agree; Ferguson, 2009a), an index of symptoms based on twelve common symptoms each scored on a 6 point Likert type scale (0 = did not

experience the symptom, 1 = experienced the symptom mildly, 5 = experienced the symptom very severely) (Ferguson, Cassaday, Erskind, & Delahaye, 2004; Isaac et al., 1995; Robbins & Kirmayer, 1991), and positive and negative affectivity assessed using the PANAS (Watson, Clarke, & Tellegen, 1988). The sample was a community based sample of 707 participants (see Ferguson, 2009a). Ten participants were removed due to over 75% or more missing data on the symptom index ($N = 697$), giving an N–p ratio of approximately 18:1.

There was a small amount of missing data (0.1–2.0% at the item level and 0.01% across the data-set).[3] There were eight eigenvalues greater than 1, however, the Scree test and parallel analysis indicated four factors, accounting for 45.9% of the variance, were the optimal number of factors to extract. The four factor solution is shown in Table 1. The fit statistics for the four factor model were good (CFI = 0.95; RMSEA = 0.08; SRMR = 0.05). The results clearly show that symptom reporting, health anxiety and positive and negative affect load on separate factors.

Incremental validity was assessed with respect to symptom reporting as there is good empirical evidence that both neuroticism and health anxiety predict symptom reporting (Ferguson, 2000). The hierarchical regression presented in Table 2 shows that health anxiety adds incrementally to the prediction of symptom reporting over and above the effects observed for positive and negative affectivity, replicating previous findings with respect to symptom reporting (Fergus & Valentiner, 2011; Ferguson, 2000). Furthermore, Ferguson, Cassaday, Ward, and Weyman (2006), using a daily diary methodology, have also shown that the severity of daily symptoms was predicted by health anxiety but not neuroticism, when both were modelled simultaneously (http://www.hse.gov.uk/research/rrpdf/rr501.pdf). Finally, Fergus and Valentiner (2011) also show that health anxiety shows incremental validity over PANAS negative affectivity with respect to health care utilization.

Empathy

Watson (2012) presents a persuasive case for empathy as a facet of agreeableness. The evidence that Watson (2012) cites to make this case treats empathy as a unitary construct (e.g., del Barrio, Aluja, & García, 2004). However, empathy is itself a multi-dimensional construct – consisting of at least emotional empathy and perspective taking (cognitive empathy) (Davis, 1983: see Batson, 2009 for a wider discussion). These 'domains' of empathy (1) have very different neurological underpinnings (Blair, 2005; Singer & Lamm, 2009), (2) show differential behavioural/emotional predictions (Davis et al., 1999) and (3) are differentially related to psychopathology (Blair, 2005). The more important question, therefore, is not if the unitary construct of empathy is related to agreeableness but rather what are the associations between agreeableness and the facets of empathy. We examined this in a sample of 805 (M age = 20.5; SD = 2.7, 52% female) undergraduates at two large UK universities (see Skatova, 2011 for details) who completed the Goldberg (1992) 35 bipolar markers of the Big 5[4] (emotional stability [ES], agreeableness [A], conscientiousness [C], intellect [I] and surgency [S]: αs = 0.93 – 0.96) and the empathic concern ($\alpha = 0.78$) and perspective taking ($\alpha = 0.76$) scales from Davis' (1983) interpersonal reactivity index (IRI). Participants also completed the Vector of Individual Choice – Degree (VIC-D), which is an index of students' motivations to study their chosen degrees (Skatova, 2011). The VIC-D indexes 4 motivations

Table 1. GEOMIN rotated loadings for symptom reporting, health anxiety and positive and negative affectivity.

