Accepted for publication in Child Development Perspectives

Developing thoughts about what might have been

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Key words: counterfactual thinking, cognitive development, imagination, regret

Abstract

Recent findings have changed how developmental psychologists understand counterfactual thinking, or thoughts of what might have been. Counter to claims that counterfactual thinking is a unitary early- or late-developing ability, recent evidence suggests it shows a protracted development into at least middle childhood, depends on domain-general processes including executive function and language, and dissociates from counterfactual emotions, such as regret. We review the developmental evidence which forms a critical, although often overlooked, complement to the cognitive, social and neuroscience literatures. Finally, we highlight future research topics, including the development of spontaneous counterfactual thinking and counterfactual thinking in clinical populations.

Much of intelligent thought involves speculating outside the here and now. Counterfactual thoughts compare what we know to be true with what might have been. We imagine how our lives would have been different had we chosen a different holiday destination, failed our high school exams, or accepted that invitation to dinner. As well as being of philosophical interest (e.g. Lewis, 1975), counterfactuals are central to the practical business of learning from our past mistakes (Roese, 2005), and support certain emotions, such as regret. Our understanding of counterfactual thinking also informs clinical and decision-making research (e.g. Roese, Park, Smallman, & Gibson, 2008; Zeelenberg & Pieters, 2007). There is a large and well-established body of work on counterfactual thinking in adults (e.g., Epstude & Roese, 2008; Mandel, Hilton, & Catellani, 2005) and a rapidly growing literature on the neuroscience of counterfactual emotions (e.g. Nicolle, Back, Driver, & Dolan, 2011). But to understand counterfactual thinking fully, we need to know how it develops.

There are three distinct theoretical positions on counterfactual thinking development: First, it develops early in the preschool years (e.g. Gopnik, 2009; Byrne, 2005). Second, it appears in late childhood (e.g. Perner & Rafetseder, 2011). Both these positions assume that counterfactual thinking undergoes a single development. Based on a number of recent findings, our position is that there are multiple developments that culminate in adult-like counterfactual thinking. These developments are underpinned by specific advances in domain general processing, especially executive control processes that organise and control behaviour. We review these developments, outline important remaining questions, and reflect on the consequences for other fields.

THE DEVELOPMENT OF COUNTERFACTUAL THINKING

The first evidence that children think outside the here and now is when they start pretending at 18 months (Leslie, 1987). Evidence of counterfactual thinking was first claimed by Harris, German & Mills (1996). Children heard a story where Carol walks across the clean floor wearing dirty shoes. They were asked “What if Carol had taken her shoes off – would the floor be dirty?” Three-year-olds gave the correct counterfactual answer (“no”) to the majority of trials. Riggs, Peterson, Robinson, and Mitchell (1998) ascribed this ability to four-year-olds, although the precise age is not relevant here. Many people have taken the Harris and Riggs findings as evidence that by 4 years, children have

achieved a milestone development: counterfactual thinking. However, recent evidence suggests that the abilities of these preschool children do not reflect adult-like counterfactual thinking.

One important subsequent development is that children come to relate the imagined counterfactual world to what they know to be true. For adults this relating distinguishes counterfactual thinking from other types of speculation: I can daydream about winning the lottery without relating this to reality. But if I fail to buy a ticket one week and 'my' numbers come up there's an all too salient relationship between the real and counterfactual world. Beck and colleagues (2006) showed that questions requiring simultaneously acknowledging both what happened and what could have happened were more difficult than the Harris and Riggs counterfactual conditional questions. In Beck's task a mouse took one of two paths finishing up at the end of it. Three- to six-year-olds found it relatively difficult to answer the question "Could he have gone anywhere else?" i.e., to acknowledge that there were two possible ways the world could have turned out.

When we consider what 'almost happened', we also think about two possible worlds. For example, describing that a horse 'almost fell' draws one's attention to the fact that it did not fall (reality) yet could have (counterfactual). Beck and Guthrie (2011) showed that it is not until children are 5 years old that they make this counterfactual interpretation of 'almost' reliably (Harris (1997) suggested that 2½-year-olds could do this, but the recent study suggests these were false positives).

Work by Perner and colleagues also emphasises the importance of the relationship between the counterfactual and real world. They found a difference in difficulty when children had to take what happened in to account to generate the counterfactual compared to when they could ignore what had gone before. Both 3- and 4-year-olds (Perner, Sprung, & Steinkogler, 2004) and 5- to 6-year-olds (Rafetseder, Cristi-Vargas, & Perner, 2010) found the former much more difficult to answer correctly than the latter.

