What is and what never should have been: Children's causal and counterfactual judgments about the same events

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Abstract

Substantial research with adults has characterized the contents of individuals' counterfactual thoughts. In contrast, little is known about the types of events children invoke in their counterfactual thoughts, and how they compare to their causal ascriptions. In the current study, we asked children open-ended counterfactual and causal questions about events in which a character's action enabled a force of nature to cause a minor mishap. Children aged 3.5 to 8 years (N = 160) tended to invoke characters' actions in their counterfactual judgments to explain how an event could have been prevented (e.g., "She should have closed the window.") and forces of nature in their causal judgments (e.g., "The rain got it wet."). Younger children were also significantly more likely than older children to invoke forces of nature in their counterfactuals (e.g., "It shouldn't have rained"). These results indicate that, similar to reasoning patterns found in adults, children tend to focus on controllable enabling conditions when reasoning counterfactually, but also point to some developmental differences. The developmental similarities suggest counterfactual reasoning may serve a similar function from middle childhood through adulthood.

Keywords: cognitive development; counterfactual reasoning; causal reasoning; imagination

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Humans have a tendency to reflect on what could have been. An individual who misses her flight after being stopped by a traffic jam may entertain counterfactual thoughts such as "I should have left my house sooner" or "If only I'd taken a different route". The human mind shows predictable patterns in the alternatives it generates when considering "if only…" scenarios (Byrne, 2002; Byrne, 2005). For instance, adults mutate exceptional, rather than routine events (Kahneman & Tversky, 1982), controllable rather than uncontrollable ones (Girotto & Rizzo, 1991; Mandel & Lehman, 1996; Roese, 1997), and enabling conditions over strong causes (e.g., Mandel & Lehman, 1996; McCloy & Byrne, 2002; N'gbala & Branscombe, 1995; Wells & Gavanski, 1989). These "fault lines" of reality show reliable inter-individual consistency (Byrne, 2005; Hofstader, 1985; Kahneman & Tversky, 1982). These patterns in counterfactual thinking are thought to influence individuals' ability to attribute causation and blame, and make adaptive decisions in the future (e.g., Byrne, 2016; Epstude & Roese, 2008).

A question for developmental research is whether these patterns are fundamental features of the human reasoning system (Beck & Riggs, 2014). Do children show similar patterns in their earliest counterfactual thoughts, or are these biases acquired over time? If they do not, it may suggest that the adaptive function of counterfactual thinking emerges and develops over time, or that counterfactual thinking serves a different function in childhood.

The majority of research on counterfactual thinking in development has asked *when* children are capable of thinking counterfactually. These studies indicate that children can first engage in counterfactual reasoning around the age of 4 (Beck, Robinson, Carroll, & Apperly, 2006, standard counterfactuals; Harris, German, & Mills, 1996; Nyhout & Ganea, 2019a; Riggs

& Robinson, 1998). Most of these studies have required children to select a logically correct answer in response to a counterfactual question to be credited with counterfactual reasoning.

Some previous work has, however, looked for the presence of fault lines or biases in children's counterfactual reasoning *indirectly* by examining how their judgments of fault and blame change in different contexts. Typically, researchers ask children to judge which of two characters will feel worse or is more deserving of blame, with the idea that such a judgment reflects the availability of a counterfactual alternative. For example, 6- and 8-year-olds in one study exhibited the *temporal order bias*, attributing blame to a character who acted most recently in a sequence of events (Meehan & Byrne, 2005), as seen in adults (Byrne et al., 2000). In another study, 7-year-olds, but not younger children, were more likely to blame a character who behaved atypically (Guttentag & Ferrell, 2004), in line with findings with adults that *exceptional events* are more mutable (Kahneman & Tversky, 1982). In the same study, 7-year-olds were more likely to attribute blame in response to acts of commission than acts of omission, showing evidence for an *action bias*. Payir and Guttentag (2019) found a developmental progression between the ages of 6 and 11 in children's use of the temporal order bias and the action bias in their judgments of regret and blame. Together, these findings suggest that children exhibit the same counterfactual biases as adults in middle childhood, but not sooner.

