Special issue on Personality and Economics
Guest Editors: E. Ferguson, J.J. Heckman and P. Corr

Contents:

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Editorial

Personality and economics: Overview and proposed framework

ARTICLE INFO

ABSTRACT

We sketch a framework for exploring the overlap between, and integration of, personality/temperament/character traits and economics. This integrative framework incorporates the study of the evolution and biology of personality, and an investment model from economics. We offer models of the development of traits and the expression of behavior associated with traits that are environmentally contingent. We demonstrate how economic games offer a well-defined and constrained social context to explore and test predictions concerning traits derived from evolutionary theory. We discuss open areas of research in the integration of personality and economics, such as fundamental identification problems in identifying traits. We finish by proposing an agenda for collaborative research on the personality–economics interface (e.g., examining anti-social behavior, psychometrics of preferences, etc.).

© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

Theoretically fertile links between cognitive psychology and economics have long been recognized (Frey & Stutzer, 2007), and previous work at this interface has led to influential breakthroughs in both disciplines (Tversky & Kahneman, 1981). Recent publications by Borghans, Duckworth, Heckman and ter Weel (2008) and Almlund, Duckworth, Heckman and Kautz (in press) discuss the more specific interface between personality psychology and economics, where the importance of individual differences loom large. Inspired by these developments, as well as a growing awareness of the use of personality (and individual differences in general) in economic research, we bring together a special issue, not only to showcase the range of research currently being conducted but also to highlight some fruitful areas for future research.

We discuss how theory and methods in personality and economics can be informed by developments in each field. In particular, this overview highlights for the personality psychologist the advantages that can be gained from the wealth of theory and methods in economics which can be utilized to address key issues in personality psychology (e.g., use of economic games to test evolutionary models). Similarly, for the economist, personality traits offer a set of coherent constructs, that, when applied in a theoretically meaningful way, can help explain complexities in patterns in economic behavior (e.g., counter-productive and anti-social behavior).

We also highlight some key research issues (behavioral heterogeneity, cross situational stability and the overlap between preferences and traits) that are central to both economics and personality psychology. Finally, to help promote progress in research in this developing area, we endorse the agenda and integration described by Borghans et al. (2008) and Almlund et al. (in press), and we elaborate on their ideas and present new ideas from

the biology and evolution of traits (Penke, Denissen, & Miller, 2007; Roberts & Jackson, 2008) and work in behavioral ecology (Dingemanse, Kazem, Reale, & Wright, 2010). The goal is to stimulate future research on economics and personality.

2. Personality theory and economic theory

Personality psychology and economics have independently tackled several common questions over the years. Among these are two key related questions. (1) What can explain heterogeneity in behaviors both within and across tasks? (2) Are personality and preferences consistent across situations?

The two fields have methods to offer each other. For example, personality theory would benefit from an appreciation and application of econometric principles (e.g., analysis of identification problems) to the measurement of traits. Similarly, economic modeling of preferences would benefit from the application of psychometric principles (e.g., construct validity, temporal stability, internal reliability, etc.).

In this article we explore these issues and highlight conceptual similarities between current thinking in the evolution and biology of traits (Dingemanse et al., 2010; Penke et al., 2007; Roberts & Jackson, 2008) and the economic model of personality (Almlund et al., in press; Borghans et al., 2008). Drawing all these themes together we aim to sketch the contours of a model of personality with resonance for psychologists and economists, and present an agenda for future collaborative work.

2.1. Behavioral heterogeneity and stability

Both economists and psychologists find heterogeneity in behaviors both within and across tasks (e.g., Andreoni & Miller, 2002; Fehr & Fischbacher, 2002; Keser & van Winden, 2000; Offerman,

Sonnemans, & Schram, 1996). Behavioral economists tend to focus on heterogeneity in performance across tasks for the same person. Psychologists and economists also document heterogeneity across people on the same task. Understanding the sources of this heterogeneity in economic domains has important implications not only for policy analysis (Heckman, 2001) but also for understanding performance in experimental games (Burlando & Guala, 2005). Behavioral economics tends to explain variability across tasks through situational specificity reflecting differences in contexts and context-specific and task-specific preferences (i.e., indicated by the behavioral choices people make). Mainstream neoclassical economics explains heterogeneity through endowments (i.e., the quantity of a construct that is available for the production of some output), preferences, expectations and incentive differences (i.e., the incentives that arise from performing a task). It models the source of context-dependent choice behavior. This heterogeneity is determined in part by individual differences in (1) capabilities (intellectual, personality, emotional) or (2) effort brought to bear by the individual (see Almlund et al., in press) that are induced by differences in preferences, constraints and expectations. By exploring the role of individual differences, for example, in behavior in economic games and the prediction of real world phenomena (e.g., scholastic achievement), some of this variability can be explained.

Within personality psychology, there is a long-standing tradition examining how personality traits influence (1) well-established experimental effects (Eysenck, 1997) and (2) behavior across a variety of tasks and situations (i.e., cross-situation consistency). A key empirical question in personality psychology is whether traits show cross-situational stability. As part of the special issue on cross-situational stability in the *Journal of Personality Research*, Roberts (2009) reviewed the history of the cross-situational consistency problem, noting that traits are consistent with cross-situational *variability*. That is, traits help to predict behavior in a particular context, even if a trait does not predict identical behavior across contexts. This variation in the manifestation of traits across tasks might have an evolutionary basis – natural selection favors adaptability, especially when contexts change (see Ferguson, in press). Along similar lines, individual differences in economics, defined in terms of distinct types or preferences (e.g., conditional co-operators, free riders; Andreoni, 1990; Fehr & Schmidt, 1999; Fischbacher, Gachter, & Fehr, 2001), have been used to account for heterogeneity in responses in economic games (see Burlando & Guala, 2005).

Whether economic preference parameters are 'stable' traits (Van Lange, Otten, Bruin, & Joireman, 1997) still needs to be established (see Almlund et al., in press). Preferences are assumed to be stable in accounting for cross-situational variation in economic behavior. Economic models of preferences will benefit from studies on cross-situational consistency and temporal stability.

2.2. Preferences and personality

What are the theoretical and empirical relationships between personality and preferences? Although preferences may seem conceptually related to personality traits, Borghans et al. (2008) suggest that a simple one-to-one mapping is difficult. They show the difficulty in relating psychological traits and economic preference parameters, because: (1) there are identification problems (discussed below); (2) some of conventional economic preference parameters can be decomposed into components that draw on *bundles* of psychological traits (Almlund et al., in press in fact, group together preference and personality traits as generators of behavior given incentives embedded in a situation); (3) personality traits (and in particular the Big Five) often miss motivation, which drives agent goals (but see Denissen & Penke, 2008); and (4) measured psychological traits may be the manifestations of economic preference parameters. This approach recognizes that the basic observational data on behaviors that define the life blood of personality psychology are generated by both productivity traits and preferences as they (along with incentives, expectations and constraints) determine behavior. Particularly important here is knowledge of *why* choices differ across situations, as this is a requisite for designing useful policies that address these differences in choices. Psychologists and economists, like all behavioral scientists, are concerned with trying to understand the mechanisms producing choices, in addition to being able to predict behavior (Funder & Colvin, 1991). Key here are the *functions* determining manifest behaviors. Preferences interacting with personality traits and other constraints determine choices. Borghans et al. (2008) introduce the notion that personality traits are constraints on behavior.