While we include Perner's studies as evidence for further counterfactual thinking development into middle childhood, Perner and colleagues hold a rather different position. They conclude that younger children answer counterfactual questions using basic conditional reasoning: they base their answer on general knowledge, not counterfactual thinking. For example, in their recent study children heard scenarios based on the Harris, German and Mills (1996) study where Carol *and* John make dirty

footprints on a floor. Children performed worse when they had to judge that the floor would still be dirty if (only) Carol had removed her shoes, than when only one person was involved (Rafetseder, Hofer, Ecker, & Perner, 2012). Perner and colleagues argue that we must wait until early adolescence for evidence of genuine counterfactual reasoning - their focus is on a late single development.

COUNTERFACTUAL EMOTIONS.

Further evidence that counterfactual thinking develops beyond the preschool years comes from research on children's counterfactual emotions, in particular regret and relief - although there are other counterfactual emotions including shame and guilt (Landman, 1993). We experience regret when our actions give rise to a reality that is worse than it could have been, for example, when a student stays out late the night before an exam that she fails. Relief is the complement to this, where reality is better than it could have been (n.b., Sweeney & Vohs (2012) consider this 'near-miss relief')

Studies of children's experience of counterfactual emotions typically involve children making a simple choice between two boxes and receiving the reward contained within their chosen one. Then they learn what was in the unchosen box: a better prize in regret trials (e.g., 8 stickers compared to 2), or a worse prize in relief trials (e.g., 0 stickers compared to 2). Children are judged to feel regret if they rate themselves as less happy on learning what was in the unchosen box compared to how they felt before learning (e.g. Weisberg & Beck, 2010). Relief is shown when children rate themselves as more happy. There has been some discussion in this fledgling literature as to whether these tasks really measure counterfactual emotions or only a reality-based emotion, such as frustration that the better prize eludes them. Supportive evidence that these are genuine counterfactual emotions comes from the observation that children are less likely to rate themselves as less happy if 'their box' was determined by overt chance (the throw of a die) rather than their own choice (Weisberg & Beck, 2012). It is not yet clear from the literature when children first experience counterfactual emotions. Weisberg & Beck (2010; 2012) find some evidence that 4- and 5-year-olds experience regret, O'Connor, McCormack, & Feeney (2011) report regret in 6-year-olds but not younger children, and Rafetseder and Perner (2012) argue that regret is not experienced until around 10 years. There is a delay between experiencing counterfactual emotions and attributing them to others (Weisberg & Beck, 2010; see also Guttentag & Ferrell, 2004). Although there is little evidence, there is a hint that

experiencing and understanding relief lags behind regret, at least in some contexts (Guttentag & Ferrell, 2004; Weisberg & Beck, 2012).

Adults experience counterfactual emotions when they reflect on what could have happened in the past, but the relationship between counterfactuals and reality is even more complicated by the fact that they also anticipate counterfactual emotions (Zeelenberg & Pieters, 2007). For example, I might avoid a novel 'dish if the day' in my favourite restaurant, opting instead for my trusted staple, because I know I will regret the risky choice if it turns out to be disappointing. Although there is very limited developmental evidence on this faculty, it should come as no surprise that anticipated regret, with its associated demands in thinking about multiple possible futures, is later developing than counterfactual thinking in the present (Guttentag & Ferrell, 2009).

To sum up so far: A single early development does not give rise to adult-like counterfactual thinking. Consistent with this view, Perner claims that counterfactual thinking is a late emerging developmental phenomenon. While we agree that fully fledged adult-like counterfactual thinking may appear late, we think it is a mistake to ignore earlier developments along the way, including i) relating the real and counterfactual world and ii) making comparisons between them that result in counterfactual emotions. We argue that these are critical developments in counterfactual thinking and in what follows we consider further evidence why: each is underpinned by changes in domain general processing.

DOMAIN GENERAL INFLUENCES ON COUNTERFACTUAL THINKING.

Counterfactual thinking draws on a variety of domain general cognitive processes, although some also claim a role for domain specific knowledge (Sobel, 2011). There is evidence from individual differences studies that the executive processes working memory - the ability to hold information in mind relevant to a task goal (Guajardo, Parker, & Turley-Ames, 2009) and inhibition - the ability to ignore interfering cognitions that are irrelevant to a task goal (Beck, Riggs, & Gorniak, 2009) underpin counterfactual thinking.

That executive processes relate to counterfactual thinking is perhaps not surprising. To speculate about what might have been, one needs to put aside what one knows to be true (inhibition) and hold both the counterfactual and real worlds in mind (working memory). Counterfactual emotions

require making a comparison between the real and imagined and in line with this, experience of regret is predicted by children's attentional flexibility – the ability to switch between mental set (Burns, Riggs, & Beck, 2012).