On the basis of some of these findings, Beck and colleagues (2014) speculated that "children's counterfactual thinking, while competent, may not show the same biases as adults…Perhaps the biases we see in adult counterfactual thinking are the result of children learning which events are useful to dwell on for future learning." (p. 684).

However, the tasks presented to children in these previous studies were particularly challenging. They were situated in contexts requiring children to make inferences about

counterfactual emotions (i.e., relief and regret). The development of counterfactual emotions appears to be protracted relative to children's ability to answer counterfactual questions when prompted (see Beck, Weisberg, Burns, & Riggs, 2014 for a review). Additionally, the scenarios involved multiple events which could have overwhelmed children's working memory.

In the current study, we presented children with scenarios that did not require inferences about counterfactual emotions, and directly prompted their counterfactual thinking with open-ended questions. We used short, simple scenarios with only a single character in order to constrain the world of possibilities. We were interested in whether children would show a tendency, like adults, to invoke a controllable enabling condition in their counterfactuals.

Adults tend to invoke *enabling conditions* when generating a counterfactual or when thinking about how the event could have been prevented, but attribute the cause of an event to a *strong cause* (Byrne, 2005; Mandel & Lehman, 1996; McEleney & Byrne, 2006). An enabling condition is necessary but not sufficient for an outcome to occur, whereas a strong cause is both necessary and sufficient (Goldvarg & Johnson-Laird, 2001). Several studies have found that the contents of adults' causal and counterfactual thoughts diverge (Mandel & Lehman, 1996; McEleney & Byrne, 2006; N'gbala & Branscombe, 1995; but see Spellman & Ndiaye, 2007; Wells & Gavanski, 1989). Typically, counterfactual and prevention judgments align with enabling conditions that are *controllable* compared to causal judgments about events that are *uncontrollable* (Mandel & Lehman, 1996). For instance, adults may respond that poor weather caused an accident to occur (uncontrollable strong cause), but may undo the event in a counterfactual by stating that the character should have stayed home that day (controllable enabling condition).

There is some previous evidence that children's causal and counterfactual (or prevention) judgments *align*. Harris and colleagues (1996) found that 3- and 4-year-olds used the availability of alternatives in their causal and prevention judgments about minor mishaps. German (1999) subsequently found that 5-year-olds used the availability of alternatives when making judgments about negative outcomes, but not for *positive* outcomes. In contrast to the present study, the counterfactual alternative in Harris et al's (1996) and German's (1999) studies was available to children as a character's foregone choice. It is an open question which events children will mutate in response to counterfactual questions when the alternative is not so readily available.

In the present study, we investigated the types of events children invoke in their counterfactuals, how these thoughts relate to causal ascriptions for the same events, and how these patterns may change with development. We included a wide age range – spanning when children first show evidence of reasoning about counterfactual conditionals (age 3.5 years, Harris et al., 1996) to when they show evidence for other types of biases in their reasoning (age 8-9 years; see above) – to investigate possible developmental changes and better understand when in development counterfactual thought begins to show adult-like patterns.

In line with several previous studies with children and adults, the events in question involved minor mishaps, given that negative events are more likely to elicit counterfactual thoughts (German, 1999; McEleney & Byrne, 2006; Roese, 1997; Sanna & Turley, 1996). We examined possible developmental changes in the contents of children's counterfactuals thoughts and intra-individual patterns in counterfactual and causal judgments about the same events.

We presented children with simple events that were caused by a strong, uncontrollable cause (a force of nature), but enabled by a controllable event (the character's action). For instance, in one story, a character leaves his drawings outside (enabling condition), which then

blow away in the wind (strong cause). Recall that in previous studies with adults, participants have tended to attribute the cause of an event to a strong cause, but to invoke the enabling condition when generating a counterfactual or thinking about how the event could have been prevented (Byrne, 2005; Mandel & Lehman, 1996; McEleney & Bryne, 2006).