Almlund et al. (in press) generalize the notion of traits to include parameters of preferences. They consider how preferences in conjunction with other traits and constraints produce choices as revealed by performance on tasks that involve both economic activity and a broader set of actions. 'Motivation' is an aspect of preferences that governs reward seeking that, in conjunction with incentives and traits, produces manifest behaviors (see McNaughton & Corr, 2009).

Appearances, though, can be deceiving. For example, someone could *appear* to be behaving selfishly on a task eliciting preferences associated with altruism (e.g., a dictator game), when in fact they are behaving according to a selfless motive – for example, they may want to gain money to give away to someone else. Similarly, a person may be motivated to maximize his/her rewards (e.g., scores high on reward responsiveness scales) by strategically cooperating when reputation building is possible. This strategy will maximize rewards in terms of direct and indirect reciprocity and status. (Direct reciprocity arises in interactions between two people. Indirect reciprocity arises from relationships that have consequences for each party through their effects on third parties, outside the relationship, that indirectly affect the initial parties.) However, the same person may free-ride when reputation building is not possible. In this case, indirect and direct reciprocity are not possible. The behavior, in this context, most consistent with the goal of maximizing rewards is to take the endowment and leave. People facing different constraints may behave very differently but with the same goal in mind. Therefore, people's expressed preferences may not appear to be consistent across tasks, but are consistent when one accounts for the incentives in a situation, as well as their underlying motivation.

2.3. Biology, evolution and the investment model of personality: expression and development

In this section we show how insights from biology (e.g., genomics), evolutionary theory and economics advance understanding of personality with respect to: (1) the development of traits; (2) the expression of behavior associated with traits across contexts; and (3) the relationship between development and expression (Denissen & Penke, 2008; Penke et al., 2007; Roberts & Jackson, 2008; Van Oers, de Jong, van Noordwijk, Kempenaers, & Drent, 2005). Any model of personality needs to be able to account for these three aspects (Almlund et al., in press).

The sociogenomic approach to personality (Roberts & Jackson, 2008) offers a conceptualization of the dynamic interaction among traits, biology and the environment that captures personality development. 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 behaviors. This approach is related in spirit to the technology of skill formation

model in economics, where direct external investment and experience affect trait development (Heckman, 2007; see Cunha & Heckman, 2008; Cunha, Heckman, & Schennach, 2010; Heckman, Stixrud, & Urzua, 2006). In the economic model, purposive modification (the expression and development of traits through investment) is central, whereas in the sociogenomic approach greater emphasis is placed on the notion of the development of traits from biological development (ontogeny) and exogenously given exposure to social environments (sociogeny). There is, however, some role for investment as well, although it is less explicitly modeled. Combining these approaches within a unified framework will be a fruitful task for future work. Models based on reaction norms (RNs) offer one way to start to do this.

A RN is a '... function relating a phenotypic response of a genotype to a change in the environment' (van Oers et al., 2005, p. 1197); and is used to describe variation in phenotypic *expression* across environments. Responses to the environment may result in relatively permanent *developmental* changes or may reflect more a flexible and potentially adaptive behavioral response to environmental changes which Dingemanse et al. (2010) term *behavioral plasticity* – this corresponds to behavioral flexibility in response to situational demands. The model of personality developed by Almlund et al. (in press) incorporates both of these ideas (Eqs. (1) and (2) below).

The notion of development is defined by Eq. (1), presented below, where I_t represents investment at time t (from parents, peers, education, self-investment) and θ_t represents capabilities (e.g., personality traits) at time t. The level of a trait at time $t + 1$ (θ_{t+1}) is a function of both the level of the trait at time t (θ_t) and the extent of investment (I_t) at that time:

$$\theta_{t+1} = f_t(\theta_t, I_t), \quad t = 1, \ldots, T, \tag{1}$$

where f_t is a function increasing in I_t.

Eq. (2), presented below, is an outcome equation reflecting behavioral plasticity, where $B_{t,s}$ reflects behavior in situation $s \in \mathcal{S}_i$ and time t, and the fact that behavior depends on situation $\psi_{t,s}$ reflects behavioral plasticity. Behavioral plasticity changes do not depend on investment but are a function of context and situation at any particular time and the trait:

$$B_{t,s} = \psi_{t,s}(\theta_t), \quad s \in \mathcal{S}_t, \quad t = 1, \ldots, T, \tag{2}$$
$$\uparrow$$

behavior in situation s at time t.

Behavioral plasticity captures Mischel and Shoda's (1995, 1999) 'if-then' personality signatures and the argument that traits, in part, show cross-situational variability (Roberts, 2009). Within the sociogenomic framework, the θ_t in Eq. (2) changes through ontogenic and sociogenomic processes, but not through investment.

With specific reference to personality psychology, a recent development in RN research is the idea of a *behavioral reaction norm* (BRN) (Dingemanse et al., 2010). BRNs are set within an evolutionary adaptive framework that aims to account for the relationship between *personality* and *behavioral plasticity*. In line with the notion of a trait producing typical behavior, *personality* is defined in a BRN as the average behavioral response across contexts (this is represented by θ_t in Eq. (2)). BRNs are assessed via manifest behavior, not questionnaires which are more common in personality psychology. *Behavioral plasticity* represents the flexible *expression* of behaviors associated with a trait as contexts change (represented by $\psi_{t,s}$ is Eq. (2)). Behavioral plasticity may be adaptive. Context (s) is defined as any stimulus with a gradient (e.g., varying group size, riskiness, stress). Dingemanse et al. (2010) formally define the BRN for a given trait within a linear random effects regression model (Eq. (3)) (although non-linearities can be incorporated), where the intercept provides the estimate of typical

personality and the slope provides the estimate of behavioral plasticity

$$Y_{ij} = (\beta_0 + \mu_{0j}) + (\beta_1 + \mu_{1j})x_{ij} + e_{0ij}, \tag{3}$$

where $(\beta_0 + \mu_{0j})$ is the intercept, with β_0 = the mean intercept and μ_{0j} = variation in individual intercepts [captures personality traits $\theta_t = \theta$, assuming stability over time], $(\beta_1 + \mu_{1j})$ is the within individual slopes, with β_1 = the estimated mean slope and μ_{1j} = variation in individual slope [captures behavioral plasticity, $\psi_{t,s}$], x_{ij} = the ith measurement of individual j in context (captures situation $s_i \in \mathcal{S}_i$), e_{0ij} = the residual error (e.g., normally distributed with a mean of zero). (It should be noted that Cronbach and Glesser (1953) presented similar ideas over 60 years ago.)

