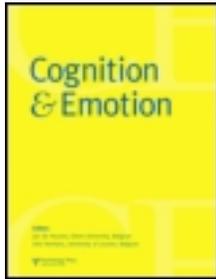


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The development of children's regret and relief

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Previous research found that children first experience regret at 5 years and relief at 7. In two experiments, we explored three possibilities for this lag: (1) relief genuinely develops later than regret; (2) tests of relief have previously been artefactually difficult; or (3) evidence for regret resulted from false positives. In Experiment 1 ($N = 162$ 4- to 7-year-olds) children chose one of two cards that led to winning or losing tokens. Children rated their happiness then saw a better (regret) or worse (relief) alternative. Children re-rated their happiness. Regret after winning was first experienced at 4, regret after losing and relief after winning were experienced at 5 years and relief after losing at 7 years. Experiment 2 ($N = 297$ 5- to 8-year-olds) used a similar task but manipulated children's responsibility for the outcome. Greater responsibility for the outcome resulted in a greater likelihood of an experience of regret and relief. Results support that previous tests of relief were artefactually difficult and regret and relief are experienced earlier than previously thought.

Keywords: Regret; Relief; Counterfactual thinking; Responsibility; Choice.

We often think about the alternatives to a decision that has been made. Thinking in this way is known as counterfactual thinking, that is, thinking about what could have been had an alternative decision been made or had the outcome been different (Roese, 1997). We are particularly likely to think counterfactually after a negative outcome (e.g., Boninger, Gleicher, & Stratham, 1994; German, 1999; Roese, 1997), when we have chosen to do something rather than chosen not to do something (e.g., Gleicher et al., 1990; Landman, 1987), or when we have acted atypically rather than typically (e.g., Kahneman & Miller, 1986; Kahneman & Tversky, 1982). There is evidence that suggests that children of 5 years, if

not earlier, can engage in counterfactual thinking (Beck & Guthrie, 2011; Beck, Robinson, Carroll, & Apperly, 2006; Riggs, Peterson, Robinson, & Mitchell, 1998). Although children may be thinking counterfactually from at least 5 years, the emotions associated with these thoughts ("counterfactual emotions") may not be adult-like (e.g., Amsel & Smalley, 2000; Guttentag & Ferrell, 2004). In two experiments, we investigated the development of these counterfactual emotions in young children.

Counterfactual emotions result from the comparison of reality with an alternative possibility that could have happened, but did not. In order to experience counterfactual emotions we must hold

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in mind “dual possibilities” (Byrne, 2002), reality and the counterfactual, and understand that both were possible at a previous point in the past (Beck et al., 2006). The counterfactual emotions include (but are not limited to) regret, relief, guilt, and shame (Landman, 1993).

Two common counterfactual emotions are regret and relief (e.g., Ferrell, Guttentag & Gredlein, 2009). Van Dijk and Zeelenberg (2005) defined regret as “a negative emotion that we experience when we realise or imagine that our present situation would have been better, if only we had decided differently” (p. 152). Relief, on the other hand, is the result of comparisons between reality and a more negative, fictive reality (e.g., Connolly & Zeelenberg, 2002; Coricelli & Rustichini, 2010; Guttentag & Ferrell, 2004). Both regret and relief result from thoughts that compare reality to a better (regret) or worse (relief) fictive reality (Bell, 1982) and, critically, the determinant of whether reality or the alternative that ensued was our own decision (Zeelenberg, van Dijk, van der Pligt, et al., 1998).

Over the last decade, researchers have explored children’s understanding and experience of regret and relief. Amsel and Smalley (2000) investigated children’s early understanding of regret and relief. Children watched a game in which a protagonist chose one of two boxes to find that it contained a more positive or a more negative prize than the box that was not chosen. Children aged 3- to 5-years-old were able to think about the counterfactual possibility, i.e., how happy the protagonist would have been had the other box been chosen, but these children were unable to infer that the protagonist would experience a consequent counterfactual emotion, regret or relief.

In a study investigating children’s experience of regret and relief, Amsel and Smalley (2000) asked 3- to 5-year-old children to choose one of two face-down cards. The aim was to beat the experimenter’s single face-up card. On all trials, children were asked to rate their feelings about the unselected card. The critical trials were those when the children’s chosen card was in fact the same as the experimenter’s card. This meant that their unselected card was either higher (regret—

they could have beaten the experimenter) or lower (relief—they could have lost to the experimenter) than their chosen card. Participants re-rated their feelings about their chosen card. The 3- to 5-year-olds’ ratings of the chosen card did not change after seeing the unselected card (therefore, they did not experience regret or relief). However, they were able to say that they would have been happier had they turned over the unselected card when it won, and have been sadder when the unselected card lost, just as adults did. Young children, capable of the relevant counterfactual thinking, did not necessarily experience or understand counterfactual emotions.

Guttentag and Ferrell (2004) investigated older children’s understanding that others experience these emotions. They read stories to children about two protagonists. In some stories, one protagonist engaged in a typical behaviour whereas the other engaged in an atypical behaviour. In other stories, one protagonist chose to do something (act of commission), while the other chose not to do something (act of omission). In all the stories, despite the protagonists’ different behaviours, both protagonists experienced the same negative outcome. Guttentag and Ferrell asked participants to identify, in each story, which character would feel worse. Adults thought that the protagonist who engaged in atypical behaviour or chose to act would feel worse, in line with the established literature (e.g., Ferrell, Guttentag, & Gredlein, 2009; Gilovich & Medvec, 1995). The 7-year-olds, but not 5-year-olds, were also able to recognise which protagonist would experience most regret. Yet in trials where the outcome was positive and protagonists were expected to experience relief, the 5- and 7-year-olds based judgements only on reality, rather than taking in to account the counterfactual world. Guttentag and Ferrell’s evidence suggested that a lag exists between the development of the understanding of these two emotions.