Children's language ability also contributes to their counterfactual thinking competence (e.g., Beck et al., 2009). This leads to the interesting possibility that language is necessary for counterfactual thought and the consequent speculation that counterfactual thinking might be a uniquely human ability. There is evidence that rhesus monkeys represent hypothetical outcomes of unchosen behaviours (e.g., Abe & Lee, 2011), but whether this is evidence of counterfactual thought is uncertain. Indeed, it is difficult to know what non-verbal behavior would provide convincing evidence of counterfactual thinking.

Domain general processes are clearly important in the development of counterfactual thinking, and key advances in this processing allow children to develop more sophisticated counterfactual thinking. What though of this relationship in adults? To some extent adult counterfactual thinking must continue to place demands on executive function and language, but it is unknown whether these processes remain necessary or limiting. Do adults tax their inhibition in order to speculate about what might have been, or is this demand trivial for them? Indeed, is adult counterfactual thought automatic and effortless (Goldinger, Kleider, Azuma, & Beike, 2003)? Another possibility is that executive processes may allow adults to strategically control how they manage counterfactual thoughts (e.g., they may use inhibitory control to avoid dwelling on unpleasant events).

FUTURE WORK

Our theoretical view of multiple developments underpinned by domain general processes provides a rich account of children's counterfactual thinking. It also informs other research in cognitive development where an understanding of counterfactual thinking is deemed important, such as causal understanding (Frosch, McCormack, Lagnado, & Burns, 2012) and decision-making (O'Connor, Feeney, & McCormack, 2012). Furthermore, the multiple developments account offers a framework for thinking about the complexities of counterfactual thinking to inform neuroscience and adult cognitive and social research. There is much to be gained by seeing counterfactual thinking as relying on numerous processes and developments rather than being unitary: different brain areas are

likely to be implicated in hitherto neglected processes and a better understanding of those areas already implicated (e.g., the orbito-frontal cortex, anterior cingulate cortex and hippocampus) can be gained by investigating their specific processing demands.

Adults spontaneously engage in counterfactual thinking, but it is unknown at what age and under which circumstances children do so. We have some preliminary ideas based on children's understanding of 'almost' and their experience of regret, but in these studies children are prompted to engage in counterfactual thought by the experimental set-up. We know children can talk about hypothetical worlds (e.g. Kucjaz & Daly, 1979) from 4 years, but when do they make spontaneous counterfactual speculations of the type that play on the minds of adults? Do children spontaneously generate their own counterfactuals as soon as they have the reasoning competence? When does counterfactual thinking become automatic? Once children spontaneously generate counterfactuals, do they necessarily experience counterfactual emotions or is even more development needed? Answering these questions is critical for understanding how this reasoning is employed in the real world.

Adults' counterfactual thinking is susceptible to various biases. They engage in more counterfactual thinking when people act rather than fail to act, or when counterfactual worlds seemed close rather than distant (e.g., I almost caught the plane or I missed it by 2 hours). Some researchers have begun to investigate these biases in children (Meehan & Byrne, 2005; Weisberg & Beck, 2012), but we have yet to understand the origins of these biases. A developmental perspective offers a unique opportunity to understand how biases appear: do they result from intrinsic differences in how we process counterfactuals, or are they learned?

Recent research suggests that counterfactual thinking is implicated in a diversity of clinical populations including: schizophrenia (Roese et al., 2008), depression (Markman & Miller, 2006), and autism (Beeger, Terwogt, Lunenburg, & Stegge, 2009). If there are multiple developments in counterfactual thinking, underpinned by different executive processes, there is a need to explore possibly subtle differences in counterfactual thinking in these disorders.

In sum, developmental psychology offers insight in to the fact that counterfactual thinking is a complex ability with a protracted development over early and middle childhood, supported by a

number of domain general cognitive processes. By neglecting these complexities researchers in a diversity of fields are at risk over oversimplification.

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Recommended Readings:

Beck, S.R., Riggs, K.J., & Burns, P.L. (2011) Multiple developments in counterfactual thinking. *In Understanding Counterfactuals/Understanding Causality. C. Hoerl, T. McCormack, S.R. Beck (eds.) OUP: Oxford, UK.*

This paper gives a detailed review of the developmental studies that suggest that several developments take place in children's counterfactual thinking.

Harris, P.L. (2000). *The Work of the Imagination.* Oxford: Blackwell.

This book situates children's counterfactual thinking within the broader literatures on pretence, hypothetical thinking and complex emotions.

Rafetseder, E., & Perner, J. (2012). When the alternative would have been better: Counterfactual reasoning and the emergence of regret. *Cognition and Emotion, 26,* 800-819.

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These two papers in the same issue of Cognition and Emotion represent the state-of-the-art of research on children's counterfactual emotions and illustrate the ongoing debate.

Endnotes

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