Dingemanse et al. (2010) argue that, for observational data, individuals are unlikely to be randomly distributed across contexts (there may be an individual x context correlation). To tease apart the between-individual and within-individual effects on behavior Y across contexts, x in Eq. (3) is replaced with $(x_{ij} - \bar{x}_j)$ in Eq. (4) below, where $\bar{x}_j$ is the mean contextual value for individual j (Eq. (3)). In Eq. (4), β_W provides the mean within-person slopes and μ_W individual variation around the slope and β_B is the mean estimated between-person slope effect:

$$Y_{ij} = (\beta_0 + \mu_{0j}) + (\beta_W + \mu_W)(x_{ij} - \bar{x}_j) + \beta_B \bar{x}_j + e_{0ij}. \tag{4}$$

Thus the BRN offers a system for simultaneously estimating the mean level of a personality trait in any one time period as well as its behavioral plasticity. The advantage over using personality questionnaires is that it allows for behavioral plasticity to be examined as well as the mean level of the trait. This approach provides a solution to the person-situation debate: both mean levels of a latent trait and its variable expression in different contexts are important.

An important feature of BRNs is that intercepts and slopes can be either correlated or orthogonal. The concept of the BRN, therefore, suggests that changes in the mean level of the trait (brought about by investment as in Eq. (1) or environmental interaction as suggest by the sociogenomic model) may affect behavioral plasticity. Raising the intercept may either reduce or increase plasticity. For example, increasing conscientiousness may reduce plasticity, as a more conscientious person is more likely to be very constrained in their behaviors. However, increasing the trait adaptability or responsiveness (Wolf, van Doorn, & Weissing, 2008) may result in greater plasticity. An important aspect of this approach is the definition of maladaptive behavior seen in psychological disorder, a prominent feature of which is either inflexibility to contextual factors or, in BRN terms reduced plasticity. This approach affords formal statistical models of personality-related processes. The goal for psychologists and economists interested in personality is to identify factors that influence both the stability and plasticity and the relationship between the two. In economics, these concepts are captured by the Hause (1980) model of earnings dynamics.

The above model could be extended to include standard personality indices (e.g., the NEO-PI-R) using multi-level models to examine how questionnaire-derived trait scores are related to behavioral stability and plasticity. It would be conceivable, for example, to assess a specific behavior associated with a trait on a number of occasions across varying contexts to assess the stability and plasticity and then relate these to the standard index of the trait. For example, conscientiousness (C) is, in part, defined by behaviors such as 'being organized' and 'methodical'. These could be assessed a number of times across a changing context (e.g., work stress). The simplest prediction would be that C is strongly positively associated with the intercept (the personality estimate).

2.4. Evolution of personality traits

It has been argued that personality traits evolved as strategies to aid adaptation to a wide variety of social problems (Buss, 2009). These traits are numerous and domain specific (Michalski & Shackelford, 2010), going beyond the Five-Factor Model (Buss, 2009), and cannot be empirically represented by a single general factor of personality (GFP; for a critique of the GFP, see Ferguson, Tomas Chamorro-Premuzic, Pickering, & Weiss, 2011). A number of candidate mechanisms for the evolution of human personality have been reviewed. Penke et al. (2007) suggest that personality is likely to have evolved through a *balancing-selection* mechanism. This mechanism is based on the idea that extremes of a trait are favored by selection under different conditions, so that if conditions vary, multiple levels of a trait have survival value. Their analysis suggests that traits have evolutionary costs and benefits associated with them, with the optimal balance depending on the context in which they are expressed. Nettle (2006) develops a cost-benefit trade-off model for the development of personality. Almlund et al. (in press) develop economic models of personality which we discuss next.

2.5. Economic model of personality: investment, environment and effort

Cunha and Heckman (2007, 2009) develop an explicit model of *investment* to explain the development of traits. Importantly, their investment model shows how external investment (parental, school and other interventions) can change IQ and personality traits. Almlund et al. (in press) show that the productivity of investment varies over the life cycle (critical and sensitive periods) and demonstrate the complementarity of capabilities (IQ and personality) with investments. For policy analysis it is crucial to know at what stage of the life cycle an intervention will be most successful. Development is not solely an ontogenic process (i.e., a process and mechanism that relates to a preprogrammed development of individual organisms) or a sociogenic process as featured in the model of Roberts and Jackson (2008), but also arises from investment, including self-investment and practice. Such investments can be conceived of as an effect of environments on the evolution of traits and are complementary with the sociogenomic models of personality traits. Cunha et al. (2010) postulate more active roles of agents (and their parents and other social institutions) in shaping the evolution of traits and their expression.

As well as modeling the development of traits, the economic approach to personality defines the process by which traits are associated with expressed behavior on tasks (Almlund et al., in press). This corresponds to our Eq. (2), previously discussed. The model proposes that traits (e.g., personality, genetic endowment, etc.) influence the expression of behavior along with effort (e.g., time, mental energy, attention, etc.) and situation. There may be a threshold for a specific task, such that if the trait is not present in sufficient quantity, increased effort will not result in successful performance on the task. The situation also serves to limit the type of responses that can be made.

With this perspective, personality traits can be viewed as public goods equally present in many tasks, but with different effects in different tasks. Effort is seen as private good, with limited capacity. Effort applied to one task reduces the effort available for all other tasks. The idea that investment can lead to the development of personality traits can be linked to behavioral expressions based on effort and situation. For example, people with particular personalities will choose specific tasks and environments. These environments will influence the type of behavior expressed and such choices will feed back into the development of the trait. As with the BRN (defined above) both development of the trait and the expression of behavior associated with the trait (as a function of the environment) can be expressed within a single system.

2.6. An integrative framework for personality and economics

Personality traits might have evolved into traits comprising constellations of organized cognitions, affects and behaviors that carry relative costs and benefits. While there is evidence for stable personality traits, there is also variability of expressed behavior (behavioral plasticity), with respect to expressed behavior that is dependent on context. The economic investment model shows how external investment at critical periods can change mean levels of traits. The sociogenomic model also suggest how contexts, but without active external investment, may influence the development of a trait. BRNs and the economic model of personality offer a useful way to integrate these ideas within a single framework. That is, active external investment (economic investment model) or changes in biological systems and the influence of thoughts, feelings and behaviors (sociogenomic model) may result in changes to the mean level of a trait. The BRN literature suggests that changes in mean level of a trait may influence the expression of behaviors associated with the traits and this change in expression may feed back – as suggested by the sociogenomic model – into changes in the mean level of the trait.

3. Understanding how the measurements of personality are generated and its consequences: lessons from econometrics

The above argument for the role of traits broadly defined is predicated on the accurate measurement of traits and preferences. Recent developments in the assessment of traits in econometrics highlight a number of key problems that personality psychologists need to consider.

3.1. Identification problems and their consequences

Almlund et al. (in press) develop an economic model of personality that substantially extends Borghans et al. (2008). Using a generalization of Eq. (2), they distinguish between measured (manifest) traits and latent traits that, along with incentives specific to situations and preferences, determine observed behavior.