Weisberg and Beck (2010) used a game, similar to that used by Amsel and Smalley (2000), to compare children’s understanding of regret and relief with their experience of the same emotions. Children watched a toy penguin, Arnold, choose

one of two boxes containing stickers. Children rated Arnold's happiness about his chosen box and were subsequently shown what could have been had he chosen the other box. Children re-rated Arnold's feelings towards his chosen box, in light of the counterfactual possibility. Children under 7-years-old were unable to infer that others would experience either regret or relief. However, when children played the game themselves and rated their own happiness, they experienced regret at 5 years, relief at 7.

Thus, the existing evidence suggests that there is a lag between the development of regret and relief, both in terms of understanding and experience. Weisberg and Beck (2010) found that 5-year-olds experienced regret, that is, they rated themselves as more unhappy after seeing that what could have been was better than reality. However, children did not show relief when the alternative was worse than reality until they were 7-years-old. Guttentag and Ferrell (2004) reported a similar lag in children's understanding of other's regret and relief, in that they showed that 7-year-olds understood regret but not relief. In fact, it is unknown when children start to understand others' relief. The focus of this paper is to identify the reasons for this lag between regret and relief.

We focused on children's experience of counterfactual emotions, rather than their ability to reflect on and explain them in others. In part this was because the only evidence for children thinking about relief comes from the study in which children experienced relief for themselves (Weisberg & Beck, 2010). Considering the evidence that children experience regret earlier than relief, we identified three possible reasons for the lag between these emotions. The first is that there genuinely is a lag and regret develops earlier than relief. The second is that previous studies had methodological limitations that made thinking about relief more difficult than regret. The third is that children's apparent thinking about regret has been a false positive.

The current literature offers some support for the first possibility: There is a lag between the emotions. German (1999) found that children are

most likely to think counterfactually after negative outcomes to events. As regret occurs following a relatively negative outcome, children may be more likely to engage in counterfactual thinking than when events are positive. In contrast, relief typically occurs after positive outcomes when children may not be thinking counterfactually. This is consistent with the notion of a negativity bias, in which the salience, potency and dominance of negative events are stronger triggers for a reaction (in our case counterfactual thinking) than positive ones (Rozin & Royzman, 2001). The negativity bias suggests that adults pay greater attention to negative outcomes over positive ones. In the current study, we investigated this possibility by using trials that were initially positive and others that were initially negative, yet the alternative was more positive (regret) or more negative (relief).

The second possibility is that the lag between the two emotions may be an artefact of how the relief trials were constructed in previous studies. In Weisberg and Beck (2010), children won two stickers and then saw that they could have won nothing (on regret trials they could have won eight stickers). Perhaps the counterfactual world was uninteresting and children were not prompted to think about the possible alternative. A related possibility is that the relative difference on relief trials (two or three stickers) was somewhat smaller than that on regret trials (five or six stickers) and may not have resulted in a counterfactual emotion. A rather different possibility has to do with the way in which counterfactual emotions were measured. Weisberg and Beck (2010) used a 5-point scale ranging from *very happy* to *very sad*. If children responded using the extreme of the scale after winning two stickers, when they then saw that they could have won nothing, even if they experienced relief, they had no way of showing on the scale that they were even happier. In the current study, we improved on Weisberg and Beck's methodology in three ways: We changed the counterfactual outcome in the hope that it would be viewed as significant by participants, the difference between reality and the counterfactual was equal across regret and relief, and the scale

allowed children to show regret and relief equally well.

There is a third possibility that could explain the lag between regret and relief. Children's apparent early experiences of regret may have been false positives that were not based on counterfactual thinking. Perhaps children's negative rating on seeing the contents of the non-chosen option represented a feeling of frustration that they had chosen badly. That is, perhaps they simply felt bad because they did not win eight stickers. This kind of thought would *not* be counterfactual but rather a description of reality.

In two experiments, we investigated which of the three possibilities explain the reported lag between children's first experiences of regret and relief. In both, we used a game based on the methodology of Amsel and Smalley (2000) and Weisberg and Beck (2010). In Experiment 1, we made methodological changes to test for our second possibility, that the lag between regret and relief was an artefact. In Experiment 2, we changed how the outcome of the game was determined, to see if there was evidence for genuine counterfactual thinking, and to rule out possibility three.

EXPERIMENT 1

Method

Participants

There were 162 participants (83 boys, 79 girls) from two schools in the UK. One school served a predominantly middle-class, white population. The other was from an area of low socioeconomic status (SES) and ethnic diversity. Individuals from the two schools were equally distributed across age groups and conditions. Children were 55 aged 4–5, $M_{\text{age}} = 5;1$ (years; months), range = 4;8–5;7, 52 aged 5–6, $M_{\text{age}} = 6;2$, range = 5;8–6;7, and 55 aged 6–7, $M_{\text{age}} = 7;3$, range = 6;8–7;7. Children were White (50%), Asian (43%) and Black (7%). All spoke English as their first language. Five participants (aged 4–5) were excluded due to failing the practice sessions with the scale after three attempts, each

time with feedback, so 157 participants were included in the final dataset (83 boys, 74 girls).

Design

We used a within-subjects design. Participants completed four experimental trials plus one filler trial.

Materials

We used a 5-point scale for rating of happiness (see Figure 1), which was based on a white horizontal board (55 × 19 × 11 cm) and made up of five yellow faces (8.5 cm in diameter) ranging from *very sad* to *very happy*. A circular “window” (8.5 cm in diameter) was cut into a white vertical piece of cardboard (12 × 18.5 cm). Below the window were three blue arrows, one pointing left, one pointing right and one pointing up. Gold stars printed on laminated card (5.5 × 5.5 cm) were the tokens during the game. We used laminated playing cards (7 × 9 cm), with either “WIN” or “LOSE” printed at the top of the card. Below this were printed gold stars, which determined the number of tokens won or lost. A screen was used to hide the tokens, cards for the remaining trials and the stickers given to the participants to thank them for their participation.