Method

Participants

Participants were 160 children between the ages of 3.5 years and 8 years. Children were recruited and tested in a semi-private area of a museum in a large urban area (n = 92) or in our laboratory (n = 68). For inclusion in the study, children were required to be exposed to English 50% or more of the time, assessed by parental report. For the purposes of recruitment and analysis, we divided children into three age groups: preschoolers (n = 53, *M* = 4.24, *SD* = 0.46, range = 3.39 to 4.99y, 25 girls), kindergartens (n = 56, *M* = 6.05, *SD* = 0.58, range = 5.08 to 6.98y, 30 girls), and school-age (n = 51, *M* = 7.82, *SD* = 0.57, range = 7.01 to 8.96y, 25 girls). An additional 34 children were tested and excluded for the following reasons: less than 50% English exposure (n = 23), failure to answer test questions (n = 10), and parental interference (n = 1). Children were predominately White (45%), Asian (27%), or Mixed race (22%), and the majority of parents had a Bachelor's degree or higher (85%).

Design and procedure

This study received ethics approval through the research ethics board at [Institution blinded]. Stimuli included 4 stories featuring a single character. In all stories, the character was doing an activity and an action or lack of action on the part of the character *enabled* a mishap to occur. In all cases, the outcome was *caused* by a force of nature. For example, in the drawing story, a character is sitting on his front porch drawing. He goes inside to get some juice, and the

wind blows his drawings away. Stories were presented using PowerPoint. Story images were created using the program Storyboard That, and narration was pre-recorded (see Appendix for full text).

Children were tested individually and heard the stories in one of two orders: (1) drawings, (2) doll, (3) sandcastle, (4) ice cream, or the reverse order. At the end of each story, the experimenter asked a causal question, a control question, and a counterfactual question. The *causal question* asked the child to explain why the outcome had occurred (e.g., "Why are Andy's drawings gone?") and the *counterfactual question* asked the child how the outcome could have been prevented (e.g., "What should have happened so Andy's drawings would not be gone?"). The wording of the causal and counterfactual questions was designed to be as similar as possible. The order of the causal and counterfactual questions was counterbalanced between participants. The *control question* requested a factual piece of information from the story (e.g., "What did Andy go inside to get?") and was always presented between the causal and counterfactual questions. Control questions were included to ensure participants attended to the stories, and to provide some separation between the causal and counterfactual questions. Children answered control questions with a high degree of accuracy (90%).

Each session was video recorded. Children's responses were transcribed and coded offline.

Coding

Children's responses were coded for whether they referred to (I) the uncontrollable cause (force of nature), (II) controllable cause (person's action), (III) both the force of nature and the person's action, or (IV) other (irrelevant, "I don't know"). Categories were mutually exclusive. Examples of children's responses to causal and counterfactual questions that fit into each

category are displayed in Table 1. One coder coded 100% of children's responses. A second coder coded 30% of total responses. Coding agreement was excellent, 95.5%, $\kappa = 0.92$, $p < .001$.

Table 1. Sample responses to causal and counterfactual questions fitting into each coding category (age of child who offered response in parentheses)

Coding category	**Causal questions**	**Counterfactual questions**
Uncontrollable (force of nature)	• *Her ice cream melted because of the sun* (4) • *Because the waves smashed it down* (4)	• *The sun shouldn't have come out* (6) • *The water shouldn't hit it* (4)
Controllable (person's action)	• *Because she didn't close the window* (7) • *If he built it further from the water* (8)	• *Put a box over it or hammer it down with a nail* (3) • *Moved it far from the ocean* (7)
Both	• *It rained and she forgot to close the window* (7) • *It's because she left it on her blanket and it started melting with the sun* (3)	• *If something blocks the wind or if he draws inside* (4) • *If she didn't put it in the sun that was hot* (4)
Other	• *Because she doesn't like wet things* (4)	• *He can just make another sandcastle* (5)

Results

The proportion of children's total responses for causal and counterfactual questions that fell into each of the 4 coding categories are presented in Figure 1. Each participant received a score out of 4 for the number of causal and counterfactual responses fitting into each of the 4 coding categories, yielding 8 total scores for each participant. Because of the presence of multiple dependent scores, we conducted within-subjects comparisons using Wilcoxon Signed-Ranks tests, and comparisons between age groups using Mann-Whitney *U* tests. Given that answers coded as *both* or *other* made up a small proportion, we focus primarily on differences between

uncontrollable and *controllable* responses. We applied Bonferroni correction for Type I error to yield an alpha value of .001 based on the 41 tests reported (.05/41). There were no significant effects of question order (p = .104 to .898).