	Symptoms	Health anxiety	Positive affect	Negative affect
Headaches	**0.41**	−0.07	−0.07	0.08
Dizziness	**0.46**	−0.08	−0.08	0.15
Palpitations	**0.45**	0.00	0.00	0.28
Weakness/fatigue	**0.54**	0.04	−0.05	0.21
Upset stomach	**0.46**	−0.07	0.00	0.16
Pains in limbs	**0.92**	0.00	0.07	0.22
Pains in joints	**0.88**	0.05	0.07	−0.21
Sexual problems	**0.40**	0.05	−0.05	0.19
Breathlessness	**0.52**	0.07	0.00	0.13
Sweatiness	**0.50**	0.02	−0.02	0.09
Tingling in hands and feet	**0.57**	0.06	0.01	0.04
Irregular bowel movements	**0.53**	0.00	−0.03	0.11
If I feel ill and someone says I look better, I become annoyed	0.00	**0.53**	0.03	0.03
People do not take my illnesses seriously enough	0.12	**0.55**	−0.03	0.02
I am bothered by the idea that something serious is wrong with my body	0.11	**0.73**	0.00	0.03
I worry about my health more than most people	0.03	**0.83**	0.02	0.03
I am afraid of illness	−0.03	**0.72**	0.02	0.08
If a disease is brought to my attention, I worry about getting it myself	−.007	**0.73**	0.03	0.00
I am bothered by many aches and pains	**0.46**	**0.46**	−0.04	−0.12
Interested	−0.02	−0.04	**0.76**	0.00
Excited	−0.01	−0.02	**0.62**	0.10
Strong	−0.01	−0.06	**0.64**	−0.09
Enthusiastic	0.00	0.00	**0.84**	0.02
Proud	0.06	0.07	**0.68**	−0.12
Alert	0.00	−0.01	**0.77**	−0.04
Inspired	−0.04	−0.01	**0.75**	0.06
Determined	0.09	0.02	**0.78**	0.02
Attentive	−0.01	0.00	**0.71**	0.02
Active	−0.06	0.00	**0.61**	−0.03
Disinterested	0.16	0.04	−0.07	**0.64**
Upset	0.24	−0.02	0.03	**0.67**
Guilty	−0.02	0.02	0.15	**0.69**
Scared	−0.07	0.09	0.03	**0.85**
Hostile	0.04	0.00	0.00	**0.53**
Irritable	0.17	−0.03	−0.03	**0.55**
Ashamed	−0.09	0.05	−0.04	**0.74**
Nervous	−0.06	−0.01	0.05	**0.77**
Jittery	0.15	−0.04	−0.03	**0.75**
Afraid	−0.03	0.08	−0.01	**0.89**

Note: The figures in bold indicate loadings greater than .30.

Table 2. Hierarchical regression of symptom reporting on health anxiety and positive and negative affectivity.

	Step 1	Step 2
Negative affect	0.40**	0.30**
Positive affect	−0.09*	−0.06
Health anxiety		0.28**
R^2	0.19**	0.25**
ΔR^2		0.06**

*$p < 0.05$, **$p < 0.01$.

derived from theory in social psychology and behavioural economics: (1) career (e.g., it provides good career options: $\alpha = 0.81$) which is self-oriented; (2) loafing (e.g., the degree seemed to be easy to pass: $\alpha = 0.73$) which is also self-oriented; (3) helping (e.g., I want to help other people: $\alpha = 0.83$) which is other focused and (4) interest (e.g., I wanted to know more about this subject: $\alpha = 0.83$) which reflects intrinsic motivation. The N:p ratio was 16:1.

There was a small amount of missing data (0.1–0.2% at the item level and 0.01% for the overall data-set). There were 11 eigenvalues greater than 1. The Scree test indicated six factors and parallel analysis that seven factors were the optimal number of factors. Both six and seven factor solutions were explored. The seven factor solution was not interpretable (no items loaded on the seventh factor above 0.30). The fit statistics for the six factor model were good (CFI = 0.92; RMSEA = 0.087; SRMR = 0.045) and as such the six factor solution was explored, which accounted for 46.2% of the variance. The solution is shown in Table 3. This solution shows the five factors that make up the FFM. However, the intellect factor is somewhat less clear and marked by loadings on 3 adjectives, curiosity, imaginative and creative, with intelligent, analytical and reflective cross-loading on conscientiousness. The issue of interest here, however, is the loadings of the empathy items designed to assess empathic concern and perspective taking. The pattern of loadings suggests that of the FFM domains, agreeableness is associated with empathy, but only empathic concern (affective empathy). Six of the seven empathic concern items load with the agreeableness adjectives. The perspective taking items, on the other hand, loaded on a separate factor with a single empathic concern item. These results show that of the domains of empathy – empathic concern – is subsumed within agreeableness but perspective taking is separate.

Incremental validity was assessed with respect to predicting motivations for degree choice. As the FFM domains have previously been shown to be associated with academic motivations (Clark & Schroth, 2010), exploring the incremental validity in this context provides a reasonable test of the hypothesis that empathy has incremental validity over the FFM domains. Specifically, empathy, along with agreeableness, should be negatively associated with the selfishly oriented motivations (loafing and career) and positively with the unselfish motive (helping). The interest motivation reflects intrinsic motivation and is associated with choosing a degree in Arts and Humanities (Skatova, 2011). Furthermore, Clark and Schroth (2010) have shown that intrinsic motivations are linked to higher agreeableness. As such, it might

Table 3. GEOMIN rotated loadings for Goldberg's (1992) five factor adjectives and empathy.

