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Brief report

The development of regret

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ABSTRACT

In two experiments, 4- to 9-year-olds played a game in which they selected one of two boxes to win a prize. On *regret* trials the unchosen box contained a better prize than the prize children actually won, and on *baseline* trials the other box contained a prize of the same value. Children rated their feelings about their prize before and after seeing what they could have won if they had chosen the other box and were asked to provide an explanation if their feelings had changed. Patterns of responding suggested that regret was experienced by 6 or 7 years of age; children of this age could also explain why they felt worse in regret trials by referring to the counterfactual situation in which the prize was better. No evidence of regret was found in 4- and 5-year-olds. Additional findings suggested that by 6 or 7 years, children's emotions were determined by a consideration of two different counterfactual scenarios.

Introduction

It is widely assumed that regret serves an adaptive function; put simply, the idea is that the experience of regret and rumination on alternative decisions leads to us making better decisions in the future (Connolly & Hardman, 2009; Roese, 1997; Zeelenberg, 1999). Moreover, it is also argued that in decision making, we attempt to minimize future regret (Loomes & Sugden, 1982). Experiencing regret depends on an established capacity to think counterfactually because it involves comparing the actual outcome with an alternative or counterfactual outcome. Although there is considerable debate over the age at which counterfactual thinking first develops (e.g., Beck, Robinson, Carroll, & Apperly, 2006; Rafetseder, Cristi-Vargas, & Perner, 2010), its emergence is usually located around 3 or 4 years

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at the earliest. Thus, it is generally agreed that counterfactual emotions such as regret cannot be present until substantially later than basic emotions such as sadness.

Recent studies have assessed when children first seem to understand that others may experience regret (Beck & Crilly, 2009; Ferrell, Guttentag, & Gredlein, 2009; Guttentag & Ferrell, 2008), typically locating this point at around 7 years of age. However, what is likely to matter for decision making is not whether one understands the conditions under which others experience regret but rather whether one actually has such experiences oneself. Some preliminary evidence on the developmental emergence of regret comes from a study by Amsel and Smalley (2000), who used a card game that was manipulated to give rise to positive and negative outcomes. Children chose one of two face-down cards and won stickers if their card had a higher value than that of the experimenter. They rated their feelings about their card choice before seeing the unchosen card and after viewing the unchosen card. Preschoolers did not rate themselves as less happy about their card choice if the alternative card would have yielded a win than if it would have yielded a loss. Thus, Amsel and Smalley concluded that children of preschool age did not compare the counterfactual outcome with the actual outcome and, thus, did not experience regret.

Weisberg and Beck's (2010a) study was the first to systematically examine the age at which children begin to experience counterfactual emotions. In their task, children chose between two boxes on each trial; on regret trials the counterfactual prize (the prize in the unchosen box) was better than the prize in the box that children had actually chosen, and on relief trials the counterfactual prize was worse than the actual prize. Children were asked to rate their feelings about their actual prize before and after the counterfactual prize was revealed. Weisberg and Beck found that by 5 years of age on regret trials, children were significantly less happy after the counterfactual prize was revealed than before it was revealed. These authors argued that children experience regret from around 5 years onward.

Given the functional role in adaptive decision making that theorists have assigned to it, it is important to establish when children first show evidence of regret. The current study follows up that of Weisberg and Beck (2010a), focusing on regret. A key methodological difference between this study and that of Weisberg and Beck is that we included a baseline trial in which the counterfactual prize was identical to the actual prize. In Weisberg and Beck's study, children were asked about their feelings regarding their actual prize twice. If children believed that they needed to change their answer when the question was repeated, then we might expect to see them changing their answer and, thus, giving lower happiness ratings regardless of the nature of the counterfactual prize. Consistent with this possibility, Weisberg and Beck found that 5-year-olds' happiness ratings in regret trials after the counterfactual prize was revealed did not differ significantly from their happiness ratings after the counterfactual prize was revealed on relief trials in which this prize was worse than the actual prize. In our study, we included a baseline trial in which both the actual and counterfactual prizes were identical to control for any effect of question repetition. If children genuinely experience regret on regret trials, then their happiness ratings should be lower when they see the counterfactual prize on regret trials than on baseline trials. In addition, we asked those children who changed their happiness ratings when the counterfactual prize was revealed to explain why they did so in order to examine whether a consideration of the counterfactual alternative underpinned this change.