Responses to causal questions

Children were significantly more likely to reference an *uncontrollable cause* than a *controllable cause* for causal questions, $Z = 9.80$, $p < .001$. This was also the case when looking at each age group separately: preschoolers ($Z = 5.32$, $p < .001$), kindergartens ($Z = 6.05$, $p < .001$), and school-age ($Z = 5.72$, $p < .001$).

There were no significant differences between age groups in the frequency of references to either uncontrollable and controllable causes in response to causal questions, ps = .232 to .904. However, school-age children (Mann-Whitney U = 894.50, Z = 3.98, $p < .001$) were more likely to mention that *both* caused the outcome than were preschoolers, but kindergarteners did not differ significantly from preschoolers (p = .002) or school-age children (p = .201). Exact age was not significantly correlated with frequency of mentions of uncontrollable causes ($\rho(160) = -0.02$, p = .798) nor controllable causes ($\rho(160) = -0.16$, p = .046), but was significantly correlated with *both* responses, $\rho(160) = 0.32$, $p < .001$.

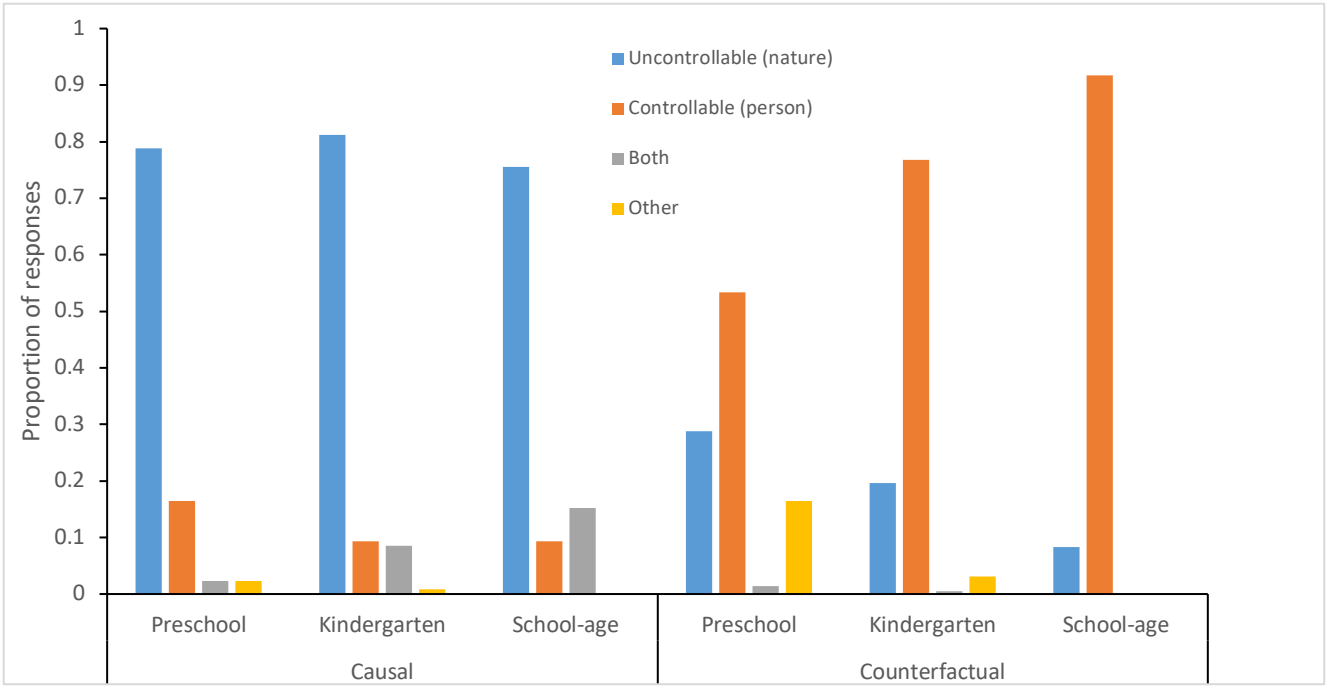

Figure 1. Proportion of children's responses to causal and counterfactual questions in each age group referencing an uncontrollable (natural) cause, controllable (person) cause, both, or other.