	S	A/EC	C	ES	PT	I
Extroverted	**0.77**	0.00	−0.08	−0.08	0.04	−0.03
Energetic	**0.52**	0.15	0.18	0.05	−0.26	0.11
Talkative	**0.78**	0.03	−0.05	−0.17	0.07	−0.05
Bold	**0.84**	−0.17	0.00	0.00	0.10	0.00
Active	**0.49**	0.17	0.25	0.07	−0.25	0.09
Assertive	**0.61**	−0.14	0.23	−0.02	−0.02	0.03
Adventurous	**0.42**	0.11	0.02	0.09	−0.07	0.25
Warm	0.21	**0.56**	−0.04	0.13	0.02	0.04
Kind	−0.03	**0.68**	0.13	0.15	0.00	0.04
Cooperative	−0.16	**0.55**	0.22	0.19	−0.01	0.02
Unselfish	−0.02	**0.54**	0.06	0.26	0.01	−0.01
Agreeable	−0.10	**0.49**	0.11	0.12	0.00	−0.01
Trustful	0.09	**0.40**	0.17	0.21	−0.04	0.03
Generous	0.15	**0.39**	0.07	0.06	−0.06	0.16
Organised	0.02	−0.04	**0.71**	−0.06	−0.02	−0.18
Responsible	−0.04	0.12	**0.75**	0.05	0.00	−0.08
Conscientious	−0.04	0.13	**0.69**	−0.03	0.10	0.00
Practical	0.02	−0.02	**0.57**	0.10	0.04	0.12
Thorough	−0.05	−0.02	**0.78**	−0.04	0.05	−0.02
Hardworking	0.05	0.10	**0.65**	−0.07	−0.03	−0.05
Thrifty	−0.19	0.06	**0.24**	0.12	0.02	0.04
Calm	−0.04	0.16	0.00	**0.64**	0.11	0.03
Relaxed	***0.32***	−0.02	−0.16	**0.80**	0.03	0.03
At ease	***0.45***	−0.09	−0.16	**0.69**	0.00	0.03
Not envious	0.11	0.00	0.01	**0.50**	0.03	0.02
Stable	0.26	0.05	0.21	**0.56**	−0.05	−0.17
Contented	***0.35***	0.13	0.09	**0.51**	−0.01	−0.08
Unemotional	0.00	−0.29	−0.01	**0.42**	−0.18	−0.06
Intelligent	0.13	−0.15	***0.34***	0.11	−0.05	**0.35**
Analytical	0.04	−0.17	***0.38***	0.00	0.13	**0.44**
Reflective	0.02	0.00	***0.31***	−0.14	***0.34***	**0.37**
Curious	0.20	0.01	0.16	−0.12	0.16	**0.46**
Imaginative	0.00	0.26	−0.07	−0.06	−0.01	**0.81**
Creative	0.00	0.23	−0.05	0.01	0.00	**0.80**
Sophisticated	0.10	0.01	0.29	0.15	0.04	0.15
I often have tender, concerned feelings for people less fortunate than me [EC]	0.03	**0.53**	0.01	−0.09	***0.33***	0.00
Sometimes I don't feel very sorry for other people when they are having problems. [EC]R	−0.07	**−0.43**	0.02	0.05	−0.17	0.16
Other people's misfortunes do not usually disturb me a great deal. [EC]R	−0.05	**−0.57**	0.07	0.19	−0.27	0.14
When I see someone being treated unfairly, I sometimes don't feel very much pity for them. [EC]R	−0.08	**−0.47**	−0.02	0.17	−0.27	0.14
I am often quite touched by things that I see happen. [EC]	0.02	**0.46**	−0.02	−0.22	0.***38***	0.14

Table 3 (*Continued*)

	S	A/EC	C	ES	PT	I
I would describe myself as a pretty soft-hearted person. [EC]	−0.08	**0.51**	−0.10	−0.02	***0.32***	0.07
When I see someone being taken advantage of, I feel kind of protective towards them. [EC]	0.08	0.28	0.09	−0.14	**0.39**	0.03
I sometimes find it difficult to see things from the 'other guy's' point of view. [PT]R	−0.04	−0.16	−0.07	−0.13	**−0.35**	0.09
I try to look at everybody's side of a disagreement before I make a decision. [PT]	−0.09	−0.03	0.16	0.21	**0.60**	0.08
I sometimes try to understand my friends better by imagining how things look from their perspective. [PT]	0.02	0.12	0.00	0.14	**0.61**	0.00
If I'm sure I'm right about something, I don't waste much time listening to other people's arguments. [PT]R	0.09	−0.25	−0.02	−0.08	***−0.24***	0.14
I believe that there are two sides to every question and try to look at them both. [PT]	−0.03	0.02	0.10	0.19	**0.62**	0.11
When I'm upset at someone, I usually try to 'put myself in his shoes' for a while. [PT]	0.00	0.00	−0.05	***0.34***	**0.74**	−0.02
Before criticizing somebody, I try to imagine how I would feel if I were in their place. [PT]	−0.03	0.02	0.00	***0.34***	**0.70**	0.00