Experiment 1

Method

Participants

The participants were 20 4- and 5-year-olds (10 girls and 10 boys, mean age = 5 years 1 month, range = 58–68 months), 16 6- and 7-year-olds (7 girls and 9 boys, mean age = 7 years 4 months, range = 81–92 months), and 24 8- and 9-year-olds (13 girls and 11 boys, mean age = 9 years 2 months, range = 105–116 months). Children were tested individually in a quiet area of their school. All participants were recruited from the same school in Northern Ireland. The vast majority were Caucasian and from working- and middle-class backgrounds.

Apparatus

Four boxes were used, each of a different color with a distinctive image on each lid. For the *regret* trial, there was a black box and an orange box with different cartoon characters on the lids. For the *baseline* trial, there was a green box and a white box with different object photographs on the lids (a tree and a postbox). For the regret trial, inside each of the colored boxes were hidden two smaller silver boxes, with one of the silver boxes containing 1 token and the other containing 5 tokens. The silver boxes were designed so that the experimenter could distinguish between them by touch. In the baseline trial, there was one silver box inside each colored box, with each of the silver boxes containing 1 token. The tokens were small green plastic disks.

A horizontal 5-point scale was used to measure ratings of happiness during the study, with pictures of five cartoon faces varying in emotional expression starting with *very happy* on the left-hand side of the scale and ending with *very sad* on the right-hand side. Children were asked to place an arrow pointer at the face that best described their feelings during the game. A Dictaphone was used to record children's verbal responses.

Procedure

Children were invited to play a game in which they could win some stickers. Children were shown a sample token, and it was explained to them that they could swap each token they won for a sticker of their choice at the end of the game. They were introduced to the 5-point scale, and the points on the scale were described to them as follows: *feeling very happy, feeling a little bit happy, not feeling happy and not feeling sad, feeling a little bit sad,* and *feeling very sad.* Children received one regret trial and one baseline trial, with the order of presentation of the trials counterbalanced, and they were not told in advance how many trials they would receive or how many tokens the boxes might contain. After both trials were completed, children swapped their tokens for stickers of their choice.

In the regret trial, the black and orange boxes were placed on a table, and children were told that there were prizes of tokens inside each box and were asked to choose one box that would be opened to reveal their prize. When they had made their choice, the experimenter opened the chosen box and deliberately retrieved the smaller silver box that contained 1 token. Children were asked to show how they felt about their prize by placing the pointer at the relevant face on the 5-point scale. The experimenter said, "Let's see how many tokens are in the box you did not choose," and then opened the other box, purposely retrieving the silver box containing 5 tokens (children were unaware that there were two silver boxes inside each larger box). Children were then shown the more attractive counterfactual prize and the experimenter said, "Here's what you said about how you felt about your prize of 1 token. How do you feel now? Do you want to leave the pointer where it is, or do you want to move it?" If children moved the pointer, they were asked to explain why they now felt differently. The experimenter removed the boxes and children retained their token. The procedure for the baseline trial was identical to that for the regret trial except that each box contained only one smaller silver box and the actual prize and counterfactual prize in the nonchosen box were the same (1 token).

Results and discussion

Children's ratings of happiness before and after the counterfactual prize was revealed were coded in relation to the 5-point scale from 1 = *very sad* to 5 = *very happy*. Fig. 1 shows the mean happiness ratings for each age group before and after the counterfactual prize was revealed for each trial type. An analysis of variance (ANOVA) was performed on happiness ratings with between-participants factors of age group and trial order (regret trial first or baseline trial first) and within-participants factors of time of rating (before the counterfactual prize was revealed or after the counterfactual prize was revealed) and trial type (regret or baseline). A significant three-way interaction among trial type, time of rating, and age was found, $F(2, 54) = 12.09$, $p < .001$, $\eta_p^2 = .309$. Further analyses revealed that the interaction between time of rating and trial type was not significant in the 4- and 5-year age group, $F < 1$. However, there was a significant interaction between trial type and time of rating in the 6- and 7-year-olds, $F(1, 15) = 5.26$, $p < .05$, $\eta_p^2 = .260$, and in the 8- and 9-year-olds, $F(1, 23) = 54.66$, $p < .001$, $\eta_p^2 = .704$. Findings from Bonferroni-corrected paired samples t tests indicate that there was a significant difference in happiness rating before and after the counterfactual prize was revealed in