Personality psychology has much to learn from the econometrics of the identification problem (see Fisher, 1966). This problem refers to any empirical situation where a statistical model will have more than one set of parameters which generate the same distribution of data. Any measure of a trait is based on observed behaviors, including performance on tests (test scores), interactions among persons, and the conduct of persons working on tasks. In Almlund et al. (in press), agents possess traits that facilitate (or impair) performance on tasks, but all that is ever observed is their performance. Latent traits are inferred by the performance on tasks that provide the markers for these latent traits.

Almlund et al. (in press) argue that personality psychologists sometimes confuse the performance on a task (e.g., observed scores on questionnaires) with individual (latent) traits. To tackle this problem, the analyst needs to control (standardize) for the other traits that affect behavior, as well as the incentives to perform in the situation. The incentives to perform depend on the rewards (perceived benefits) of performing the task at a given level and the costs of doing so. Personality psychologists have not been careful in standardizing for these other factors that generate behavior and have been too quick to go from measured behaviors to infer traits.

This injunction is nothing more than an appeal to develop a more rigorous approach to construct validity in personality assessment and theorizing. At the same time, the injunction highlights

the complexity of measured personality, especially the complexity of manifest personality on any given task. For example, achievement tests (as production on a task) reflect intelligence, but also crucially effort, persistence, tolerance of frustration, delay of gratification, etc. By similar reasoning (see the paper by Borghans, Golsteyn, Heckman, and Humphries (2011), in this issue), when constructing a personality measure, care must be taken to eliminate variance due to extraneous factors by standardizing such factors when they can be identified. The benefit of an economic perspective in personality psychology is to outline the complexity of the problem and to show the value of using methods that have been developed to control and constrain this complexity. Economic theory has had to confront great complexity in economic behavior, and has been challenged to provide rigorous and parsimonious models. This problem in psychology has not gone completely unrecognized as psychometric approaches have been developed, including multi-trait multi-method approaches and multi-indicator multi-causal (MIMIC) models, to explore some of these complexities in trait measurement (Brown, 2006; Heckman et al., 2006; Jöreskog & Goldberger, 1975).

In general, multiple traits affect the performance on any task, and the effects of these multiple traits are not always additive. For example, there is evidence that the effects on military officer and managerial selection are predicted best by the statistical interaction of neuroticism and cognitive ability (e.g., Perkins & Corr, 2005, 2006). This study highlights the importance of formal modeling. Most validation studies in personality psychology assume additive effects, yet behavior likely entails a high degree of interactive behavior. Manifest behavior is often the result of the interaction of distinct causal trait influences. In addition, incentives influence performance. These considerations make it difficult to isolate any single trait from behavior even if incentives to perform are properly standardized (a difficult task in itself). A fruitful avenue of research is to tackle this identification problem and to show how manifest traits (measured behaviors) depend on latent traits and incentives, including situations.

In this enterprise, the role of incentives within trait psychology should be made more explicit. One prominent approach in personality psychology that has considered the incentive nature of the situation is the Reinforcement Sensitivity Theory (RST) of personality, which argues for two broad affective neurobehavioral dimensions of reward and punishment sensitivity (Corr, 2008). To predict behavior in any given situation, we would need to know two things: (1) the situational affordance for reward and punishment and (2) values for individual differences in sensitivity to reward and punishment (as measured by traits and latent personality factors). Knowing just one of these two aspects leads to poor prediction of performance and apparent instability of trait behavior.

4. Personality–economics research agenda

Reflecting upon the issues highlighted above, and those contained in the work of Borghans et al. (2008) and Almlund et al. (in press), we point to the following key areas for future research and theory development.

4.1. Trait-preference overlap – levels of analysis

We identify four potential avenues for research in this area. First, overlap between preferences and traits could initially be explored through the application of psychometric procedures (e.g., factor analytic models), especially their nonlinear extensions (see Cunha et al., 2010). A second line of research could examine overlap at a neuro-anatomical level. For example, there is evidence that traits, such as alexithymia (a trait reflecting the inability to understand one's own emotions), and preferences concerning loss aver-

sion, overlap at a neuro-anatomical level (De Martino, Kumaran, Seymour, & Dolan, 2006; Kugel et al., 2008; Moriguchi et al., 2006; Tom, Fox, Trepel, & Poldrack, 2007).

A third line of enquiry could focus on genetic overlap. For example, twin paradigms have been used to explore the genetic influence on reciprocating behavior as measured by economic trust and ultimatum games (Cesarini, Dawes, Fowler, Johannesson, & Lictenstein, 2008). Incorporating personality traits within these types of studies would allow an exploration not only of the heritability of traits and preferences but also the extent to which genetic variation accounts for any phenotypic correlation between preferences and personality. The study of the genetic determinants of preferences would complement the emerging field of neuroeconomics.

A fourth way to study overlap would be with respect to levels of analyses of control of trait behavior. Psychology has identified multiple levels at which cognition, emotion and behavior are controlled, going from the automatic-reflexive level (involving fast prepotent responses) to the controlled-reflective level (involving slower cognitive control and conscious awareness). The significant implications of understanding these levels, and the problems they pose for models of behavioral control, have been underestimated in personality psychology (Corr, 2010a); and their recognition may hold equally important implications for explanatory models of economics. Are similar levels observed for preferences, and at which level is the overlap with traits the strongest? But, achieving the objective of a mutually-enhancing theoretical framework requires developing a common language relating to concepts and operational procedures: an economics-personality Rosetta stone.

4.2. Psychometrics of economic tasks/preference

The psychometrics of preferences needs to be improved. For example, do different measures of risk aversion, ambiguity aversion, and loss aversion all load on a single latent factor? Do individuals respond in the same way across different tasks that purport to measure the same construct and, indeed, on the same task over time (i.e., is there internal and test–retest reliability)? For example, Burlando and Guala (2005) used responses across a number of behavioral economic tasks (supplemented by qualitative responses) to look for consistent patterns to classify people as free-riders, reciprocators or cooperators. They define cutoff values for continuous variables to define each type of task and look for consistency. Basic psychometric analyses could be applied to these types of data.

Statistically distinguishing between types and continua is difficult, and it is well known that discrete mass point models are often good approximations to underlying continuous distributions (Heckman & Singer, 1984). However, formal techniques to distinguish discrete or continuous traits have been proposed, for example (1) taxometrics (Ruscio, Haslam, & Ruscio, 2006; Waller & Meehl, 1998) and (2) information-theoretic approaches (Markon & Krueger, 2006). The importance of this distinction concerns the implications for the descriptions of preference or traits. For example, a dimensional account implies the existence of a continuum of agents whereas the categorical approach suggests that there are distinct types. This has implications for theory and the clinical/practical application of personality traits (see Ruscio et al., 2006).