S, surgency; ES, emotional stability; I, intellect; C, conscientiousness; A, agreeableness; PT, perspective taking; EC, empathic concern.
Note: The figures in bold indicate loadings greater than .30 on the target factor and the figures in bold italics indicate cross-loadings greater than .30

be expected that the interest motivation should be positively associated with both agreeableness and empathy (empathic concern and perspective taking).

Given the small amount of missing data, missing values were replaced with item means. The results are presented in Table 4. As can be seen empathic concern showed clear and consistent incremental validity over the FFM domains across all the analyses, with perspective taking also showing incremental validity with respect to helping. Empathic concern was, as predicted, negatively associated with the career and loafing motivations and positively associated with helping. Thus, while empathic concern forms a factor with agreeableness it does add explanatory power over agreeableness. Overall the factor analytic and incremental validity analyses provide initial evidence that some domains of empathy may lie outside the FFM domains. This study only examined two domains of empathy. However, the domain space of empathy is likely to be much wider than this, and indeed Batson (2009) has identified eight different domains/definitions of empathy. Examining the links between empathy and agreeableness should therefore, be set within a wider conceptual model

Table 4. Hierarchical regression of FFM domains and empathic traits on motivations for degree choice.

	Interest		Helping		Loafing		Career	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Surgency	−0.008	−0.003	0.03	0.05	−0.08*	−0.09*	0.02	0.02
Agreeableness	−0.002	−0.06	0.15***	−0.01	−0.19***	−0.03	0.05	0.13**
Conscientiousness	0.18***	0.17***	0.10**	0.08*	−0.18***	−0.15***	0.10**	0.11**
Emotional stability	−0.01	0.009	−0.04	0.03	0.12**	0.05	0.05	0.01
Intellect	0.15***	0.14***	0.06	0.03	0.07	0.10**	0.05	0.07
Empathic Concern		0.10*		0.28***		−0.30***		−0.14**
Perspective Taking		0.04		0.08*		−0.05		−0.02
R^2	0.07***	0.07***	0.06***	0.06***	0.09***	0.09***	0.04***	0.04***
ΔR^2		0.01**		0.08***		0.08***		0.015**

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

of empathy. Furthermore, incremental validity in other domains needs to be established.

Alexithymia

A recent paper by Bibby and Ferguson (2011) provides evidence relating to the hypothesis that alexithymia shows incremental validity over the FFM domains. They tested the theory that alexithymia is associated with reduced sensitivity to loss (Ferguson, Bibby, et al., 2009), and explored the association between alexithymia and economic assessments of loss aversion under conditions of risk and no-risk. Consistent with the hypothesis, they showed that alexithymia was negatively associated with loss aversion (high alexithymia is associated with lower loss aversion) but importantly from the point of view of this discussion they showed incremental predictive validity for alexithymia over all five domains of the FFM and sensation seeking.

The data provided by Bibby and Ferguson (2011) were factor analysed. However, as there were only 260 participant and 55 items the *N*:*p* ratio of 4.7:1 was too small to justify analysis at the item level and instead analysis was conducted here at the scale level. A CFA approach was adopted for these analyses as it is possible to propose a priori theoretical models: (1) A general factor of personality (GFP: all scales load on a single factor) (Musek, 2007), (2) a two factor model (all the FFM domains load on one factor and alexithymia on a separate factor, (3) a three factor model based on Digman's (1997) alpha (ES, A and C) and beta (S and I) and alexithymia loading on separate factors. The five FFM domain scales (see Bibby & Ferguson, 2011 for details) and the three alexithymia facets [difficulty identifying feeling ($\alpha = 0.83$), difficulty describing feelings ($\alpha = 0.71$) and externally oriented thought ($\alpha = 0.66$)] were subjected to a CFA, using ML estimation with robust standard errors. There were missing data from 11 participants, with a total of 15 missing values (0.1% of the data) and with the percentage missing data ranging from 0.4% to 1.2% per scale. The missing data were treated using FIML. The Akaike Information Criteria (AIC) was used to compare the fit of the models. A smaller AIC indicates a better fit. The GFP was a poor fit to these data (CFI = 0.70, RMSEA = 0.13, RMSR = 0.080, AIC = 13161.69), as was the two-factor model (CFI = 0.88, RMSEA = 0.089, RMSR = 0.054, AIC = 13101.71), whereas the three-factor model was a good fit to these data (CFI = 0.89, RMSEA = 0.088, RMSR = 0.053, AIC = 13097.177). The three-factor solution is shown in Figure 1. Modification indices suggested that this model could be improved by freeing correlated error between EOT and I (CFI = 0.94; RMSEA = 0.067, RMSR = 0.048, AIC = 13082.316). The parameters for this solution are in parentheses in Figure 1.[5]

