Socially discounted reinforcement may seem similar in some respects to vicarious reinforcement, in that the outcome's effects are observed rather than directly experienced (e.g., Bandura et al. 1963; Deguchi 1984). Vicarious reinforcement has been proposed as a necessary component of observational learning (Bandura 1972). However, the crucial difference is that whereas vicarious reinforcement serves an instructional and motivational role, as understood here, socially discounted reinforcement acts directly on the altruist's behavior.

Overall, Rachlin's target article is an important and provocative contribution. However, we are curious to know what his account can provide beyond the one we have outlined. Perhaps some, if not all, altruistic behavior can be understood in terms of socially discounted extrinsic reinforcement. This framework might be more amenable to experimental investigation and more conducive in the long run to understanding this important phenomenon.

Cognitive control in altruism and self-control: A social cognitive neuroscience perspective

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Abstract: The primrose path and prisoner's dilemma paradigms may require cognitive (executive) control: The active maintenance of context representations in lateral prefrontal cortex to provide top-down support for specific behaviors in the face of short delays or stronger response tendencies. This perspective suggests further tests of whether altruism is a type of self-control, including brain imaging, induced affect, and dual-task studies.

The idea that altruistic behavior is a special case of self-controlled behavior is deeply intriguing. However, although Rachlin's argument is elegant and particularly strong on analysis, it is not as well grounded empirically. A social cognitive neuroscience perspective (Ochsner & Lieberman 2001) suggests multiple ways to test whether being altruistic in a prisoner's dilemma situation requires self-control. We first present a task analysis of the two decision-making paradigms.

Self-control in the primrose path paradigm might require cognitive control (Gray 1999): the control of thought and behavior by representations of context information actively maintained in lateral prefrontal cortex (PFC) (Braver & Cohen 2000; Gray 2001). Context is defined as any information that is represented internally in a form that is able to bias processing in the neural pathways responsible for task performance. Goals are a paradigmatic type of context information and must be active (rather than latent) to influence behavior. Context information can also include task instructions or a prior stimulus, or it can be the result of processing a sequence of prior stimuli and responses. Active representations of context can control behavior by biasing brain activity in structures that subserve task-specific processes (e.g., mapping stimuli to responses). Such top-down support is critical for bridging short delays or in the face of stronger behavioral tendencies (e.g., an overlearned or salient stimulus-response mapping that is usually adaptive but is contextually inappropriate). For participants to do well in the primrose path task, top-down support is useful and perhaps necessary to keep track of contingencies over time, and to resist choosing the option that is locally better but globally worse.

Cooperation in the prisoner's dilemma paradigm could also require cognitive control for similar reasons. Although the Braver and Cohen model has not explicitly incorporated social variables, lateral PFC mediates remarkably diverse control functions. Domain-general rather than domain-specific mechanisms are likely to be used for actively maintaining information, including information about other people. Patients with lesions to lateral PFC have gross impairments in both social and nonsocial behavior.

Finally, both paradigms appear to require not just bridging short delays and resisting a prepotent response, but also the integration of information (across time or individuals). Lateral PFC is critical for integration (Gray et al. 2001). Therefore, unless participants are responding by rote, decision making in both paradigms is likely to require cognitive control and lateral PFC function. This task analysis might seem to flatly contradict data showing that patients with lateral PFC damage were not impaired at decision making during the Iowa gambling task, whereas patients with medial PFC damage were impaired (Bechara et al. 1998). However, not all forms of decision making are identical. The Iowa gambling task assesses the ability to learn about discrete risks and rewards – which can be done associatively, that is, using stimulus-response learning, with no contextual dependence of the mappings and hence little need for cognitive control.

How might this task analysis be useful? Rachlin's argument makes a strong prediction: If a particular manipulation biases people to be altruistic, then it must also bias them to be self-controlled. Rachlin presents results showing that (1) manipulating reinforcement contingencies had similar effects on performance in both tasks, and (2) manipulating the context produced similar effects on both tasks. These results weakly support Rachlin's prediction: Many such experiments can be envisioned, and if even just one did not find identical influences of a given manipulation on both tasks, it would argue against a strong form of Rachlin's hypothesis; if they converge, it would further support it. To our knowledge, the following three methods have not been applied to investigate both the primrose path and prisoner's dilemma paradigms. We expect considerable but not perfect overlap.

First, functional brain imaging provides access to internal states that are critical for the control of behavior (e.g., as shown by lesion studies). In principle, two tasks can show identical behavioral effects of different manipulations and yet be very different in underlying mechanisms. If altruism requires self-control, then brain regions that contribute to cooperation in the prisoner's dilemma should also contribute to self-control in the primrose path. The paradigms are not identical in content, so different loci within lateral PFC could be activated. Activation should be sustained across trials but may not be event related.

Second, affective variables are important in many social and nonsocial forms of decision making. Pleasant moods increase the likelihood that people will spontaneously help others (Isen 1972). Pleasant mood enhances the perception that other people belong to one's social group (Dovidio et al. 1995). Thus pleasant emotion should promote cooperation on a prisoner's dilemma task, which it appears to do (Lawler et al. 2000). Does a similar effect of positive mood hold for self-control? Perhaps: Pleasant mood can help people delay gratification (Fry 1977). What about unpleasant mood? Stress and threat-related affect decrease self-control in the primrose path (Gray 1999), suggesting that unpleasant affect should increase selfish responding during a prisoner's dilemma.

Third, dual-task manipulations can be used to reveal whether a task requires cognitive control. If performance degrades when participants must perform another task concurrently, then the primary task requires control. Both Rachlin's hypothesis and the current task analysis predict that participants should be less self-controlled and less cooperative under dual-task conditions.

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