4.3. Measured or manifest personality traits as strategies and economic games as social adaptive problems

Buss (2009, p. 363) points out that to understand individual differences requires a '... crisp conceptualization of situations as defined by adaptive problems ... in which different cost-benefit trade-off are favored'. These adaptive problems are likely to be

social (Buss, 2009) and, as such, reflect issues such as altruism, status, and so on. The social games widely used in behavioral economics (e.g., ultimatum games) offer well-formulated 'social' adaptive problems with different cost/benefit trade-offs, from which specific hypotheses about the role of adaptive human personality can be tested. More specifically, we would suggest that the same trait will result in different behaviors for different social contingencies (see the example above of reward responsiveness and reputation building). Thus, the vast array of tasks involved in playing these games offers the personality researchers a valuable resource for testing predictions from personality theory.

4.4. Utility models and methods

Economics has many methods to offer personality psychology, not only for dealing with issues of causality and reverse causation (do traits reflect outcomes or do outcomes reflect traits: see Almlund et al., in press; Borghans et al., 2008; Heckman, 2008) but also in developing mathematically well-defined paradigms that allow modeling of risk taking, social preferences, exchanges, and discounting that can be adapted to a variety of contexts. For example, decomposed games (measuring preferences for distributing income between the self and others) can be subject to psychometric scrutiny. These games could be extended to domains that do not involve money, for example, preference for the amount of time people are willing to spend in one context versus another (home vs. work), or time performing different tasks within different contexts. Furthermore, design and statistical methods used more widely within economics could be used to help infer causality, especially in cross-sectional data of the type often collected in personality research.

4.5. An investment model of personality

Concerning the development of personality and how it changes over time, the investment model developed by Almlund et al. (in press), previously discussed, is informative for psychologists interested in social policy interventions (see also Cunha & Heckman, 2007, 2009). This model demonstrates how investment from parents, school and self-development can causally change psychological traits (i.e., IQ and personality). The benefit of any investment may vary over the life cycle. There may be critical and sensitive periods of the life cycle as well as the complementarity of capabilities (IQ and personality) and investments. Almlund et al. (in press) review evidence that shows that investments change IQ and personality. This model has clear implications for intervention designs and the study of the natural development of traits. Their work also suggests that indices of investment in environments (e.g., parental investments, etc.) need to be measured concurrently with traits, over time, to help to identify the sensitive and critical period of change.

4.6. The dark side

Personality theory has long recognized the dark side of human nature. Traits might be pro or anti-social. A large literature examines basic dimensions of psychopathy (Corr, 2010b), callous-unemotional traits (Barry et al., 2000; Frick, Bodin, & Barry, 2000), aggression (Lawrence, 2006; Lawrence & Hodgkins, 2008), and the triad of personality traits that form the 'dark side': Machiavellianism, narcissism and psychopathy (Jakobwitz & Egan, 2006). The study of this dark side of human nature has rarely been the focus of study in economics (e.g., crime, aggression, exploitation) – despite its obvious prevalence in real-world economic interactions. Study within economics has tended to focus on pro-social behavior (e.g., cooperation, altruism), as well as identifying ways to increase cooperation via social sanctions (altruistic or 3rd party punish-

ment) (Fehr & Fischbacher, 2003, 2004; Fehr & Gachter, 2002). While there is an economics literature on negative behaviors (e.g., negative reciprocity, defection in Prisoner Dilemma, free-riding in public goods games, spiteful behavior in ultimatum games) the study of direct anti-social behavior – behavior without the consideration for others, that harms others or society either intentionally or via negligence – is limited and is more than just not cooperating. The previous examples arise from retaliation against other negative behavior (perceived or otherwise), whereas anti-social behavior per se is not reactive but proactive; and, within the context of economic games, may be seen as reflecting a negative action toward someone who has been previously helpful (Herrmann, Thoni, & Gachter, 2008). Economic theory could benefit from the extensive empirical research in personality theory in order to help to develop an economic theory of anti-social behaviors.

For example, it would be possible to explore how personality traits influence people's interaction and behavior in economic games where they can cooperate or exploit each other (Buss, 2009; Buss & Duntley, 2008). People high in certain traits (e.g., agreeableness) may be more likely to be exploited, and people may develop anti-exploitation and cheater detector strategies. This leads to the proposal that, within economic games, people with different personality characteristics may respond differently depending on the (actual or perceived) characteristics of their co-player. For example, someone who is likely to be exploitative (e.g., high in psychoticism) may take advantage of someone high in agreeableness who is far more likely to be cooperative. Pairing people in predefined groups and allowing them the chance to meet prior to games and assess each others' character would allow for specific evolutionarily informed hypotheses to be proposed and tested. This research strategy would be different from the study of reputation building, as the interaction would instead be based on character judgments from a limited interaction – this situation is not too different from economic interactions in the real-world.

4.7. Traits beyond the Big 5

Finally, as noted in Almlund et al. (in press), traits beyond the Big Five (Goldberg, 1992), which is dominant within personality psychology, may also be usefully incorporated within economic studies. They explicitly discuss the addition of motivation and preference to the five trait list. As another example, empathy is generally absent from the study of social preferences of altruism (but see Fong, 2007; Kirman & Teschi, 2010), but empathy is widely applied to understanding cooperative behavior both in biology (see de Wall, 2008) and psychology (see Batson, Early, & Salvarani, 1997). While the case for empathy, as a direct precursor for cooperative behavior, is far from proven (Maner et al., 2002; Singer & Lamm, 2009) a number of processes have been identified that modify the link between feeling empathy towards an individual or group in need and helping them. For example, the costs associated with performing a behavior are important, with empathy more likely to influence helping when costs are low (Ferguson, Farrell, & Lawrence, 2008). This finding is consistent with the arguments presented in Almlund et al. (in press).

Empathy can also lead to reduced contributions to the group in low-cost public goods games (PGG). That is, if empathy towards an individual is highlighted, people tend to be more generous to that person, at a cost to the group and themselves (Batson et al., 1995). Along with other personality constructs, incorporating empathy manipulations, or looking at trait empathy within PGGs would be a beneficial route for future research. Disaggregating the Big Five into sub-facets can lead to greater predictability in certain economic contexts (e.g., Anderson, Burks, DeYoung, & Rustichini, 2011).

4.8. A theoretical approach

Following Almlund et al. (in press), we advocate developing theoretical frameworks for conceptualizing personality within economics. Theory is crucial to avoiding data fishing expeditions. A priori hypotheses should be specified. Indeed, applied areas of personality psychology have, in the past, been accused of such data fishing and this leads to undermining the theoretically important role that traits can play (Blinkhorn & Johnson, 1990). We also call for replication of findings. As this is a new and developing area it is important to start to establish consistent associations across tasks and laboratories in order to develop a strong evidence base.

5. The special issue

Our discussion has set the scene for why the time is right to forge stronger links between personality psychology and economics. There are a number of exciting new lines of enquiry and fruitful avenues for developing theory both *within* personality psychology and economics, and, most importantly, *between* these closely related behavioral sciences. The high-quality and thought-provoking papers in this special issue bode well for the success of this endeavor. While these papers do not cover the entire field, they are representative of the work currently being undertaken.