Type D

Watson (2012) makes a strong case that Type D – high negative affect (NA) and high social inhibition (SI) – reflects a blend of high N and low E. Indeed, there is evidence that NA is positively correlated with N and SI correlated negatively with E (De Fruyt & Denollet, 2002; Grande, Glaesmer, & Roth, 2010; Pedersen & Denollet, 2004; Yu, Thompson, Yu, Pedersen, & Denollet, 2010), and that a 'distressed' personality type

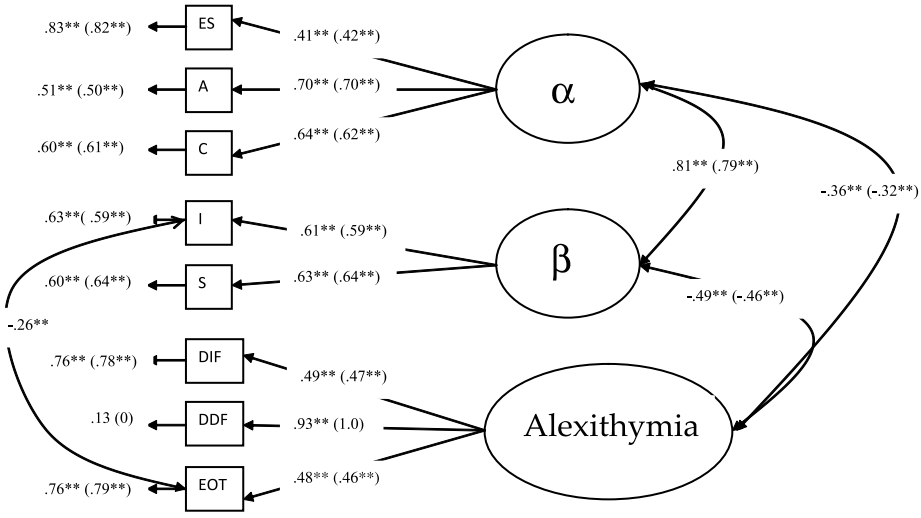

Figure 1. CFA model for the Big 5 and alexithymia.
Note: $*p < 0.01$, $**p < 0.001$. ES, emotional stability; A, agreeableness; C, conscientiousness; I, intellect; S, surgency; DIF, difficulty identifying feelings; DDF, difficulty describing feelings; EOT, externally oriented thought. Coefficients in parentheses are those for the model with the correlated error between EOT and O specified.

can be identified based on a N+ E– A– C– FFM profile (Chapman, Duberstien, & Lyness, 2007).

There are no factor analytic data at present examining if the SI and NA facets of Type D are distinguishable from the FFM. Indeed, they may not be. The question whether Type D is a unique trait outside the FFM rests on the toxic combination of NA and SI: only when both NA and SI are high are detrimental effects on health observed. However, recent taxometric evidence shows that Type D is dimensional rather than taxonic (Ferguson et al., 2009), making it problematic to use NA and SI to simply categorise people as Type D or not Type D. This being the case the interaction between SI and NA (defining Type D) is crucial and needs to show incremental validity over N and E, as well as the interaction between N and E.

In this respect, Pedersen and Denollet (2004) have shown that Type D (dichotomous characterization) is an independent predictor of symptoms of Post Traumatic Stress Disorder (PTSD) once E and N are controlled, and Pedersen and Denollet (2008) similarly showed that Type D independently predicted major adverse clinical events once N, E and the remaining FFM domains were controlled (see also Mols and Denollet, 2010). There is also evidence demonstrating incremental validity of Type D over depression with respect to cardiac mortality (Martens, Mols, Burg, & Denollet, 2010). This evidence is slightly weaker as depression acts as a marker of N rather than a direct measure.

However, other studies have failed to find any incremental effects for Type D over depression and anxiety (see Tully, Baker, Eld, & Turnball, 2010). Tully et al. (2011) showed the interaction of NA and SI did not predict cardiac morbidity. Two recent epidemiological studies have failed to show that Type D or the interaction of NA and

SI as predictors of all-cause mortality or coronary heart disease specific mortality (Coyne et al., 2011; Grande et al., 2011).