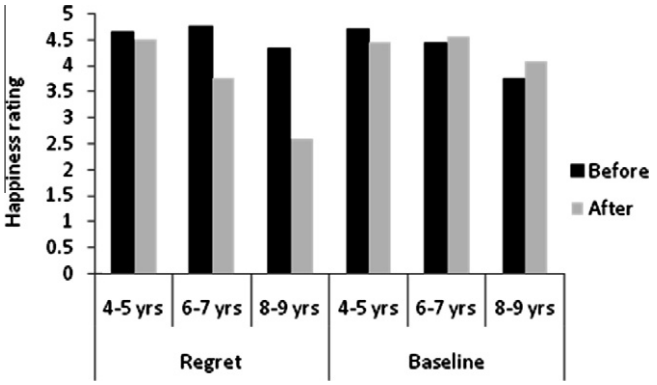

Fig. 1. Happiness ratings in Experiment 1 as a function of age group, trial type, and time of rating.

the regret trial in the 6- and 7-year-olds, $t(15) = 3.04$, $p = .008$, $\eta^2 = .270$, and in the 8- and 9-year-olds, $t(23) = 8.67$, $p < .001$, $\eta^2 = .765$, with both of these older age groups being significantly less happy with the actual prize after the counterfactual prize was revealed in the regret trial than before. There were no such differences in the baseline trial. Differences in ratings of happiness after the counterfactual prize was revealed were also compared across trial types. The 8- and 9-year-olds were significantly less happy after the counterfactual prize was revealed in the regret trial compared with the baseline trial, $t(23) = -6.91$, $p < .001$, $\eta^2 = .675$; this difference was not found to be significant in the younger age groups.

The effect of trial order was found to significantly interact with time of rating, $F(1, 54) = 4.86$, $p = .032$, $\eta_p^2 = .082$, and with trial type, $F(1, 54) = 34.01$, $p < .001$, $\eta_p^2 = .386$. Additional analyses revealed that children who received the baseline trial first reported significantly lower ratings of happiness after the counterfactual prize was revealed in the regret trial than children who received the regret trial first, $t(58) = 2.15$, $p = .035$, $\eta^2 = .271$. However, the order of trial type did not affect happiness ratings after the counterfactual prize had been revealed on the baseline trials, $t(58) = -1.65$, $p > .05$.

Children's explanations of their change in feelings were classified in terms of whether they referred to the alternative prize or not (e.g., "because the other box had more tokens"). In addition, as a more stringent test, we also examined whether children actually used counterfactual language. In the 6- and 7-year ($n = 8$) and 8- and 9-year ($n = 22$) age groups, 100% and 95.5% of children, respectively, explained their change of feeling about the actual prize on regret trials by referring to the counterfactual prize, with 37.5% of 6- and 7-year-olds and 32% of 8- and 9-year-olds who felt worse using counterfactual language. No child in these groups referred to wanting the counterfactual prize in baseline trials. In the 4- and 5-year ($n = 9$) age group, only 22.2% of children referred to the counterfactual prize when explaining their change of feelings in regret trials, with none of these children using counterfactual language.

In summary, we found evidence of regret in our two oldest age groups but not in our 4- and 5-year-old group. Moreover, the two older age groups were able to explain their change in feelings by pointing out the greater desirability of the counterfactual prize, and some of them used counterfactual language in doing so. We interpret these findings as evidence for regret rather than an emotion such as disappointment because the procedure was one in which children themselves made a choice leading to the outcome, and children were also made aware of the counterfactual outcome after they had made their choice. It is argued that these task features are more likely to yield regret than disappointment on the basis of both behavioral and neuropsychological evidence (e.g., Chua, Gonzalez, Taylor, Welsh, & Liberzon, 2009; Zeelenberg, van Djik, Manstead, & van der Pligt, 1998). An unexpected finding in the study was the effect of order; regret was more marked when children received the baseline trial first. An obvious explanation of this finding is that these children were anticipating the counterfactual prize on regret trials to be the same as the actual prize because this is what they had observed on the first (baseline) trial. When they saw that they could have in fact won 5 tokens on the regret trial, they may have been particularly likely to regret their choice.

Experiment 2

In Experiment 2, we made two changes in methodology that we thought might increase the likelihood of observing regret in the younger children. First, all children received the baseline trial first because the order effect in Experiment 1 indicated that this would maximize the possibility that regret would be reported. Second, we changed the method by which children reported their change in feelings. In Experiment 1, we found that children were very likely to use ratings at the end of the scale (either 1 or 5), with such responding accounting for 84% of all the responses given by the younger children. Thus, we followed Weisberg and Beck (2010b) by introducing a mode of responding whereby children could indicate their change in feelings in a categorical way after viewing the counterfactual prize.