Procedure

Pre-test. All participants completed a simple pre-test to confirm their understanding of the scale. The experimenter asked the participant to point to the very happy face, and then to the very sad face (half in the reverse order). Sixty-two participants did not point to the happy or sad faces on the extremes of the scale, so the experimenter asked, “Which is the really, really happy/sad face?” to which all these participants responded correctly.

Explanation of the scale. Participants were shown the window with the three arrows underneath. The experimenter said, “This is my window. It's a special window because it goes on top of any of my faces like this [the experimenter placed the window over all five face faces, one by one].

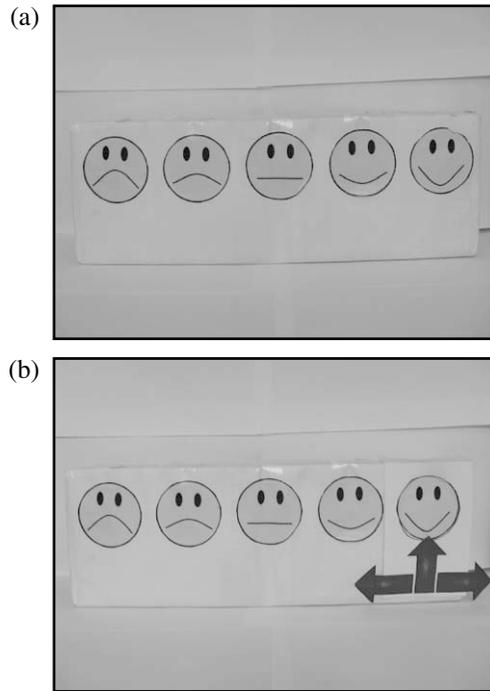


Figure 1. The 5-point rating scale that we used in the current study: (a) showing the initial scale on which participants rated their feelings towards their initial card, and (b) showing the blue arrows on which participants rated their feelings after seeing the alternative card.

Now, wherever my window goes, these arrows* [* represents the experimenter pointing to the appropriate place] always mean the same thing. This [* left-pointing] arrow always means even sadder than the face that you can see in the window. This is because it points towards the sad faces. This [* right-pointing] arrow always means even happier than the face that you can see in the window. This is because it points towards the happy faces. This [* upwards-pointing] arrow always means the same as the face that you can see in the window, because it points towards the face in the window.” The window was moved over the three remaining faces (not the neutral face) and the key points of the descriptions were repeated, highlighting the use of the left-pointing arrow (“even sadder”) on the very unhappy face, and the right-pointing arrow (“even happier”) on the very happy face, despite the scale itself having ended.

Finally, the window was placed over the middle, neutral face and participants were asked

to identify the arrow that meant even happier than the face in the window, the arrow that meant even sadder than the face in the window, and the arrow that meant the same as the face in the window (counterbalanced across all participants). Feedback was provided. Only five participants (all aged 4–5) failed to correctly identify the three arrows despite feedback each time. These children continued with the game but were not included in the data analysis.

Training. Participants had six rounds of training to use the scale. On the first round, participants were given six tokens and were asked to rate how they felt on the 5-point scale. The experimenter took away four tokens and put the window over the face the participant had chosen. The experimenter asked, “How do you feel now that four have been taken away?” and pointed to the arrows referring to them in turn as “this one” [* right-pointing], “this one” [* left-pointing] and “or this one” [* upwards-pointing]. The appropriate arrow

was the left-pointing arrow, as this represented the meaning “even sadder than the face in the window”. Participants were given feedback for correct responses (“Yes, well done, I think it’s this one too because after losing, you feel sad”) or incorrect responses (“I think it’s this one, because after losing, you feel sad”). The remaining five training procedures covered other situations in which children won, lost, or retained the same number of stars. Every participant correctly answered at least four of the six training rounds with the majority ($n = 118$) responding correctly to all six rounds.

Experimental procedure. Participants were shown two face-down laminated cards. The experimenter explained that the participant could choose only one card and the contents of that particular card would be the participant’s to keep. After participants chose a card (the *initial card*), the experimenter read what was written on the reverse of the card and gave or took away the according number of tokens. Participants were asked the *initial question* (“How do you feel about choosing your card*?”) and rated their happiness. Once completed, the participants were told that the non-chosen card (the *alternative card*) would be turned over to “see what you would have chosen”. The window was placed over the face that the participants initially chose. The alternative card was turned over and participants were told, “If you chose this card, you would have won/lost X tokens”. Participants were then asked, “How do you feel about choosing your card* now? This one [* right-pointing arrow], this one [* left-pointing arrow] or this one [*upwards-pointing arrow]?”

The experimental procedure was fixed so that the participant always chose a predetermined initial card. Unbeknown to the participant, the two cards placed on the table were identical and while the participant was looking at the initial card, an identical looking alternative card was taken from behind the screen and subtly replaced the non-chosen card. No children commented on this sleight of hand.

Both regret and relief trials had an initial win trial, in which participants initially won tokens but

the alternative was better (regret) or worse (relief) and one initial lose trial, in which participants initially lost tokens, but the alternative was better (regret) or worse (relief). For the *Regret initial-win* trial, participants won 2 or 3 and could have won 8; *Regret initial-lose*, participants lost 2 or 3 and could have won 3; *Relief initial-win*, participants won 2 or 3 and could have lost 3; *Relief initial-lose*, participants lost 2 or 3 and could have lost 8. The correct response on regret trials was to show a more negative response to the initial card after seeing the alternative, and on the relief trials, a correct response was the reverse pattern.