Therefore, at present the data are mixed, at best, on the prognostic value of Type D. The weight of the current evidence is inconclusive as to whether or not the construct of Type D offers something beyond the FFM and personality theorists interested in health need to pay particular attention to Type D, to test if indeed it is just old wine in new bottles. As such, Watson's (2012) caution that Type D may not lie outside the FFM space is at present justified. However, it is a trait that is of particular importance to health psychologists as these controversies need urgent resolution.

No general factor of personality

While a general factor of personality (GFP) has been postulated recently (Musek, 2007; Rushton & Irwing, 2008), the evidence for the GFP has been questioned on theoretical, evolutionary and psychometric grounds (Ferguson, Chamorro-Premuzic, Pickering, & Weiss, 2011). The results from the three factor analyses reported above add to the growing evidence that there is not a GFP. In all the analyses there was no evidence for a GFP.

Summary

In his target paper, Ferguson highlights four traits that have particular relevance to health psychology that he considers lie outside the FFM. Watson rightly takes Ferguson to task over this claim. The evidence reported here for health anxiety, empathy and alexithymia clearly show that Ferguson's arguments are tenable. The data are less clear for Type D, and health psychology research needs to explore the independent role of Type D.

Personality and cognition

Matthews (2012) rightly highlights two issues about personality and cognition that need to be clarified. First, personality traits can influence other cognitive processes not mentioned by Ferguson (2012) such as selective attention. Second, traits have a much more pervasive influence on cognitive systems in general than the specific association suggested by Ferguson (2012).

The decision processes detailed in Figure 3 in Ferguson (2012) should be supplemented with a stage prior to the motivation to act (stage 1) reflecting attentional processes. Indeed, health anxious individual are more likely to pay more attention to health relevant stimuli (Ferguson, Moghaddam, & Bibby, 2007) and there is also a wide literature on the influence of traits on cognitive processes in general (Kumari, Ffytche, Williams, & Gray, 2004; Matthews, 1997; Matthews & Gilliland, 1999; Shaw et al., 2010).

Matthews also suggests that the influence of traits on decision-making process will be more distributed than implied by Ferguson (2012). There is no doubt that the traits described may have a much wider range of effects. A more complete exposition would attempt to follow Matthews (1997) recommendations for personality research, tying together the biological substrate with the cognitive architecture and the

knowledge (meaning) level. However, what Figure 3 in Ferguson (2012) tries to do, based on the neuroscience of the traits, is identify where evidence suggests that specific traits are likely to have their *largest* effects. Having said this, Matthews comments are important and require further consideration when articulating when and how personality traits influence health decisions.

Matthews (2012) highlights the role of meta-cognitive processes to question some of the biological arguments presented by Ferguson (2012) and in particular the idea that cost-benefits may have a simple evolutionary basis. Using the example of health anxiety, Matthews (2012) argues that health anxious individuals demonstrate seemingly contradictory behaviours: seeking health information and also distrusting this advice. As Matthews points out, this demonstrates the importance of (1) the meaning of the situation and (2) the possible outcomes to the individual. However, this 'contradiction' is inherent in the functional concept of defensive direction (Perkins & Corr, 2006). That is, moving towards an anxiety provoking situation affords more opportunities to manage the threat. The health anxious person will seek information and help and as such also obtain treatment or reassurance. While the health anxious individual may not always trust the advice they receive this does not preclude the possibility that ultimately they may obtain objective health benefits from seeking help via early detection of illness and successful treatment. This is not to say that health anxiety is reducible to general anxiety. Indeed, health anxiety shows incremental validity over trait anxiety with respect to medical utilization (Fergus & Valentiner, 2009). Rather these seemingly contradictory behaviours have an explanation within a cogent biological framework for personality (Perkins & Corr, 2006).

Determinism, dynamics and groups processes

Haslam et al. (2012) present a case for moving away from a conceptualization of personality traits as deterministic (i.e., fixed entities that interact with fixed properties of the environment to produce fixed health behaviour) towards a dynamic interactionism whereby the individual is changed through the nature of social interaction. They argue that studying the individual in isolation 'is as bad for psychological theory as it is for health' (p. 5) and that dynamic group processes provide the lens (social norms) through which individuals define themselves and their behaviours. Haslam et al. (2012) suggest that trait psychology (the Five Factor Model in particular) and Ferguson's (2012) article view traits as static fixed and deterministic entities. Ferguson (2012) took care to show that this was not the case, and to show that personality theory has moved away from deterministic models (e.g., sociogenomic model: Roberts & Jackson, 2008). Indeed, the model of personality described by Ferguson (2012) is in fact a dynamic interactionist model of the type proposed by Haslam et al. (2012). It may be useful at this juncture to highlight the key points concerning the dynamic nature of traits presented by Ferguson (2012) and others (e.g., Roberts & Jackson, 2008). Ferguson (2012) drew together work from sociogenomics (Roberts & Jackson, 2008), behavioural ecology– the behavioural reaction norm (BRN) (Dingemanse, Kazem, Reale, & Wright, 2010), economic theory (Almlund, Duckworth, Heckman, & Kautz, 2011; Borghans, Duckworth, Heckman, & ter Weel, 2008) and evolutionary theory (Nettle, 2006) to derive a

dynamic interactionist model (see Ferguson, Heckman, & Corr, 2011 for more detail).