Method

Participants

The participants were 18 4- and 5-year-olds (10 girls and 8 boys, mean age = 5 years 5 months, range = 59–71 months), 29 6- and 7-year-olds (12 girls and 17 boys, mean age = 7 years 5 months, range = 84–94 months), and 31 8- and 9-year-olds (18 girls and 13 boys, mean age = 9 years 4 months, range = 108–119 months). The backgrounds of children were very similar to those in Experiment 1.

Apparatus

The apparatus used in Experiment 2 was identical to that used in Experiment 1 except that the original single arrow pointer was amended to include three arrows that allowed children to indicate simply whether they felt *the same, sadder,* or *happier.*

Procedure

All children received the baseline trial first. The rest of the procedure was the same as in Experiment 1 except for the training phase, during which the function of the altered pointer was made clear. This training session included the use of two puppets. The first puppet, "Molly," was given a toy camera and was described as feeling *a little bit happy*, with the upward arrow pointer placed under the corresponding face on the 5-point scale. The puppet was then given a toy mobile phone and participants were asked, "How do you think Molly will feel now that she has a camera *and* a mobile phone? Do you think she will feel happier, sadder, or the same?" The experimenter pointed to the left-pointing arrow, right-pointing arrow, and upward pointing arrow, respectively, while she asked the latter question and in subsequent similar questions during training. The second puppet, "Peg," was then introduced, and this puppet was given two toy cameras and was described as feeling *very happy*, with the upward arrow on the pointer placed at the appropriate far-left point at the end of the scale. This puppet was then given a toy mobile phone and again participants were asked, "How do you think Peg will feel now that she has two cameras and a mobile phone? Do you think she will feel happier, sadder, or the same?" Children gave their answer by choosing one of the three prongs on the arrow.

This training was then repeated, but this time involving the characters having toys removed from them so that they felt sadder. In each case, children were again asked, "Do you think she will feel happier, sadder, or the same?" The aim of this training was to ensure that children understood the scale and that the pointer allowed them to indicate that a character could feel happier or sadder even if she already felt very happy or very sad (i.e., even if ratings were already at the end of the scale). To ensure that each participant could use the altered pointer before the study began, those children who did not give the right answer to a question were corrected and the training was repeated. During the experiment itself, children initially rated their feelings when the first prize was revealed using the scale, as in Experiment 1, and the upward arrow of the pointer (with the left- and right-pointing arrows attached) was placed on the scale where they indicated. Next, when the counterfactual prize was revealed, they indicated whether their feelings had changed by selecting the left- or right-pointing arrow or had stayed the same by selecting the upward-pointing arrow.

Table 1
Children's reported change in happiness ratings as a function of age group and trial type in Experiment 2.

		Happier than before (%)	Sadder than before (%)	No change (%)
4–5 years ($n = 18$)	Regret	11	17	72
	Baseline	11	17	72
6–7 years ($n = 29$)	Regret	10	59	31
	Baseline	34.5	0	65.5
8–9 years ($n = 31$)	Regret	7	83	10
	Baseline	39	3	58

Results and discussion

The use of the new pointer yielded categorical data, with Table 1 showing the percentage of children in each group who reported feeling the same, happier, or sadder when the counterfactual prize was revealed. In the regret trials, there was a significant age difference in the nature of responses, $\chi^2(4) = 23.01$, $p < .001$. The 6- and 7-year-olds, $\chi^2(2) = 8.63$, $p = .008$, and the 8- and 9-year-olds, $\chi^2(2) = 22.64$, $p < .001$, were significantly more likely to report being sadder than the 4- and 5-year-olds after the counterfactual prize was revealed in this trial. Both of the older age groups were more likely to report feeling sadder than before in regret trials than would be predicted by chance, binomial test $p < .01$, assuming that by chance responses would be equally distributed between the categories. Furthermore, responses differed significantly between regret and baseline trials for the 6- and 7-year-olds, $\chi^2(2) = 24.30$, $p < .001$, and for the 7- and 8-year-olds, $\chi^2(2) = 41.01$, $p < .001$. Thus, as in Experiment 1, there was evidence for regret in the older age groups.