A filler trial was used so that participants did not end the game with no tokens. This trial was fixed so that the initial card read “WIN” five, and the alternative card read “LOSE” two. Data were not collected on this trial. All trials were presented in two fixed orders: (a) relief, regret, regret, filler and relief or (b) regret, relief, relief, filler and regret. All children accumulated five tokens over the course of the game, which were swapped at the end for two stickers.

Results and discussion

As there were three possible answers to each alternative question, the probability of responding correctly by chance was 33%. We ran binomial sign tests to compare the choice of arrow to chance performance. We made a Bonferroni correction ($\alpha = .013$) to account for the fact that there were four measures from each age group. The results are shown in Table 1. The 5- to 6-year-olds experienced regret after winning and losing. Relief following an initial win was experienced from the age of 5 to 6 years. However, children did not experience relief on initial lose trials until they were 6- to 7-years-old.

Participants received a score of 0 (*incorrect*) or 1 (*correct*) for their responses to the alternative question. Answering with the upwards arrow (“the same”), was regarded as incorrect. These were summed so that each participant received two further scores of 0 (*both incorrect*), 1 (*one correct*) or 2 (*both correct*) for their responses on the regret trials and on the relief trials. We examined

Table 1. Ratings of happiness by age group: Results of the binomial tests in Experiment 1

Age (years)	n	Regret initial-win				Regret initial-lose				Relief initial-win				Relief initial-lose			
		%		p	%		p	%		p	%		p	%		p	
		←	→		←	→		←	→		←	→		←	→		
4-5	55	49	31	.010*	22	60	18	.049†	9	60	31	.432	16	64	20	.025†	
5-6	52	55	25	.001**	69	19	12	<.001**	14	14	73	<.001**	39	22	39	.212	
6-7	55	62	36	<.001**	73	21	6	<.001**	0	22	78	<.001**	22	29	49	.010*	

Notes: Shaded area represents the correct arrow for that trial (← = even sadder, → = the same, ↗ = even happier). * $p < .05$; ** $p < .004$; † $p < .05$, but in an unexpected direction.

interactions between age and children's performance on regret and relief trials. We used a 5% two-tailed level to test significance. There were no differences between the number of appropriate responses given by girls and boys on the pairs of regret ($p = .509$) or relief ($p = .456$) trials, nor was performance affected by school (regret $p = .266$, relief $p = .733$), so these factors were not included in further analyses. There were no interactions between children's performance on regret and relief trials. We conducted regression analyses for children's performance on both regret and relief trials. Performance on regret and relief trials were the dependent measures and age was the predictor variable. On regret trials, age was a significant predictor of performance, $B = 0.025$, $SE = 0.01$, $\beta = 0.367$, $SE_{Estimate} = 0.70$. Similarly, on relief trials, age was a significant predictor of performance, $B = 0.029$, $SE = 0.01$, $\beta = 0.438$, $SE_{Estimate} = 0.66$.

Weisberg and Beck (2010) provided evidence that children experience regret from the age of 5 to 6 years. The regression analyses in combination with the binomial tests identify that children's performance improves with age, but children as young as 4- to 5-year-olds experience regret on one trial type: the *Regret initial-win* trial. This suggests that 4- to 5-year-olds may have a fledgling understanding of regret.

Regarding the lag between children's first experience of regret and relief, the first possible explanation that we considered was that this delay was genuine. Our second possible explanation was that children's first experiences of relief lagged behind regret due to artefacts of the design. We improved the methodology by ensuring that that the counterfactual was more striking, the difference between reality and the counterfactual was comparable across regret and relief trials, and that the scale included "even happier" and "even sadder". Our results supported this second possibility: Relief was first experienced at a younger age than currently reported. However, we also provide evidence to support the first possibility that regret slightly precedes relief. The 4- to 5-year-olds' very first counterfactual emotional experiences arose from *Regret initial-win* trials. Children one year

older responded appropriately to the *Regret initial-lose* and the *Relief initial-win* trials.

Further evidence that development of relief was not the same as regret comes from children's responses to the *Relief initial-lose* trials. On these trials, children lost tokens yet could have been worse off. Under these circumstances, children first experienced relief at 7 to 8 years. The experience of relief after seeing that a negative outcome could have been worse seems to develop later, perhaps due to the fact that a game that completely revolves around losing is not enjoyable for young children, or perhaps because the combination of two negatives is difficult for children to process.

Our third possible explanation for the lag between children's first experiences of regret and relief was that children may not really have been experiencing regret but were instead feeling frustrated at not winning the non-chosen card. In Experiment 1, we undermined this possible explanation because children also appeared to experience relief, which could not be the result of frustration. However, perhaps an adapted version of this explanation may still explain these results without needing to invoke counterfactual emotions. One possibility is that children make a comparison between the two boxes and judge whether they have won or lost the game. If children have the box with more stickers, they have won and therefore feel happy, and if they have the box with a smaller number of stickers, they have lost and feel sad. This would provide the same pattern of results as genuine experiences of regret and relief, but would be based entirely on an evaluation of reality, not a comparison with a counterfactual. One reason to doubt this, however, is that children did not pass the *Relief initial-lose* trials when they should have been able to judge that they had won if they were just making a direct comparison.