Behavioural reaction norms are set within an evolutionary adaptive framework designed to account for two key parameters of traits (1) personality (defined in a BRN as the average behavioural response across contexts) and behavioural plasticity (representing the flexible expression of behaviours associated with a trait as a context changes) (Dingemanse et al., 2010). Indeed, Roberts (2009) in reviewing the history of the cross-situational consistency problem in personality theory noted that most definitions of traits are consistent with the idea of cross-situational variability (traits help to predict behaviour in context, even if a trait does not predict identical behaviour across contexts) rather than stability. People who have higher degrees of extraversion, for example, are more likely to be sociable, outgoing and thrill seeking in general (personality), but have to be in the appropriate context to express this behaviour, and as contexts vary so will the expression of these behaviours (plasticity). Thus there is a dynamic interplay between the level of the trait, the expression of behaviour and variation in context.

The sociogenomic approach to personality further articulates the link between traits, behaviour, biology and environment (Roberts & Jackson, 2008) and captures personality development and change as well as trait expression (plasticity). It postulates that environmental factors influence the development (change) of personality traits indirectly via changes in biological systems (e.g., changes in genetic expression and brain structures) or via thoughts, feelings and behaviours (as well as active intervention). Thus the level of the trait (personality in BRN terms) can change as a function of environmental experiences. These developmental changes in level of personality may changeover the life course (Roberts, Walton, & Viechtbauer, 2006), responses to evolutionarily pressures (Nettle, 2006; Schaller & Murray, 2008) or a major acute event such as infection (Skallova et al., 2005). Similarly, the technology of skill formation model in economics emphasizes the external investment and experience on trait development (Heckman, 2007; see Cunha & Heckman, 2007; Cunha, Heckman, & Schennach, 2010; Heckman, Stixrud, & Urzua, 2006).

Analogies from behavioural genetics can also be used to understand the dynamic relationship between traits, context and groups. One concept within behavioural genetics is that of the gene-environment correlation (GE_r). This is the idea that genetic effects influence environmental exposure – these may be *passive* (where parents provides the genes and the environment: extraverted parents provide genes for extraversion as well as a sociable and exciting environment), *active* (a phenotype increases the probability that that a person will end up in certain environment: tall people playing basket-ball, high IQ people at University and so on) or *evocative* (people with different phenotypes are treated differently: beautiful people are reacted to differently to less beautiful people) (see Leohlin, 2010).

Both active and evocative mechanisms may influence group formation. For example, people with certain levels on a trait or expression of a trait in a particular context may have a greater probability to form groups. Indeed, while minimal groups can be formed in the lab, groups outside the lab will not form at random. At a broad level, Rentfrow (2010) has demonstrated regional personality differences in the USA. For example, Neuroticism is higher in the North Eastern and South Eastern States, while Openness is higher in the Pacific States, New England and Middle Atlantic regions, and lower in the Midwest, Great Plains and South Eastern States. One

reason cited for these regional differences is selective migration patterns. That is, individuals high in a particular personality trait such as Openness tend to migrate and form associations and affiliations (groups) with those who are similarly minded (Rentfrow, 2010). As individuals high in Openness are typically lower in racial prejudice, and enjoy new experiences and diversity, they are more likely to gravitate towards and settle with people and places where these aspects of their character are welcome and nourished. Indeed, there is evidence that certain personality traits (e.g., high openness) are more likely to migrate (Jokela, 2009). There are of course other possible explanations for regional personality including ecological/evolutionary processes and the influence of local norms (Rentfrow, 2010), and at present it is difficult to differentiate these.

