

A schooling hypothesis

Deater-Deckard and colleagues [2] recognize that heritable components of traits 'become more influential as children transition to school, because they are spending more time outside of the home and are gaining more control over their own experiences' ([2], p. F24). In other words, schooling affords children more choice, choice that may be related to genetic predispositions. The implicit assumption here is that children enter school at age 5; however, this is no longer necessarily the case. It is likely that many of the children in their sample, like all western samples, entered various early childhood education programs earlier in their lives. If there is sufficient variability on early childhood education experience within their sample, then this would offer Deater-Deckard *et al.* [2] the possibility of testing whether shared environment coefficients vary as a function of early childhood experience, that is, time outside the home. Specifically, they could use natural variation in early childhood experience to conduct a quasi-experiment on developmental shifts in shared environment estimates for task persistence to test a schooling hypothesis.

Plomin [4] identifies evidence for genetic change in cognitive ability at two time points: the transition from infancy to early childhood and the transition from early to middle childhood; the findings reported here pertain to the latter shift. Plomin [4] also reminds us that all theories recognize age 7 yrs as a time of transition. What this transition reflects is less clear. It is possible that genes turn off and on, of course. There is a second possibility. Consider that success on task persistence is grounded in the development of executive functioning and effortful control, defined as components of cognition and temperament respectively. Throughout the early childhood years, children's ability on tasks related to executive functioning and effortful control increases steadily [8]. For example, over time children perform better on response delay tasks, tasks in which they must delay an approach to a desired object. If increased competence during a specified developmental period allows children to exercise more choice, then one would expect a concomitant increase in heritability coefficients. Because formal schooling is no longer confounded with the well-documented shift in cognitive processing from 5–7 yrs of age [9], the proposed quasi-experiment could disentangle the effects of formal schooling from maturation or development *per se*.

Concluding thoughts

Over the years, critics of behavioral genetics have rightly pointed out potential methodological problems with the twin method, especially the equal environments hypothesis that people impose more similar environments on monozygotic twins than dizygotic twins. Although this criticism applies to studies in which the purpose is merely to produce quantitative genetic parameter estimates, it is hard to see how it might bias developmental shifts in effect sizes for these estimates. Like all findings, the present one on task persistence requires replication, especially replication across samples. We say this in light of the finding reported by Turkheimer *et al.* [10] that heritability coefficients vary greatly with socioeconomic status. Finally, we know that Deater-Deckard and colleagues [2] would agree with us that an important next step lies in documenting gene–environment processes directly via hybrid research models, combining work in molecular biology with longitudinal observations of behavior.

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Letters

Is emotion regulation self-regulation?

Georg Northoff

Laboratory of Neuroimaging and Neurophilosophy, Department of Psychiatry, Otto-von-Guericke University of Magdeburg, Leipziger Strasse 44, 39120 Magdeburg, Germany

Ochsner and Gross [1] suggest two different neural systems to be involved in emotion regulation. The first

system concerns ventral and orbital prefrontal cortical regions accounting for context-dependent evaluation of the value of emotional stimuli as required in stimulus–reward reversal learning and extinction. The second

Corresponding author: Northoff, G. (georg.northoff@medizin.uni-magdeburg.de).
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system involves the dorsal prefrontal cortex that allows for explicit reasoning about stimuli–emotion associations.

Recent imaging studies show that the ventromedial prefrontal cortex (VMPFC), the perigenual anterior cingulate cortex (PACC), and the dorsomedial prefrontal cortex (DMPFC) are also involved in relating emotional stimuli to the self. Phan *et al.* [2] observed that the degree of emotional self-relatedness (as obtained in subjective ratings) was associated with signal changes in VMPFC, PACC and DMPFC: The more self-related the picture content was appraised by the subject, the more activation was observed in these regions. In another study [3], signal changes in DMPFC were related to positive and negative emotional personality trait adjectives. This is in line with an earlier study by Gusnard *et al.* [4] where self-related (i.e. internal) attention to emotional stimuli induced signal changes in PACC, VMPFC and DMPFC when compared with non-self-related (i.e. external) attention. Finally, Ochsner *et al.* [5] observed increased recruitment in PACC during self-referent emotional contents (self-focus) as compared with situational context meanings (situation-focus). Although this is shown in their review in Figure 3c it is not discussed.

This suggests an overlap between self-relatedness and emotion regulation in anterior cortical midline regions. Is self-referential processing one way to regulate emotion? One could, for example, imagine that the degree of self-relatedness controls the subjective experience of emotion, that is, feelings. The more activation in VMPFC, the more self-related an emotional stimulus will be evaluated, leading to increased personal involvement with stronger feelings. Conversely, the less the VMPFC is activated, the less self-related an emotional stimulus, resulting in less personal involvement with weaker feelings.

Future studies should focus on directly comparing self-referential processing and stimulus–reward reversal learning vs extinction; this could answer the question of whether self-referential processing is a separate process or not (see also [6,7]). Furthermore, one could investigate the interference between self-referential processing and other emotion regulation mechanisms (anticipation, attentional distraction, reappraisal). This could contribute to the issue of whether self-referential processing is a higher-order cognitive process by itself, or whether it is a more basal process underlying higher-order cognitive mechanisms of emotion regulation.

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Letters Response

Putting the ‘I’ and the ‘Me’ in emotion regulation: Reply to Northoff

Kevin N. Ochsner¹ and James J. Gross²

¹Department of Psychology, Columbia University, 369 Schermerhorn Hall, 1190 Amsterdam Avenue, New York, NY 10027, USA

²Department of Psychology, Stanford University, Building 420, Stanford, CA 94305-2130, USA

Northoff’s comment [1] raises important questions about the role of the self in emotion regulation. Space constraints precluded our addressing these questions in our original article [2]. We are therefore delighted to have the chance to consider them here.

More than a century ago, William James [3] distinguished between two aspects of the psychological self: the ‘I’ and the ‘Me’. James’s ‘I’ is the first-person agentic ‘doer’ that in the context of emotion regulation inhibits prepotent responses, generates reappraisals, and so on. Because the ‘I’

aspect of self accompanies all goal-directed activities, it is involved in all forms of self-regulation, not just those involving the cognitive control of emotion. Research has just begun to examine the neural bases of this aspect of self, but we believe that, depending upon the task and context, different combinations of neural systems (including, for example, dorsolateral prefrontal cortex and anterior cingulate cortex) may be involved in the agentic, ‘I’ mode of regulatory control over emotion and other processes.

By contrast, James’s ‘Me’ is the third-person object of self-reflection about one’s traits (*‘am I friendly?’*), beliefs (*‘do I like chocolate?’*), states (*‘am I angry?’*) and so on. The

Corresponding author: Ochsner, K.N. (ochsner@psych.columbia.edu).
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