In order to investigate this third possibility, we drew on the adult counterfactual thinking literature. Byrne (2002), Roese and Olson (1995) and Zeelenberg, van Dijk, and Manstead (1998) suggested that feeling responsible for the outcome

results in an increased likelihood of an experience of regret and relief, and other counterfactual emotions. When we do not feel responsible for an outcome of a causal chain of events, we might experience frustration or happiness but not the feeling of regret or relief. Imagine choosing between one of two lottery tickets and finding out that the ticket you did not choose won the jackpot. While one would feel regret in this situation, the negative emotion would be greatly reduced if the tickets had simply been allocated at random. To investigate this phenomenon, Zeelenberg, van Dijk and Manstead (1998) asked participants to report life events in which they experienced regret and to rate how responsible they felt for the outcome. Participants' responses revealed that there was a positive strong correlation between regret and responsibility for the outcome. Zeelenberg, van Dijk, and Manstead argued that this indicated that the greater the responsibility over the outcome, the more likely it is that regret will be experienced. In Experiment 2, we reduced the child's responsibility for the outcome, to investigate whether our task did test children's experiences of regret and relief. We reasoned that if the children's emotions were influenced by this manipulation, it was likely that the task was inducing counterfactual emotions under the conditions where children made a choice.

In a new condition, we *gave* children their cards rather than asking them to choose between two options. Thus, after reducing responsibility for the outcome, we expected children who were able to experience regret and relief not to choose the correct arrow. However, if children's responses in the new condition were similar to those when they chose the cards, it is more likely that children were simply responding to their current state based on reality. This would provide support for our third hypothesis that the previously reported lag between regret and relief was due to false positives on regret trials, where children passed by responding to reality, and it would undermine our claims that children as young as 5-, or even 4-years-old experienced counterfactual emotions.

EXPERIMENT 2

In our second experiment, we manipulated children's responsibility for the outcome of the game in three between-subject conditions. The first condition, *Choice*, was a replication of Experiment 1. Children chose one of two cards that they wanted to turn over. In doing so, the outcome was due to their decision. In the second condition, *No choice-experimenter*, the experimenter rolled a dice, the outcome of which determined the card given to participants. Under these circumstances, the participant held no responsibility over the outcome. However, children were barely involved in this game. If children did not experience regret or relief, this could be due to an overall muting of emotions due to lack of involvement in the game. To address this, we added a third condition, *No choice-child*. In this condition, the roll of a dice still determined the card given to the participant, however, the participant, rather than the experimenter, rolled the dice. Children may feel some responsibility for the outcome, but it would be expected to be less than in the choice condition.

One interesting possibility is suggested by the illusion of control literature. According to this research, positive outcomes are attributed to personal involvement but negative outcomes are attributed to external factors, such as chance (e.g., Langer & Roth, 1975; Wortman, Costanzo, & Witt, 1973). Over the four trials, there were positive outcomes (initial win trials) and children may have attributed responsibility for these outcomes to themselves, but there were also negative outcomes (initial lose trials), which children may have attributed to chance. Thus, in the *No choice-child* condition we might see children experiencing counterfactual emotions on win trials (where they assume responsibility for the outcome) but to a lesser extent on lose trials.

We used the same procedure as in Experiment 1: On two occasions children won and then had the opportunity to experience regret or relief, and on another two, they lost and then could experience regret or relief. To summarise, in our second experiment we manipulated whether children should feel responsible for the outcome of the

game. If they were as likely to report positive and negative emotions when they had no control over the outcome, then the most parsimonious conclusion would be that children were not in fact experiencing counterfactual emotions but were simply responding to reality.

We included an older group of children in this study because the 6- and 7-year-olds in Experiment 1 showed far from ceiling performance and because despite there being no significant difference between the 5- and 6-year-olds and the 6- and 7-year-olds we wanted to investigate if performance continued to improve after the shift we had identified between 4- and 5-year-olds and 5- and 6-year-olds.

Method

Participants

There were 297 participants (154 boys, 143 girls) from three schools in UK. All schools served a predominantly middle-class, white population. Children were 101 aged 5–6, $M_{\text{age}} = 6;2$, range = 5;7–6;10, 94 aged 6–7, $M_{\text{age}} = 7;2$, range = 6;3–7;10, and 102 aged 7–8, $M_{\text{age}} = 8;3$, range = 7;7–8;10. Children were White (55%), Asian (37%) and Black (8%) and all spoke English as their first language. Three participants (one from the 5- to 6-year-old group, two from the 6- to 7-year-old group) were excluded from the dataset due to failing the practice sessions with the scale on three separate occasions, each time with feedback, leaving 294 participants in the final dataset (152 boys, 142 girls).

Design

Participants completed the same five trials as in Experiment 1. They were assigned to one of three conditions: *Choice*, *No choice-experimenter* or *No choice-child* according to the order of the teachers' class lists.

Materials

We used the same materials as in Experiment 1, with the addition of a small dice (4 cm³) and a playing mat (21 × 30 cm). Three sides of the dice were coloured green and the other three were

coloured yellow. The playing mat was coloured in two halves: the same green and yellow as the dice.

Procedure

Choice condition ($n = 108$, distributed across all age groups). The procedure was identical to that of Experiment 1.

No choice-experimenter condition ($n = 95$). The procedure was similar to the *Choice* condition, except that the two cards were presented face down on the playing mat. The cards were verbally labelled for the participants by the colour on which they were placed. This placing was done unsystematically. The experimenter provided the same instructions as in Experiment 1 with the exception that the words “choice” or “choose” were replaced by “get” or “give” to give participants as little ownership over the card as possible and the participant’s initial card was determined by the throw of the dice. The participants were told that the experimenter would throw the dice and the colour that it landed on would correspond to the colour of the card to be given (the *initial card*). The dice was rolled and the initial card corresponding to the colour on the dice was picked up by the experimenter and given to the participant. After the experimenter read the card to the participant and gave or took away the number of tokens according to the card, participants were asked the *initial question* (“How do you feel about getting your card?”) and rated their happiness using the scale. Once completed, the participants were told that the other card (the *alternative card*) would be turned over to see what would have been won or lost. Sleight of hand was used as in Experiment 1.