The above is not to imply that groups will be homogenous. A good functional group will have a mixture of complementary traits (e.g., a balance of cooperative people and free-riders: a negative frequency dependency process). Rather the suggestion is that group formations may involve both active and evocative processes (I like the people in this group, they are like me and they treat me well). The group itself is obviously a context that may influence both trait expression and over time the mean level of trait itself (Dickens & Flynn, 2001). Thus the relationship between personality and groups is dynamic. Indeed, traits can also moderate well established in-group out-group effects. For example, there is evidence that in-group favouritism with respect cooperation, altruism and helping is moderated by traits of agreeableness (Graziano, Habashi, Sheese, & Tobin, 2007) and empathy (Ferguson, 2009b). Specifically while in-group helping was unaffected by agreeableness those high in agreeableness were more likely to help out-group members (Graziano et al., 2007). Ferguson (2009b) showed that people low in trait empathic concern are more willing to help an in-group, but that those high in empathic concern do not show an in-group favouritism effect.

Traits are not deterministic entities but rather reflect the dynamic interactionism that Haslam et al. (2012) call for. They may influence group formation and group processes and vice-versa.

Hierarchical model for health psychology

Cutting across all the arguments presented by Ferguson (2012) and the commentaries is a three-level hierarchical model. Level 1 concerns individual health outcomes, level 2 concerns the effect of one-person's behaviour on another (e.g., doctor–patient interaction, other regarding preferences) and level 3 specific organizational effects (e.g., turnover) in this context of health care provision. Most health psychology research is focused at level 1 and hence Ferguson's desire to emphasize the wider context. Matthews (2012) points out that it is sometimes not clear at which level the analysis is operating. He uses the example of personality influencing doctors' learning and performance and asks if this is level 1 or 3. This is a level 1 outcome that influences level 3 provision of health care maybe via a level 2 process of doctor–patient interaction. Ferguson (2012) states that this multi-level approach means that one level can influence another and the aim is to understand the health process not just in terms of individual health outcomes and that health psychologists should start to include assessments of levels 2 and 3 variables in their studies (personality will influence all of these). For example, more introverted

medical students/doctors will perform better in their assessments (level 1). This may influence level 3 outcomes (career progression, salary) as well as level 2 outcomes (doctor–patient interaction). Indeed, introverted and socially inhibited doctors may have less satisfactory doctor–patient interactions. Such unsatisfactory interactions may lead to lack of trust which, in part, leads to doctor-shopping behaviour. Thus the different levels of the hierarchy can interact with each other and that personality traits can influence the levels both independently and across the different levels of the hierarchy. By way of another example the introverted doctor, while doing well in assessments (level 1) may choose a career path (level 3) within the health service (e.g., pathology) that reduces doctor–patient interaction (level 2).

Summary

All three commentaries raise important issue and concerns with Ferguson's (2012) paper. In this paper we have attempted to answer these and show that traits such as empathy, health anxiety and alexithymia (the jury on Type D is still out) are very likely lie to outside the FFM, that traits are not deterministic but dynamic and influence group processes in a number of ways (formation and response) and finally, that cognitive processes (e.g., attention) need to take a more central role in understanding how trait motivations are translated into behaviours.

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Notes

1. Weighted least square estimator with diagonally weighted matrix with standard errors and mean adjusted chi-square using a full weight matrix (WLSM estimator).
2. EFA in M*plus* 6 provides SEs of loading from which statistical significance can be estimated. All items loaded significantly on their target factors.
3. When the analyses for these data (and for the subsequent factor analyses) were conducted on the *listwise* deleted data the same results emerged as for the FIML estimated data.
4. The Five Factor Model (FFM) and the Big 5 come from different research traditions. The Big 5 from a lexical exploratory analysis of adjectives and the FFM developed to have a more explicit theoretical and hierarchical basis (Goldberg, 1993; McCrae & Costa, 1999). Give these different approaches both provide convergent evidence that normal human personality reflects five board domains of normal personality and the terms FFM and Big 5 are often used inter-changeably. Therefore, in the text of this article while we use Goldberg's adjective markers we will refer to the FFM.
5. Within this modified three-factor model the difficulty describing feelings scale had a negative error variance (a Heywood case). This was corrected by fixing the negative error variance to zero as recommended by Dillon, Kumar and Mulani (1987). Dillon et al. (1987) showed this procedure performed better than alternative fixes when the negative error variance is attributable to sample fluctuations. The exact cause of Heywood cases is unclear, however, Dillon et al. (1987) identify two possible causes (1) sample fluctuations and (2) model mis-specification. If the negative error variance is due to sample fluctuations this is less of a problem and can be corrected by fixing the offending error to zero. There is good reason to believe that the Heywood case here is due to sample fluctuation. Following the suggestion by Dillon et al. (1987) the model fit statistics did not change when the error

variance was fixed to zero also the loadings and error terms did not alter significantly when the error was fixed. This is a widely used procedure in the literature (e.g., Jones, Cauffman, Miller, & Mulvey, 2006). Together these findings indicate that the Heywood case is likely due to sample fluctuations and that the solution reported is tenable.

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