

readily incorporated. Specifically, in what was little more than a side comment when discussing his model's implications, Corr suggested that linguistic interaction (specifically, 'talk therapy') may affect the proposed personality systems and consequent behaviours by verbally engaging conscious, off-line processing. Further examination of the manner in which social and especially linguistic interactions affect behavioural controls would add greatly to the value of this model by broadening its theoretical range and generalizability.

A final suggestion for this model is to consider further its practical implications. Personality is inherently an applied science because all humans are in the business of recognizing and getting the best out of the personalities of ourselves and those around us. As inadequate as it may be in many regards, one of the pleasures of the Freudian approach to personality processes is that it allows the cognoscenti to recognize patterns of behaviour that correspond to psychoanalytic processes, enhancing one's sense of awareness. Being able to recognize projection, denial and splitting serve practical purposes as well, not only in counselling and therapy but also in organizational development (e.g., de Vries, 1991). Even the theoretically-impooverished lexical models of personality are easier to discuss and apply than concepts like BIS. Integrating RST with consciousness and behavioural control theory is one thing, but it will lack something until people are able to apply it easily to everyday inter- and intra-personal issues.

Of course, there are many missing links in as ambitious a model as this—the manner by which the various components of the model interact, how the 'cybernetic weights' are constructed and applied, the relationship to brain and somatic physiology are just some that spring to mind—but there is already much that has been addressed. The biggest challenge, however, is still to come: Where do the lexical factors fit into the picture?

Levels of Personality

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Abstract

Personality may be analyzed at three levels of information processing, the reactive, routine and reflective. Corr's target article shows that Reinforcement Sensitivity Theory (RST) is an impressive model for personality at the reactive and routine levels. We argue that RST must be expanded in order to adequately capture higher level reflective processes such as long-term goal setting and would benefit from incorporating a dynamic temporal component. By doing so, RST may have the potential to reveal causal mechanisms underlying behavioural control. Copyright © 2010 John Wiley & Sons, Ltd.

Personality is the coherent patterning over time and space of affect, behaviour, cognition and desires. This patterning may be analyzed at three descriptive levels, the reactive, the routine and the reflective (Ortony, Norman, & Revelle, 2005, Revelle, 2007, Revelle &

Wilt, 2008). Rather than proposing these three levels as completely different systems which are instantiated in the brain, we prefer to consider them as a way of describing the breadth of integration over time and space that is being analyzed. At the lowest level, *reactive* responses to stimuli are automatic and may be thought to include even a lower level, the reflexive. The time horizon is the immediate moment. *Routine* behaviours show somewhat more temporal integration and represent well learned responses to stimuli that have occurred in the immediate past (seconds to minutes) based upon expectations of the immediate future (also seconds to minutes). *Reflective* cognition and affect organize memories and feelings from the past and expectations of the future where the time horizon might be a lifetime. The distinction between levels is thus one of breadth rather than kind.

Consider John who gets up in the morning in reactive response to an alarm clock, routinely brushes his teeth, takes a shower and has breakfast while reflecting on the day's activities. If a graduate student, John might be thinking while showering about how to design a study that incorporates his most recent findings on the effect of amygdala lesions in the rat. He remembers what his graduate advisor told him when she discussed how to best present his results at a forthcoming conference to avoid embarrassment and he hopes that his performance will enhance his long-term job prospects. These reflective level feelings, thoughts and desires do not themselves result in behaviour, but by integrating prior affective experiences that were consequences of past behaviour they serve as a steering function for future behaviour.

Phillip Corr in his target article has bravely attempted to apply Reinforcement Sensitivity Theory (RST) (Corr, 2008, Gray & McNaughton, 2000, Smillie, Pickering, & Jackson, 2006) to personality at multiple levels of processing and analysis. Not only does he proffer a theoretical framework for behavioural control, but he also details the nature of the relationship between conscious awareness and the previously formulated behavioural inhibition system as well as demonstrating the fundamental importance of all these topics to the study of personality psychology.

Although mentioning the need to consider multiple levels of processing, most of Corr's analysis is at what we would call the reactive or routine level. He argues from the 300–500 millisecond delay between action and thought that cognition and consciousness are not the processes to be analyzed to understand behaviour. But a part (and unknown) amount of human behaviour is not routine nor does it happen within 500 milliseconds of an event. Successful navigation of an oil tanker requires planning at least an hour ahead. Students make plans for a day or a term, parents save for their children's college tuition for two decades, couples optimistically marry for life. That is, much of human behaviour is guided by reflective processes. Just as consciousness fulfils the momentary role of error detection as Corr suggests, so too must it assist with the resolution of longer-term problems related to the temporal integration of experience. Over longer timeframes, behaviour interacts more extensively with other aspects of personality including cognition, goals and affect. Of these, Corr seems particularly silent with respect to goals, yet a significant portion of behaviours (especially those which are conscious) are conducted in accordance with a hierarchy of goals (Carver & Scheier, 1982).

Broad personality traits such as extraversion or neuroticism are descriptive summaries of affective, cognitive and goal driven processes as they result in observable behaviour over time and space. As such, it is important to consider the temporal dynamics of actions and action tendencies. One such model, the Dynamics of Action, DOA (Atkinson & Birch, 1970), may be reparameterized in terms of Cues, Tendencies and Actions, CTA (Revelle,

1986). In the DOA-CTA model, environmental cues for reward and punishment elicit action tendencies which in turn elicit actions. These actions may be mutually incompatible and the resulting conflict leads to one or another action being executed. Actions in turn reduce action tendencies and if reinforced, modify the cue-action tendency link. Traits may be seen as rates of change in the growth and decay of expectations, action tendencies and actions. Cognitive architectures incorporating the DOA-CTA model with a learning component inspired by RST have been implemented in simple simulations of social interaction (Fua, Horswill, Ortony, & Revelle, 2009, Fua, Revelle, & Ortony, 2010). These simulations view RST in terms of three conceptual systems that act on multiple levels of complexity and that do not require such a tight linking between behaviour and subsequent consciousness as demanded by Corr. Dynamic models such as the DOA-CTA and the control theory models of Carver and Scheier (1982), when integrated with more biologically based models such as RST, have the potential to allow researchers to look for the causal mechanisms of behaviour rather than merely generating descriptive summaries. By analogy to astronomy versus astrology, we view dynamic models as similar to causally linked star clusters and descriptive models as similar to star constellations, which are grouped together only at a superficial level. Nonetheless, the utility of constellation-like personality variables (e.g. Big 5) is evident but may be limited if we are really trying to understand personality. The theory behind cluster-like personality theories is elegant but its practical significance is still unproven.

We believe that Corr's target article shows that the RST is a powerful beginning of a general theory of behavioural control, but one that needs to be elaborated to consider multiple levels of processing as well as the temporal dynamics of action. By thinking about the functions served rather than the specific mechanisms of the three systems of RST it is possible to do so.