As in Experiment 1, the window was placed over the face that the participant initially chose on the scale. Participants were asked the same question as in Experiment 1, except for the replacement of “choice” and “choose” with “get” and “give”. The procedure was repeated for the remaining four trials.

No choice-child condition ($n = 94$). The procedure was identical to the *No choice-experimenter*

condition with the exception that the participant rolled the dice.

Results and discussion

Coding procedures were the same as in Experiment 1. We first compared which arrow children chose with chance performance. Results of the binomial sign tests can be seen in Table 2.

In the *Choice* condition, we replicated the pattern of results seen in Experiment 1: Children experienced both regret and relief (after winning) from 5 years and relief (after losing) from 7, $p < .001$. In the *No choice-experimenter* condition none of the three age groups reported a positive or negative change in their emotions on any of the four trials. Rather, they consistently chose the upwards facing arrow suggesting that the counterfactual possibilities did not affect their happiness ratings. Children were more likely to experience regret and relief when they were more responsible for the outcome of a decision.

Each participant received two scores of 0 (*both incorrect*), 1 (*one correct*) or 2 (*both correct*) for their responses on the regret trials and on the relief trials. Similarly to Experiment 1, we used a 5% two-tailed level to test significance. The mean scores for each condition can be seen in Figure 2. Within each condition there were no significant differences in how boys and girls responded to the pairs of regret and relief trials, highest $t = 1.76$, lowest $p = .081$. There were some differences in performance by children from different schools in the *No choice-experimenter* condition only. Children at one school performed worse than children in both the other schools on the regret trials ($p = .006$; $p = .001$) and worse than children in one of these schools on the relief trials ($p = .003$). However, performance by children in all three schools was consistently worse on the *No choice-experimenter* than either of the other two conditions. We believe that normal variation between samples is the most likely explanation of these differences, and that any differences are unlikely to influence the main questions we are investigating and so neither gender nor school were included in our further analyses. We note, however,

Table 2. Ratings of happiness by age group and condition: Results of the binomial tests in Experiment 2

Age (years) and condition	n	Regret initial-win				Regret initial-lose				Relief initial-win				Relief initial-lose			
		%			p	%			p	%			p	%			p
		←	↑	→		←	↑	→		←	↑	→		←	↑	→	
Age 5–6																	
Choice	37	65	16	19	<.001**	76	13	11	<.001**	0	13	87	<.001**	14	54	32	.548
No Choice–Child	32	44	50	6	.135	25	59	16	.222	0	47	53	.015*	6	69	25	.222
No Choice–Experimenter	31	23	55	22	.148	26	64	10	.259	3	61	36	.450	19	58	23	.148
Age 6–7																	
Choice	33	88	12	0	<.001**	82	6	12	<.001**	3	12	85	<.001**	6	60	33	.549
No Choice–Child	27	56	33	11	.013*	30	63	7	.443	0	41	59	.005*	7	71	22	.162
No Choice–Experimenter	32	31	62	7	.500	16	84	0	.024 [†]	3	81	16	.024 [†]	12	66	22	.123
Age 7–8																	
Choice	37	92	5	3	<.001**	97	3	0	<.001**	0	5	95	<.001**	2	30	68	<.001**
No Choice–Child	33	55	39	6	.009*	64	36	0	<.001**	3	45	52	.021*	3	55	42	.167
No Choice–Experimenter	32	22	78	0	.123	22	75	3	.123	0	72	28	.352	3	63	34	.500

Notes: Shaded area represents the correct arrow for that trial (← = even sadder, ↑ = the same, → = even happier). * $p < .05$; ** $p < .001$; [†] $p < .05$, but in an unexpected direction.

that further investigation into individual differences in counterfactual thinking is warranted (see, e.g., Beck, Riggs, & Gorniak, 2009; Burns, Riggs, & Beck, 2011; Guajardo, Parker, & Turley-Ames, 2009).

We investigated the relationship between Trial Type and Condition (*Choice*, *No choice-child* and *No choice-experimenter*). A univariate analysis of variance (ANOVA) for regret scores revealed a main effect of Condition, $F(2, 291) = 84.37$, $p < .001$, $\eta_p^2 = .37$, as did a separate ANOVA for relief scores, $F(2, 291) = 36.27$, $p < .001$, $\eta_p^2 = .20$. Post hoc t -tests showed differences between all three conditions for both regret and relief scores (all $ps \leq .002$).

When we investigated the interaction between Age and Trial Type (regret and relief) we did so separately for the three Conditions as the ANOVA had shown differences between them. We conducted regression analyses in which performance on regret and relief trials were the dependent measures and age was the predictor variable. In the *choice* Condition, Age was a significant predictor of performance on regret trials, $B = 0.016$, $SE = 0.005$, $\beta = 0.311$, $SE_{Estimate} = 0.56$, and relief trials, $B = 0.016$,

$SE = 0.005$, $\beta = 0.283$, $SE_{Estimate} = 0.61$. In the *No choice-child* condition Age was only a significant predictor of regret, $B = 0.018$, $SE = 0.007$, $\beta = 0.259$, $SE_{Estimate} = 0.77$, but not relief, $p = .303$. Age predicted neither measure in the *No choice-experimenter* condition (regret $p = .794$, relief $p = .107$). There was no development of emotional experience (counterfactual or otherwise) in the *No choice-experimenter* condition.

These findings provide evidence against our third possible reason for the lag between regret and relief trials: that children were experiencing frustration or happiness. As the level of responsibility for the outcome increased, children were more likely to experience positive or negative emotions. This suggests that, as in the adult literature, a greater responsibility for the outcome is more likely to lead to children's experiences of regret and relief.

