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Executive control and the experience of regret

Patrick Burns [a,1], Kevin J. Riggs [b,*], Sarah R. Beck [a]

[a] School of Psychology, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK
[b] Department of Psychology, University of Hull, Hull HU6 7RX, UK

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ABSTRACT

The experience of regret rests on a counterfactual analysis of events. Previous research indicates that regret emerges at around 6 years of age, marginally later than the age at which children begin to answer counterfactual questions correctly. We hypothesized that the late emergence of regret relative to early counterfactual thinking is a result of the executive demands of simultaneously holding in mind and comparing dual representations of reality (counterfactual and actual). To test this hypothesis, we administered two regret tasks along with four tests of executive function (two working memory tasks, a switch task, and an inhibition task) to a sample of 104 4- to 7-year-olds. Results indicated that switching, but not working memory or inhibition, was a significant predictor of whether or not children experienced regret. This finding corroborates and extends previous research showing that the development of counterfactual thinking in children is related to their developing executive competence.

Introduction

One of the distinguishing features of human cognition is the ability to consider alternatives to the here and now. Thoughts about what might have been are counterfactual thoughts, and when such thoughts concern better alternatives to the present they often lead to negative emotional affect. This experience is what we typically call *regret*, and researchers have posited that regret serves to promote more beneficial future behavior and even happiness (King & Hicks, 2007).

* Corresponding author. Fax: +44 0 1482 465599.
E-mail addresses: k.riggs@hull.ac.uk, pl_burns@hotmail.com (K.J. Riggs).
[1] Current address: Department of Experimental Psychology, University of Cambridge, Cambridge CB2 1TN, UK.

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An additional feature of human behavior is the ability to adapt attentional and motor processes flexibly in the pursuit of complex and abstract goals. The monitoring, selection, and coordination of the cognitive processes involved in complex behaviors have been most often studied under the umbrella term *executive function*.

In this article, we investigate the relationship between the emergence of counterfactual emotions during early childhood and the development of executive function. We begin by presenting an analysis of regret along with a review of its development. We then set out our reasons for believing that individual differences in executive function predict the experience of regret in young children.

The feeling of regret

When we miss a train or forget to do something important, thoughts of how the world might have been often come to mind. These counterfactual thoughts involve reasoning about alternative possible realities (Roese, 1997) and in adults are typically associated with the experience of regret (Zeelenberg & van Dijk, 2005). Two approaches have been taken in the study of the development of regret. The first, pioneered by Guttentag and Ferrell (2004; see also Ferrell, Guttentag, & Gredlein, 2009), assesses children's understanding of the conditions that lead to regret in others. Guttentag and Ferrell presented children with stories concerning two characters who encountered negative events. In one story, two boys cycled along one of two paths around a pond. One boy typically took the left path, whereas the other boy typically took the right path. One morning, both boys independently decided to take the same path around the pond. They both had a minor accident (hit a tree and fell off their bike). Children and adults were asked whether one of the boys felt worse about what had happened. Both 7-year-olds and adults judged that the boy whose action was atypical felt worse. By contrast, 5-year-olds judged that both boys felt equally sad.

A second approach to regret is to examine when children begin to experience regret themselves for events in which they are personally involved. A recent study by Weisberg and Beck (2010) addressed this issue. Children played a game in which they chose one of two boxes, both of which contained some stickers. Children rated how happy they felt after the contents of the box they chose were revealed (either two or three stickers) and again after contents of the nonchosen box were revealed (eight stickers). Children from 5 years of age rated themselves as less happy once they discovered they could have won more stickers. Weisberg and Beck interpreted this as evidence of regret. By contrast, children younger than 5 years of age tended to judge themselves as no less happy after the alternative box had been opened than before it had been opened (see also O'Connor, McCormack, & Feeney, 2012; Weisberg & Beck, in press).

Executive function

Although executive function is implicated in a heterogeneous array of everyday tasks such as planning, organization, and problem solving, evidence from laboratory studies indicates that the executive system consists of three dissociable but related components: updating and monitoring (interpreted by some as working memory), inhibitory control, and shifting/switching (Collette et al., 2005; Diamond, 2006; Fisk & Sharp, 2004; Lehto, 1996; Miyake et al., 2000).

Studies of the developmental trajectory of executive control have found a general and protracted improvement across a range of executive tasks beginning in early infancy and culminating in early adulthood (Crone, Ridderinkhof, Worm, Somsen, & van der Molen, 2004; Davidson, Amso, Anderson, & Diamond, 2006; Simpson & Riggs, 2005). Although there is some disagreement as to how best to characterize the early executive system, with some arguing for a single construct during the preschool years (Espy, Wiebe, & Charak, 2008), the weight of evidence suggests that executive function comprises dissociable subcomponents by at least 6 years of age (Beveridge, Jarrold, & Pettit, 2002; Brocki & Bohlin, 2004; Garon, Bryson, & Smith, 2008; Hughes, 1998).

Domain-general executive processing has been implicated in a wide array of domain-specific behaviors and abilities that undergo development during early childhood such as theory of mind (Carlson & Moses, 2001) and reading and mathematics (Blair & Razza, 2007). However, no research to date has sought to investigate the link between executive control and the experience of regret. Here, we provide