A large proportion of the papers focus on constructs from the Five-Factor Model (Extraversion, E; Neuroticism, N; Conscientiousness, C; Openness to Experience, O; Agreeableness, A) and the Reinforcement Sensitivity Theory (RST; Corr, 2008), namely the behavioral approach system (BAS; reward related) and behavioral inhibition system (BIS; punishment and goal-conflict related) personality variables. Whereas RST focuses on the neuropsychological bases of personality, the FFM focuses on descriptions of traits.

Pothos, Perry, Corr, Matthew and Busemeyer relate reward responsivity and A to behavior in a one-shot prisoner dilemma game, finding that when the optimal strategy is to defect then high reward responsive individuals are more likely to do so, whereas when the optimal strategy is to cooperate, high A individuals are more likely to cooperate. In both cases behavior is consistent with the goal of each trait (high reward responsive is associated with maximizing reward and high A with cooperation). Ben-Ner and Kramer study altruism in a dictator game with kin, collaborators, competitors and neutrals, finding that kin are treated generously with no further contribution from personality – as predicted by evolutionary theory. However, for the other groups, the highest levels of altruism are seen from those who are N+/E+/C−/A−. Such data show the rather counter-intuitive effects of personality and altruism: high A should be thought to lead to greater altruism. These authors also identify quadratic effects for personality. These need to be explored and understood further. Brandstatter summarizes meta-analyses of personality and entrepreneurship, revealing that it is related to C+/O+/E+/N−/A, as should be expected. Exploring leadership, Gillet, Cartwright and Vugt study it as a social good to the group, showing that leaders benefit less than followers, and O+ people are less prone to lead.

Examining traits that focus on sensitivity to reward and punishment Skatova and Ferguson, using a public good game, find that the BIS and BAS affect decision-making depending on the amount of the initial endowment contributed. Specifically, when participants knew that their group members had contributed a high amount, high levels BAS reward responsiveness were negatively associated with the contribution levels. This is also taken as evidence of responses consistent with the goals generated by personality traits such as free riding which in this context maximizes the reward of money. This theme is taken-up by Hall, Chong, McNaughton and Corr who offer evidence for a refinement of the RST by separating gain/loss valuation from the reward/approach and punishment/avoidance systems (previously, they had been conflated, if considered at all together).

Moving to narrower traits of personality, Mahoney, Buboltz, Levin, Doverspike and Svyantek show that the relationship between a questionnaire measure of risk aversion and framing effects depends crucially upon how framing is defined – again indicating subtle effects of the situation on personality-behavior relations. Once again, paralleling the non-intuitive nature of personality-performance, Fleming and Zizzo relate the personality trait of social desirability to contributions in a public good game, showing, contrary to prediction, that the highest contribution was made by *low* social desirability individuals, despite the fact that high social desirability individuals were associated with increased conformity in paying taxes. This indicates that the traits influence apparently similar behaviors in different ways. Bibby and Ferguson report that higher alexithymia (i.e., lack of emotion recognition) is related to lower loss aversion, in both risky and riskless context, suggesting that reduced sensitivity to loss is a characteristic of alexithymia. This is an example of how use of economic tasks can shed light on the mechanisms underlying traits. Desmet, Cremer and Dijk show that recovery of trust following voluntary or forced compensation is related to dispositional forgiveness, with lower scores leading to a discounting of the value of compensation. Carnevale, Inbar and Lerner study how the trait of need for cognition (i.e., extent to which people engage in and enjoy effortful cognitive activities) relates to decision biases, finding that leaders with this trait have better decision making competence. Within the context of social value orientation Van Lange, Schippers and Balliet show that volunteers tend to be prosocial, whereas individualists and competitors volunteer less. This has wide wide-ranging implications for who volunteers for laboratory studies. This may be a concern if the studies concern altruism, as the values of the sample will be skewed.

These studies show that when theoretical predictions are made, for example, concerning five-factor model domains, RST traits, SVO orientations and more specific traits such as forgiveness, these predictions were supported. What is more these effects were not only consistent with theoretical predictions and show consistency across studies (especially for RST reward responsiveness), but also accounted for additional variance in performance on economic tasks. There were also a number of counter-intuitive findings for personality also reported and these deserve further study and replication.

Several papers examine real-world outcomes. Xiao, Bechara, Palmer, Trinidad, Wei, Jia and Johnson examine the effects of parent–child engagement in decision making on adolescent affective decision making capacity and binge-drinking, showing positive benefits of such interactions. Linz and Semykina study five transition economies, showing that earnings are positively related to internal locus of control and preference for challenge, although differences are found for different countries. Importantly, the size of the personality effects on performance is, at least, as great as the effect of experience or education. However, as the authors note, interpretation of these findings need to take account of factors such as level of economic development, market orientation and cultural diversity. Moving onto health outcomes, using longitudinal data, Jokela and Keltikangas-Jarvinen relate low socioeconomic status and depressive symptoms, revealing that depression is related to low socioeconomic status and income in individuals who are N+ (and high in Harm Avoidance). Mental health risks of socioeconomic stress may, therefore, be most potent among individuals who are sensitive to negative and threatening stimuli, which echoes the themes of RST mentioned above. Serra, Serneels and Barr show that the personality correlates of philanthropic motivation and pro-social motivation, as forms of intrinsic motivation, in contrast to extrinsic (monetary) motivation, help

to explain the choice of health workers to work in the non-profit sector in Ethiopia.

Finally, Borghans, Golsteyn, Heckman and Humphries discuss and illustrate identification problems in interpreting relationships between psychological measurements and outcomes. They show how personality traits and intelligence both predict scores on achievement tests and grades. Their evidence affects the interpretation of correlations between psychological measures and outcomes. A substantial portion of what is thought to be the effect of cognition on outcomes is, according to this analysis, due to the effect of personality variables. The concept and measurement of cognition has to be re-examined. When Herrnstein and Murray (1994) claimed to be establishing the predictive power of intelligence, in fact they were also establishing the predictive power of personality.

These papers are noteworthy for the range of topics covered, and for the consistent findings of relationships between well-established personality factors and decisions and behaviors in different economic contexts. The range of traits explored is broad from general broad domains of the five factor model to more biologically based traits (e.g., RST domains), specific narrower traits (e.g., forgiveness) and traits with clinical significance (e.g., alexithymia). This broad range only serves to highlight the challenge facing psychologists and economists interested in the overlap between traits and preferences. The relevance of personality for economics does, indeed, seem to be pervasive. However, the patterns of relationships found also pose challenges to formulating coherent models of how personality relates to preferences, choices and behaviors. In an endeavor to start to address this, we have outlined a model, integrating ideas from investment theory and the biology/evolution of traits, suggesting that people's behavior (choices and preferences) varies across context, but is consistent with the overall goal associated with the trait. We hope that this will provide an initial starting framework for future research in this important and exciting area.

Acknowledgements

References

Almlund, M., Duckworth, A., Heckman, J. J., & Kautz, T. (in press). Personality psychology and economics. *Handbook of the Economics of Education*.