Responses to counterfactual questions

In contrast to their responses to causal questions, children were significantly more likely to reference a *controllable cause* than an *uncontrollable cause* for counterfactual questions ($Z = 7.89$, $p < .001$). This effect held separately for kindergartens ($Z = 4.56$, $p < .001$) and school-age children ($Z = 6.14$, $p < .001$), but not preschoolers ($Z = 2.53$, $p = .012$).

Preschoolers were significantly more likely to reference uncontrollable causes than school-age children, Mann-Whitney U = 920.50, $Z = 3.59$, p < .001, but not kindergartens, Mann-Whitney U = 1244.50, $Z = 1.74$, p = .082. Conversely, preschoolers were significantly less likely to reference controllable causes than kindergartens, Mann-Whitney U = 994.00, $Z = 3.23$, p = .001, and school-age children, Mann-Whitney U = 617.00, $Z = 5.47$, p < .001. Kindergarteners and school-age children did not differ significantly in their references to uncontrollable, $p = .066$, or controllable causes, $p = .011$.

This trend toward decreasing uncontrollable cause and increasing controllable cause references with increasing age was further confirmed by looking at correlations; exact age was negatively correlated with *uncontrollable cause* responses, $\rho(160) = -0.27$, $p = .001$, and positively correlated with c*ontrollable cause* responses to counterfactual questions, $\rho(160) = 0.42$, $p < .001$.

Causal versus counterfactual responses

Children were significantly more likely to reference an *uncontrollable* cause for causal questions than counterfactual questions, $Z = 9.90$, $p < .001$. This was also the case for each age group separately: preschoolers ($Z = 5.12$, $p < .001$), kindergarteners ($Z = 6.01$, $p < .001$), and school-age children ($Z = 5.96$, $p < .001$). Children were also more likely to reference *both* uncontrollable and controllable causes jointly in response to causal than counterfactual questions, $Z = 5.40$, $p < .001$. This trend held when looking separately at kindergarteners ($Z = 3.84$, $p < .001$), and school-age children ($Z = 4.20$, $p < .001$), but not preschoolers ($Z = 0.54$, $p = .541$).

Children were significantly more likely to reference a *controllable* cause for counterfactual questions than causal questions, $Z = 9.97$, $p < .001$. This was also the case for each age group: preschoolers ($Z = 4.68$, $p < .001$), kindergarteners ($Z = 6.11$, $p < .001$), and school-age children ($Z = 6.31$, $p < .001$).

We also examined intra-individual patterns of responses by looking at instances of when children responded in an "adult-like" way, by responding with an uncontrollable cause for causal questions and a controllable cause for counterfactual questions. With age, children showed an increasing tendency to respond in this way, $\rho(160) = 0.30$, $p < .001$.

Discussion

Adults show predictable biases in counterfactual thinking (Byrne, 2005). In the current study, we asked whether and when children's counterfactual thoughts show evidence for one such bias – a tendency to focus on controllable enabling conditions. Across all ages, and in line with previous research with adults (Mandel & Lehman, 1996; McCloy & Byrne, 2002), children most often referenced an uncontrollable strong cause (i.e., a force of nature) in response to causal questions and a controllable enabling condition (i.e., a character's action) in response to counterfactual ones.

The current results indicate that the majority of preschoolers are already channeling events differently when asked causal vs. counterfactual questions. Even before they provide a logically-correct answer to certain types of counterfactual questions (e.g., McCormack et al., 2018) and long before they reason with counterfactual emotions (O'Connor, McCormack, & Feeney, 2012), children are already attuned to which events are counterfactually relevant – at least when it comes to controllable vs. uncontrollable causes. We also found earlier evidence for this counterfactual bias than previous studies measuring children's use of the temporal order (Meehan & Bryne, 2005) and action biases (Payir & Guttentag, 2019).