The finding that children in the *Choice* condition were more likely to show regret than relief is out of line with the finding in Experiment 1 where there was no difference. One difference between the two experiments was the age of the children tested: 4- and 5-year-olds in Experiment 1 but not in Experiment 2, and 7- to 8-year-olds

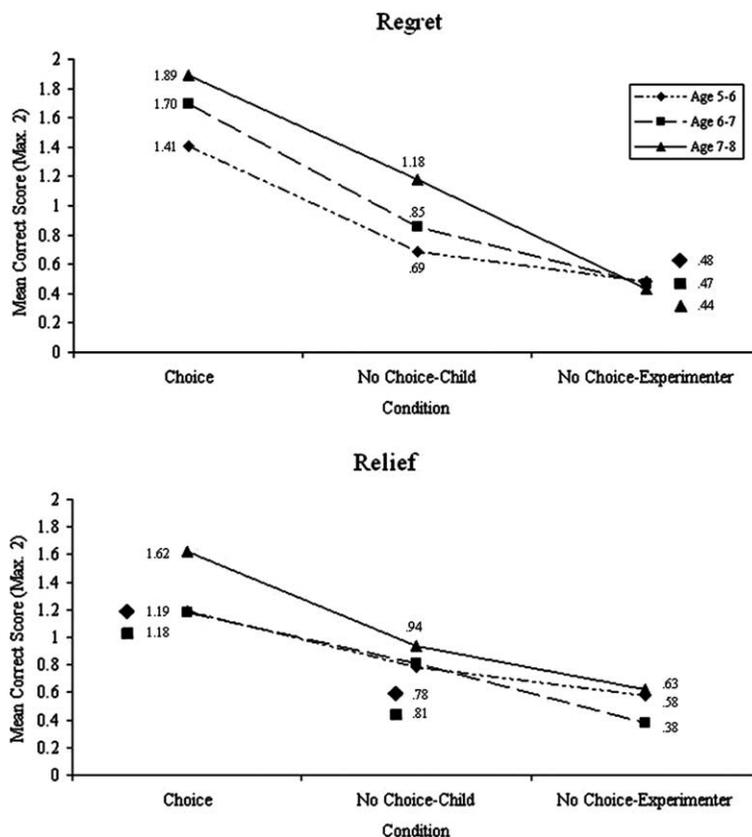


Figure 2. Mean scores for both regret and relief by age and condition in Experiment 2.

in Experiment 2 but not Experiment 1. One possibility is that regret may be a stronger emotion than relief, experienced with a greater intensity with age. The 7- to 8-year-olds responded correctly to 95% of the regret trials, but only to 81% of the relief trials. The greater accuracy on regret trials may be indicative of the function of both emotions to children. Regret may be critical for children's learning from their decisions so that they do not lose out again, whereas, perhaps the lessons learnt from situations where you have got the better outcome (and could feel relief) are less important.

In the *No choice-child* condition we removed the element of choice as which of the two cards the child received was due to a chance event. However, participants rolled the dice themselves, so the outcome *could* be attributed to the partici-

pants. Binomial test results for the two younger groups hint that children were more likely to experience counterfactual emotions when they won, in line with the illusion of control suggestion that people are more likely to assume responsibility after a positive outcome (Langer & Roth, 1975; Wortman et al., 1973).

Note that in the *No choice-child* condition, children did show evidence of some change in emotions. As they never reported the same emotions in the *No choice-experimenter* condition, and they were influenced by our responsibility manipulation, we believe that these were counterfactual emotions. Perhaps children perceived their involvement in the game (i.e., rolling a dice) as causally relevant to the outcome of the game, ignoring the fact that the outcome of a dice is a chance event. This misunderstanding

should decline with age so we might expect that adults would not experience counterfactual emotions after chance events. On the other hand, adults are capable of generating counterfactual thoughts about events out of their control. In our game one might think, “If only the dice had landed on the other colour, I would have won”. This might result in a counterfactual emotion (whether or not one wants to call this regret or another term is open to debate). Perhaps, then, if we played this game with adults we would expect to see some muted counterfactual emotions in the *No choice* conditions. Characterising adults’ counterfactual thinking following chance events is beyond the scope of this paper, but future work with adult participants should investigate this.

Our finding that children were influenced by our manipulation of responsibility is sufficient to lead us to reject the third possibility. Results of Experiment 2 revealed that the greater the responsibility over the outcome, there is a greater likelihood that children will experience regret and relief. These results offer support for our task as a measure of counterfactual emotion.

GENERAL DISCUSSION

In two experiments, we investigated the reported lag between the development of experience of regret and relief. We provided three possible explanations for the lag. The first is that there genuinely was a lag between regret and relief, the second was that relief was artefactually difficult, and the third was that children were feeling frustrated or happy based on their current state, rather than experiencing regret or relief. The results of our experiments suggest that our second possibility is most likely to be the case.

Experiment 1 provided evidence that was inconsistent with the first possibility: That there was a lag between the two emotions. By introducing trials in which the outcome of the participants’ choice was negative (i.e., losing) rather than only positive (i.e., winning; as in Weisberg & Beck, 2010), we found that the apparent lag was

greatly reduced. Although, it seems that regret after a positive outcome may be experienced slightly earlier (at 4 to 5 years) than regret after a negative outcome and relief after a positive outcome (at 5 to 6 years). An experience of relief after a negative outcome was first shown even later (at 6 to 7 years).

In Experiment 2, we addressed whether children were simply frustrated or happy with reality, rather than experiencing genuine counterfactual emotions. When we reduced children’s responsibility for the outcomes they were less likely to experience regret and relief. In combination with Experiment 1 this countered the possibility that regret trials had been artefactually easy in previous studies.

The experiments supported our remaining possibility that relief had not previously been adequately assessed. We improved the design of the relief trials by making the counterfactual a more significant alternative, the difference between reality and the counterfactual equal across regret and relief trials, and the scale include “even happier” and “even sadder” than the extreme faces. With these methodological improvements, 5-year-olds demonstrated both regret and relief.