Anderson, J., Burks, S., DeYoung, C., & Rustichini, A. (2011). Toward the integration of personality theory and decision theory in the explanation of economic behavior. Unpublished manuscript. *Presented at the IZA workshop: Cognitive and non-cognitive skills, January 27, 2011*. <http://www.iza.org/conference_files/CoNoCoSk2011/rustichini_a3566.pdf>.

Andreoni, J. (1990). Impure altruism and donations to public goods: A theory of warm-glow giving? *Economic Journal, 100*, 464–477.

Andreoni, J., & Miller, J. (2002). Giving according to GARP: An experimental test of the consistency of preferences for altruism. *Econometrica, 70*, 737–753.

Barry, C. T., Frick, P. J., DeShazo, T. M., McCoy, M. G., Ellis, E., & Loney, B. R. (2000). The importance of callous-unemotional traits for extending the concepts of psychopathology to children. *Journal of Abnormal Psychology, 109*, 235–240.

Batson, C. D., Batson, J. G., Todd, R. M., Brummett, B. H., Shaw, L. L., & Aldeguer, C. M. R. (1995). Empathy and the collective good: Caring for one of the others in a social dilemma. *Journal of Personality and Social Psychology, 68*, 619–631.

Batson, C. D., Early, S., & Salvarani, G. (1997). Perspective taking: Imaging how another feel imagining how you would feel. *Personality and Social Psychological Bulletin, 23*, 751–758.

Blinkhorn, S., & Johnson, C. (1990). The insignificance of personality testing. *Nature, 348*, 671–672.

Borghans, L., Duckworth, A. L., Heckman, J. J., & ter Weel, B. (2008). The economics and psychology of personality traits. *Journal of Human Resources, XLIII*, 972–1059.

Borghans, L., Golsteyn, B. H. H., Heckman, J., & Humphries, J. E. (2011). Identification problems in personality psychology. *Personality and Individual Differences, 51*, 315–320.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford.

Burlando, R. M., & Guala, F. (2005). Heterogeneous agents in public goods experiments. *Experimental Economics, 8*, 35–54.

Buss, D. M. (2009). How can evolutionary psychology successfully explain personality and individual differences. *Perspectives on Psychological Science, 4*, 359–366.

Buss, D. M., & Duntley, J. D. (2008). Adaptations for exploitation. *Group Dynamics, 12*, 53–62.

Cesarini, D., Dawes, C. T., Fowler, J. H., Johannesson, M., & Lictenstein, P. (2008). Heritability of cooperative behaviour in the trust game. *Proceedings of the National Academy of Science, 105*, 3721–3726.

Corr, P. J. (Ed.). (2008). *The reinforcement sensitivity theory of personality*. Cambridge: Cambridge University Press.

Corr, P. J. (2010a). Automatic and controlled processes in behavioural control: Implications for personality psychology. *European Journal of Personality, 24*, 376–403 (Special Issue).

Corr, P. J. (2010b). The psychoticism–psychopathy continuum: A neuropsychological model of core deficits. *Personality and Individual Differences, 48*, 695–703.

Cronbach, L. J., & Glesser, G. C. (1953). Assessing similarity between profiles. *Psychological Bulletin, 50*, 456–473.

Cunha, F., & Heckman, J. J. (2007). The technology of skill formation. *American Economic Review, 97*, 31–47.

Cunha, F., & Heckman, J. J. (2008). Formulating, identifying and estimating the technology of cognitive and noncognitive skill formation. *Journal of Human Resources, 43*, 738–782.

Cunha, F., & Heckman, J. J. (2009). The economics and psychology of inequality and human development. *Journal of the European Economic Association, 7*, 320–364.

Cunha, F., Heckman, J. J., & Schennach, S. (2010). Estimating the technology of cognitive and noncognitive skill formation. *Econometrica, 78*, 883–931.

De Martino, B., Kumaran, D., Seymour, B., & Dolan, R. J. (2006). Frames, biases, and rational decision-making in the human brain. *Science, 313*, 684–687.

de Wall, F. B. M. (2008). Putting the altruism back into altruism: The evolution of empathy. *Annual Review of Psychology, 59*, 279–300.

Denissen, J. J. A., & Penke, L. (2008). Motivational individual reaction norms underlying the five-factor model of personality: First steps towards a theory-based framework. *Journal of Research in Personality, 42*, 1285–1302.

Dingemanse, N. J., Kazem, A. J. N., Reale, D., & Wright, J. (2010). Behavioral reaction norms: Animal personality meets individual plasticity. *Trends in Ecology and Evolution, 25*, 81–89.

Eysenck, H. J. (1997). Personality and experimental psychology: The unification of psychology and the possibility of a paradigm. *Journal of Personality and Social Psychology, 73*, 1224–1237.

Fehr, E., & Fischbacher, U. (2002). Why social preferences matter – the impact of non-selfish motives on competition, cooperation and incentives. *Economic Journal, 112*, C1–C33.

Fehr, E., & Fischbacher, U. (2003). The nature of human altruism. *Nature, 425*, 785–791.

Fehr, E., & Fischbacher, U. (2004). Third party punishment and social norms. *Evolution and Human Behavior, 25*, 63–87.

Fehr, E., & Gachter, S. (2002). Altruistic punishment in humans. *Nature, 415*, 137–140.

Fehr, E., & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics, 114*, 817–868.

Ferguson, E. (in press). Personality is of central concern to understand health: Towards a theoretical model, new hypotheses and directions for health psychology. *Health Psychology Review*.

Ferguson, E., Tomas Chamorro-Premuzic, T., Pickering, A., & Weiss, A. (2011). Five into one doesn't go: A critique of the general factor of personality. In T. Chamorro-Premuzic, A. Furnham, & S. von Stumm (Eds.), *Handbook of individual differences*. (pp.162–186) London: Wiley-Blackwell.

Ferguson, E., Farrell, K., & Lawrence, C. (2008). Blood donation is an act of benevolence rather than altruism. *Health Psychology, 27*, 327–336.

Fischbacher, U., Gachter, S., & Fehr, E. (2001). Are people conditionally cooperative? Evidence from public goods games. *Economics Letters, 71*, 397–404.

Fisher, F. (1966). *The identification problem in econometrics*. New York: McGraw-Hill.

Fong, C. M. (2007). Evidence from an experiment on charity to welfare recipients: Reciprocity, altruism and the empathic responsiveness hypothesis. *Economic Journal, 117*, 1008–1024.

Frey, B. S., & Stutzer, A. (2007). *Economics and psychology: A promising new cross-disciplinary field*. London: MIT Press.

Frick, P. J., Bodin, S. D., & Barry, C. T. (2000). Psychopathic traits and conduct problems in community and clinic-referred samples of children: Further

development of the psychopathy screening device. *Psychological Assessment, 12*, 382–393.