Comparing across ages, we found developmental differences in children's counterfactual attributions. Preschoolers were significantly more likely to mention an uncontrollable natural cause in their counterfactuals (e.g., "The wind shouldn't have blown") than older children. Conversely, they were significantly less likely than older children to reference a controllable cause (e.g., "He should have brought the paper inside"). Although controllable causes were the most common response type among all age groups, we found that around 30% of preschoolers invoked an uncontrollable natural cause in their counterfactuals. What drives this developmental

difference? The current findings connect to a wider body of research suggesting that counterfactuals may play a changing role in judgment and reasoning with age.

In adulthood, counterfactuals have been found to play a role in decision-making and self-regulation. One prominent account, the *functional theory* of counterfactual thinking, argues that individuals think about how they could have acted differently in the past to secure a better outcome and plan to adapt their behavior in the future – a process that is often mediated by feelings of regret or relief (Epstude & Roese, 1997).

This contribution of counterfactuals to decision-making and self-regulation may be one that emerges in middle childhood, as children's counterfactual thoughts become more focused on human action. Children do not appear to understand counterfactual emotions such as relief and regret before the age of 6 (O'Connor, McCormack, & Feeney, 2012; Rafetseder & Perner, 2012), after they are able to reason about counterfactuals in other contexts (Beck & Riggs, 2014; Nyhout & Ganea, 2019a). Counterfactual considerations do not appear to enter into children's judgments of regret and blame until late childhood (Payir & Guttentag, 2019), and counterfactuals may not factor into decision-making until between the ages of 6 and 9 (McCormack & Feeney, 2015).

The developmental shift toward controllable human causes that we observed in children's counterfactual responses, and the increasing role of counterfactuals in emotion and decision-making may have a similar underpinning – both involve an increasing focus on human action in counterfactuals. The impetus for this hypothesized change, however, is unknown. With age and experience, children may learn that human actions and decisions are changeable, whereas forces of nature are not. Through conversations with parents, children may also learn which types of events other individuals focus on in their counterfactuals.

Another explanation for the developmental differences we observed is a change in children's conceptions of natural causes. Younger children are more likely to view forces of nature as animate beings (Carey, 1985; Piaget, 1929), which may result in an increased tendency to mutate these causes in their counterfactuals. "The sun shouldn't have come out" is a less unusual response when one considers that young children are often presented with depictions of the Sun with agency, "hiding" behind the clouds and going away at night.

Despite the observed developmental differences, kindergarteners and school-age children's causal and counterfactual attributions looked very much like those of adults. This finding contributes to a growing body of work suggesting that, rather than being a late developing ability, counterfactual reasoning is available to children from relatively early in development (McCormack et al., 2018; Nyhout & Ganea, 2019a; 2019b). These findings also raise several questions, including in which other ways children's counterfactuals may be similar to adults', how other developmental, social, and cultural factors may contribute to which events children see as counterfactually-relevant, and why some children tend towards invoking natural causes in their counterfactuals.

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Appendix

Story	Causal Question	Control Question	Counterfactual Question
Story 1: Andy *Andy is doing some drawing on the porch.* *He leaves his papers on the porch and goes inside to get some juice.* *The wind comes along and blows his papers away.* *Andy's drawings are gone now.*	Why are Andy's drawings gone?	What did Andy go inside to get?	What should have happened so Andy's drawings would not be gone?
Story 2: Claudia *Claudia is playing with her dolls by the window.* *She leaves her dolls by the open window while she goes to watch TV.* *It starts to rain and the rain gets inside.* *Claudia's dolls are all wet now.*	Why are Claudia's dolls all wet?	What did Claudia leave her room to do?	What should have happened so Claudia's dolls would not be wet
Story 3: Harry *Harry is playing in the sand at the beach.* *He builds a sandcastle right beside the water and goes to get his bucket.* *A big wave comes along and knocks over the sandcastle.* *Harry's sandcastle is ruined now.*	Why is Harry's sandcastle ruined?	What did Harry go to get?	What should have happened so Harry's sandcastle would not be ruined?
Story 4: Katie *Katie is hanging out at the park.*	Why does Katie not have ice cream?	What did Katie go to do in the park?	What should have happened so Katie's ice cream would not be gone?

She puts her ice cream down on her blanket and goes off to fly her kite. The Sun comes out and melts her ice cream. Katie doesn't have any ice cream now.