In relief trials with a negative outcome, and a more negative alternative, 6- to 7-year-olds experienced relief. Thinking “it is not as bad as it could have been” seems to be later developing compared to thinking about negative alternatives after a positive outcome. The delayed development of this type of thinking may be due to the complexity of processing these two negatives. Under these circumstances, children may focus on reality and using a summative approach: combining the two negatives (Guttentag & Ferrell, 2004). An alternative explanation may be that after a negative outcome, comparisons to a more negative alternative may not influence children’s emotional state. Both these suggestions ought to be the focus of further research. Despite this, given the evidence that 5-year-olds experienced regret and relief on at least some trials, we suggest that these positive and negative counterfactual experiences rely on the same cognitive processes. However, situational factors may influence when and to what intensity they are experienced.

We found that children, like adults, are more likely to experience counterfactual emotions when responsible for an outcome (see also Byrne, 2002; Roese & Olson, 1995; Zeelenberg, van Dijk, & Manstead, 1998). We suggest that there are two possible reasons for the lack of counterfactual emotions when the individual lacks responsibility. The first is that children make the comparison between the counterfactual possibility and reality, just as they do in the choice condition, but when there is less responsibility, they are less influenced by this comparison. The second possibility is that children do not engage in counterfactual thinking when they recognise that they are not responsible for the outcome. Both these possibilities ought to be the subject of future work.

Our results, based on responses using the rating scale, cannot show unequivocally that children were experiencing regret or relief. Instead, this is an inference that we make based on the context in which children rate themselves as “happier” or “sadder” and the influence of our choice manipulation in Experiment 2. One possible way to confirm if these are genuine experiences of regret or relief is to ask children to justify the responses they gave. It is worth noting that in other studies of counterfactual emotions children who gave the correct response to a forced choice almost always justified their answer in a way that indicated that they were thinking about what might have been (Guttentag & Ferrell, 2004). Furthermore, if children were not experiencing regret and relief in our game, but rather a non-counterfactual emotion, it is not clear why the choice manipulation should have affected their responses.

A further avenue for future research is to explore when children start to generate counterfactuals to chance events that result in counterfactual emotions. It seems likely that emotional reactions to counterfactuals like “If only the dice had landed on another colour . . .” are even later developing than experiences of regret and relief that are based on one’s own agency. A related area of research suggests that agency may affect children’s and adults’ handling of uncertainty in different ways (Harris, Rowley, Beck, Robinson & McColgan, 2011).

Our results contribute to the debate in the counterfactual literature about the age at which children think counterfactually. Some claim that this ability develops between 3 to 4 years of age (e.g., Harris, German, & Mills, 1996; Riggs et al., 1998). However, Beck et al. (2006) suggested that it is not until children are 5 to 6 years old that they are able to think counterfactually. If, as the results from Experiment 1 suggest, children of 4 to 5 years have some fledgling experiences of regret, then perhaps children of this age can engage in counterfactual thinking, but do not do this under all circumstances. We suggest that 5- to 6-year-olds experience counterfactual emotions, the same age at which Beck et al. suggest that genuine counterfactual thought emerges. The asymmetry between children’s first success on counterfactual emotions tasks and thinking about counterfactuals as possibilities might not be as great as previously thought (e.g., Amsel & Smalley, 2000; Beck & Crilly, 2009; Beck, Riggs, & Burns, in press; Guttentag & Ferrell, 2004).

One question that remains, however, is why we found regret and relief so much earlier than Guttentag and Ferrell (2004) and Amsel and Smalley (2000). The most important difference is that in Weisberg and Beck (2010) and the current experiments, we investigated children’s own experiences (rather than their understanding of others’ emotions). Children may develop the cognitive processes necessary to experience regret and relief before being able to understand them in others, which will make greater demands on metacognitive and linguistic processes. Experience of these emotions may be more important to development than a reflective understanding of them.

This possibility that an experience of emotions develops earlier than an understanding of them has support in the moral emotions literature. Arsenio and Lover (1995) identified a particular pattern of children’s attributions of emotions, the “happy victimiser”, in which children would expect a wrongdoer to feel good. There is evidence to suggest that young children of 5- to 6-years-old attribute more negative emotions to themselves when they are in the role of victimisers, compared

to others in the same role. Older children, aged 8- to 9-years-old, attribute negative emotions to both (Arsenio, Gold, & Adams, 2006; Keller, Lourenço, Malti, & Saalbach, 2003). This developmental shift in the attribution of emotions to an imagined victimiser provides further evidence for a self-other dissociation.

An alternative possibility as to why we have found evidence for earlier experiences of regret and relief than Guttentag and Ferrell (2004) and Amsel and Smalley (2000) regards the methodology of assessing counterfactual emotions. Both Guttentag and Ferrell and Amsel and Smalley read stories to children that would have made substantial language demands and involved reflective processes. Weisberg and Beck (2010) and the current paper used a games task, making minimal language demands and concerned with children's immediate experience, that revealed counterfactual emotions at a younger age than previously thought.

Our results advance the growing body of developmental counterfactual emotions research, however some questions remain. The first is that further work must investigate the reasons for the lag between children's first experience of relief after a positive outcome and their first experience of relief after a negative outcome. Second, the results of Experiment 2 offer a new direction for research on children's understanding of counterfactual emotions in others. Weisberg and Beck (2010) found that children did not infer that others would experience these emotions until 7 years. Do children understand that responsibility for the outcome is a prerequisite for others to experience regret and relief?

We demonstrated that regret and relief both develop earlier than initially thought. Both emotions are experienced by 5- to 6-year-olds, and there is some evidence that regret after a positive outcome can be experienced by 4- to 5-year-olds.

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