Unexpectedly, children's responses also differed between age groups on baseline trials, $\chi^2(4) = 9.78$, $p = .049$. Although the majority of 6- and 7-year-olds reported feeling the same after the counterfactual prize was revealed, this age group was significantly more likely to report feeling happier than the 4- and 5-year-olds, $\chi^2(2) = 7.28$, $p = .027$, and the 8- and 9-year-olds also reported feeling happier marginally significantly more often than the 4- and 5-year-olds, $\chi^2(2) = 5.92$, $p = .051$. Responses in the older age groups that indicated a change in feelings were significantly more likely to fall into the "happier than before" category than would be predicted by chance, binomial $p < .01$, assuming that such responses would fall equally into the "happier than before" and "sadder than before" categories by chance. These findings suggest that at least some of the older children felt relief on seeing that the counterfactual prize was the same as the actual prize in the baseline trial.

Explanations of changes in feelings were examined as in Experiment 1. In the regret trial, of the 6- and 7-year-olds ($n = 20$) who had changed their feelings, 85% referred to the counterfactual prize in explaining this change (30% using counterfactual language), as did 89.3% of the 8- and 9-year-olds ($n = 28$) (28.6% using counterfactual language). Of the 4- and 5-year-olds ($n = 5$) who reported a change in feelings in the regret trial, 20% made reference to the fact that there had been a better prize, and the remaining 4- and 5-year-olds gave a variety of unrelated explanations such as "because I like Mickey Mouse."

General discussion

Across our two experiments, we first observed evidence of regret at 6 years of age; moreover, by this age, children consistently and coherently explained why they felt this way by making reference to a more desirable counterfactual outcome. Because we compared patterns of responses on regret trials with those on baseline trials, in which the counterfactual and actual outcomes were the same, we can be confident that reported changes in feelings on the regret trials were not due to question repetition. The 4- and 5-year-olds showed no evidence of regret in either experiment even when the response mode was changed in Experiment 2 to overcome any difficulties they may have had in using the scale to report a change in feelings, and trial order was set so as to magnify regret effects. Thus, the age at which we first report regret is slightly older than that reported by Weisberg and Beck

(2010a) (6- and 7-year-olds vs. 5- and 6-year-olds in their study), although the average age of our youngest group of children was slightly lower than the average age of the youngest group that they tested. Although we did not assess children's understanding of regret in others, comparison of our findings with those of previous studies that examined such understanding suggests that it may develop shortly after regret is directly experienced, that is, around 7 years of age (Beck & Crilly, 2009; Ferrell et al., 2009).

We have argued that experiencing regret requires the ability to compare a counterfactual alternative with the actual outcome, and indeed children's explanations of their feelings bear this out. However, aspects of our data suggest that at least by 6 years of age, children's feelings are determined not only by a comparison between the counterfactual and actual outcomes but also by expectations that they might possess about possible outcomes. In Experiment 1, regret on finding out that a counterfactual prize was more valuable than the chosen prize was more marked when preceded by a trial in which both counterfactual and actual prizes were identical. This suggests that viewing the baseline trial led children to erroneously expect that the counterfactual prize on the regret trial would again be the same as the actual prize, and thus they were particularly likely to report feeling sadder when they saw that this was not the case. Therefore, we would speculate that children's feelings were determined by a mental representation of *two* different counterfactual possibilities: the real unchosen alternative (the better prize) and the counterfactual alternative that they erroneously anticipated based on their experience in the baseline trial (a circumstance in which the alternative prize was not better).

Some further evidence for the suggestion that children's feelings stem from a consideration of not just one but two different counterfactual possibilities comes from the baseline trial of the second experiment in which a notable minority of the older children reported feeling happier on viewing the counterfactual prize even though it was of equal value to the actual prize. We would argue that these children felt relief on viewing the counterfactual prize because they realized that they could not have made a choice leading to a better outcome. If this is correct, then it suggests that at least a minority of children may be capable of experiencing relief at around the same time as they experience regret, that is, at around 6 or 7 years of age (cf. Weisberg & Beck, 2010a). Moreover, it would again suggest that children's emotional responses were determined by representing three outcomes: the actual outcome and two different counterfactual possibilities. In this case, the two counterfactual possibilities were the real unchosen alternative (which was the same as the chosen prize) and an alternative outcome in which the unchosen prize was better than the actual prize. Because this second alternative was shown not to be possible, some children experienced relief. This interpretation of our findings (i.e., that even 6-year-olds can consider multiple counterfactual possibilities) may have implications for the literature on adult counterfactual thinking where there are different views on the number of counterfactual alternatives that adults bear in mind when assessing outcomes (see Feeney & Handley, 2006).

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