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Review

Neuroscience and approach/avoidance personality traits: A two stage (valuation–motivation) approach

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ABSTRACT

Many personality theories link specific traits to the sensitivities of the neural systems that control approach and avoidance. But there is no consensus on the nature of these systems. Here we combine recent advances in economics and neuroscience to provide a more solid foundation for a neuroscience of approach/avoidance personality. We propose a two-stage integration of valuation (loss/gain) sensitivities with motivational (approach/avoidance/conflict) sensitivities. Our key conclusions are: (1) that *valuation* of appetitive and aversive events (e.g. gain and loss as studied by behavioural economists) is an independent perceptual input stage – with the economic phenomenon of loss aversion resulting from greater negative valuation sensitivity compared to positive valuation sensitivity; (2) that valuation of an appetitive stimulus then interacts with a contingency of presentation or omission to generate a motivational 'attractor' or 'repulsor', respectively (vice versa for an aversive stimulus); (3) the resultant behavioural tendencies to approach or avoid have distinct sensitivities to those of the valuation systems; (4) while attractors and repulsors can reinforce new responses they also, more usually, *elicit* innate or previously conditioned responses and so the perception/valuation–motivation/action complex is best characterised as acting as a 'reinforc*er*' not a 'reinforce*ment*'; and (5) approach–avoidance conflict must be viewed as activating a third motivation system that is distinct from the basic approach and avoidance systems. We provide examples of methods of assessing each of the constructs within approach–avoidance theories and of linking these constructs to personality measures. We sketch a preliminary five-element reinforc*er* sensitivity theory (RST-5) as a first step in the integration of existing specific approach–avoidance theories into a coherent neuroscience of personality.

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1. Introduction

1.1. The goal

With the upsurge of neuroscience in psychology, there has been a proliferation of theories that incorporate personality traits with neural systems that control basic approach and avoidance behaviours. In some cases, this is purely in terms of approach and avoidance (Gray, 1970); in others, approach and avoidance are part of larger schemes (e.g., Cloninger, 1986; Cloninger et al., 1993; for an overview, see DeYoung and Gray, 2009). In fact, the number of these theories has increased rapidly, and members of this extended family include: Depue (Depue and Collins, 1999; Zald and Depue, 2001); Davidson (Davidson et al., 1990, 2004); and Carver (Carver, 2004, 2008; Carver and Harmon-Jones, 2009; Carver et al., 2008; Carver and White, 1994). However, as these theories have proliferated, they have tended to become separated from the increasingly complex neural bedrock on which they are nominally based. We recognise this problem as significant for maintaining consensually agreeable definitions of basic concepts, behaviours and underlying systems. In the absence of agreement on these basic issues, it is difficult to know whether differences between theories are substantive rather than differences of definition and/or emphasis.

In this article, we summarise key aspects of what is currently known about the basic state control of approach and avoidance, and the conflict that can occur between them. These are important for theories of personality; and we provide a preliminary translation of the knowledge of these state systems into the realm of personality description and explanation.

1.2. The problem

Approach–avoidance personality theories invoke long term sensitivities of the major state systems that are activated by appetitive and aversive stimuli, and so attempt to explain consistent patterns of individual differences in behavior. Current theories are not strongly linked to their *a priori* theoretical and empirical foundations. In particular, questionnaires are often constructed intuitively and not validated against more objective neural or behavioural criteria. To tackle this major problem, we argue for the necessity to build a consensus as to the scientific foundations of all approach–avoidance personality theories. It is these general state systems, their interactions, and how they differ between individuals, that provide the facts that are the progenitors of all members of the family of approach–avoidance theories.

The fundamental problem we address is that, in statistical terms, independent trait level variables are the result of interacting state systems. Traits can be viewed as constants within psychological input–output equations. But states, and particularly the behavioural and other measures we use to assess changes in them, are the result of the combination (and often interaction) of the effects of multiple, rapidly changing, variables within an individual.

At the state level, the main problem is theory specification. To test a neuroscientific personality theory, one must take into account the details of the state theory 'equations' through which the trait 'constant' expresses its effects. As we will see (Section 2), this requires careful definition of state level constructs and of their detailed interaction with experimental variables. This issue is complicated by the fact that neural state theories continue to evolve and so their mapping to specific trait measures also needs to evolve.

1.3. The solution

One solution to this problem is to provide a neuroscientific groundwork that is driven by recent advances in the Reinforcement Sensitivity Theory (RST) of personality (Gray, 1970, 1973, 1981, 1982; Gray and McNaughton, 2000; McNaughton and Corr, 2004, 2008b), which has a lineage dating back to the origins of the current family of approach–avoidance theories of personality. We believe that, while the specifics of each member theory of the approach–avoidance family may currently differ, the fundamental underlying constructs to which they are intended to apply should not – or, if they do, then these differences should be made clear. However, we also believe that the precise nature of these constructs, and of the state interactions between them, remains to be demonstrated experimentally via hypothesis testing of theories such as the preliminary one presented here.

In this article, we will end with an attempt to produce a theory, a revised RST, to indicate possible steps in the direction of integration, so that falsification of it can drive future development. But, our main aims are to provide: (1) a clearer definitional picture of background state concepts, many of them thought to be well-established, that underlie any approach/avoidance-related trait theory; (2) a linkage between these concepts and those of behavioural economics; and (3) a clear (and potentially mathematical) picture of the generation of output from the states that result from the interaction of traits with situational input.

We see the road to progress as starting with the original behaviourist and neural methodologies on which state theory is based and via which it has evolved. We argue that, in humans, travel along this road to a coherent theory of personality will be eased by including methods and theory from the study of valuation as revealed by behavioural economics and extended into the neuroscience realm by 'neuroeconomics' (Glimcher et al., 2005;