Funder, D. C., & Colvin, C. R. (1991). Explorations in behavioral consistency: Properties of persons, situations, and behaviors. *Journal of Personality and Social Psychology, 60*, 773–794.

Goldberg, L. R. (1992). The development of the markers for the Big-Five factor structure. *Psychological Assessment, 4*, 26–42.

Hause, J. C. (1980). The fine structure of earnings and the on-the-job training hypothesis. *Econometrica, 48*, 1013–1029.

Heckman, J. J. (2001). Micro data, heterogeneity, and the evaluation of public policy: Nobel lecture. *Journal of Public Economics, 109*, 673–748.

Heckman, J. J. (2007). The economics, technology and neuroscience of human capability formation. *Proceedings of the National Academy of Sciences, 104*, 13250–13255.

Heckman, J. J. (2008). Econometric causality. *International Statistical Review, 76*, 1–27. National Bureau of Economic Research Working Paper 13934. <http://www.nber.org/papers/w13934>.

Heckman, J. J., & Singer, B. S. (1984). A method for minimizing the impact of distributional assumptions in econometric models for duration data. *Econometrica, 52*, 271–320.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics, 24*, 411–482.

Herrmann, B., Thoni, C., & Gachter, S. (2008). Antisocial punishment across societies. *Science, 319*, 1362–1367.

Herrnstein, R. J., & Murray, C. A. (1994). *The bell curve: Intelligence and class structure in American life*. New York: Free Press.

Jakobwitz, S., & Egan, V. (2006). The dark triad and normal personality. *Personality and Individual Differences, 40*, 331–339.

Jöreskog, K. G., & Goldberger, A. S. (1975). Estimation of a model with multiple indicators and multiple causes of a single latent variable. *Journal of the American Statistical Association, 70*, 631–639.

Keser, C., & van Winden, F. (2000). Conditional cooperation and the voluntary contributions to public goods. *Scandinavian Journal of Economics, 102*, 23–39.

Kirman, A., & Teschi, M. (2010). Selfish or selfless? The role of empathy in economics. *Philosophical Transactions of the Royal Society, B, 265*, 303–317.

Kugel, H., Eichmann, M., Dannlowski, U., Ohrmann, P., Bauer, J., Arolt, V., et al (2008). Alexithymic features and automatic amygdala reactivity to facial emotion. *Neuroscience Letters, 435*, 40–44.

Lawrence, C. (2006). Measuring individual responses to aggression-triggering events: Development of the situational triggers of aggressive responses (STAR) Scale. *Aggressive Behavior, 32*, 241–252.

Lawrence, C., & Hodgkins, E. (2008). Personality influences on interpretations of aggressive behavior: The role of provocation sensitivity and trait aggression. *Personality and Individual Differences, 46*(3), 319–324.

Maner, J. K., Luce, C. L., Neubrg, S. L., Cialdini, R. B., Brown, S., & Sagarin, B. J. (2002). The effects of perspective taking on motivations for helping: Still no evidence for altruism. *Personality and Social Psychology Bulletin, 11*, 1601–1610.

Markon, K. E., & Krueger, R. F. (2006). Information-theoretic latent distribution modeling: Distinguishing discrete and continuous latent variable models. *Psychological Methods, 11*, 228–243.

McNaughton, N., & Corr, P. J. (2009). Central theories of motivation and emotion. In G. G. Berntson & J. T. Cacioppo (Eds.), *Handbook of neuroscience for the behavioural sciences* (pp. 710–730). London: Wiley.

Michalski, R. L., & Shackelford, T. K. (2010). Evolutionary personality psychology: Reconciling human nature ad individual differences. *Personality and Individual Differences, 48*, 509–516.

Mischel, W., & Shoda, Y. (1995). A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics and invariance in personality structure. *Psychological Review, 102*, 246–268.

Mischel, W., & Shoda, Y. (1999). Integrating dispositions and processing dynamics within a unified theory of personality: The cognitive-affective personality system. In A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 197–218). Guildford Press: New York.

Moriguchi, Y., Ohnishi, T., Lane, R. D., Maeda, M., Mori, T., Nemoto, K., et al (2006). Impaired self-awareness and theory of mind: An fMRI study of mentalizing in alexithymia. *Neuroimage, 32*, 1472–1482.

Nettle, D. (2006). The evolution of personality variation in humans and other animals. *American Psychologist, 61*, 622–631.

Offerman, T., Sonnemans, J., & Schram, A. (1996). Value orientations, expectations and the voluntary contribution in public goods. *Economic Journal, 106*, 817–845.

Penke, L., Denissen, J. J. A., & Miller, G. F. (2007). The evolutionary genetics of personality. *European Journal of Personality, 21*, 549–587.

Perkins, A. M., & Corr, P. J. (2005). Can worriers be winners? The association between worrying and job performance. *Personality and Individual Differences, 38*, 25–31.

Perkins, A. M., & Corr, P. J. (2006). Cognitive ability as a buffer to neuroticism: Churchill's secret weapon? *Personality and Individual Differences, 40*, 39–51.

Roberts, B. W. (2009). Back to the future: Personality and assessment and personality development. *Journal of Research in Personality, 43*, 137–145.

Roberts, B. W., & Jackson, J. J. (2008). Sociogenomic personality psychology. *Journal of Personality, 76*, 1523–1544.

Ruscio, J., Haslam, N., & Ruscio, A. M. (2006). *Introduction to the taxometric method: A practical guide: Mahwah*. NJ: Lawrence Erlbaum Associates.

Singer, T., & Lamm, C. (2009). The social neuroscience of empathy. *Annals of the New York Academy of Science, 1156*, 81–96.

Tom, S. M., Fox, C. R., Trepel, C., & Poldrack, R. A. (2007). The neural basis of loss aversion in decision-making under risk. *Science, 315*, 515–518.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science, 211*, 453–458.

Van Lange, P. A. M., Otten, W., Bruin, E. M. N., & Joireman, J. A. (1997). Development of prosocial, individualistic and competitive orientations: Theory and preliminary evidence. *Journal of Personality and Social Psychology, 73*, 733–746.

Van Oers, K., de Jong, G., van Noordwijk, A. J., Kempenaers, B., & Drent, P. J. (2005). Contribution of genetics to the study of animal personalities: A review of case studies. *Behaviour, 142*, 1185–1206.

Waller, N. G., & Meehl, P. E. (1998). *Multivariate taxometric procedures*. Thousand Oaks, CA: Sage.

Wolf, M., van Doorn, S., & Weissing, F. J. (2008). Evolutionary emergence of responsive and unresponsive personalities. *Proceedings of the National Academy of Science, 105*, 15825–15830.

Eamonn Ferguson
Department of Psychology, Nottingham University, UK
E-mail address: Eamonn.Ferguson@nottingham.ac.uk

James J. Heckman
University of Chicago, USA
University College Dublin, Ireland
American Bar Foundation, USA
Cowles Foundation, Yale University, USA

Philip Corr
School of Social Work and Psychology, and Centre for Behavioural and Experimental Social Science (CBESS), University of East Anglia, UK