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The Development of the Experience and Anticipation of Regret

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Abstract

Although recent studies have established that children experience regret from around 6 years, we do not yet know when the ability to anticipate this emotion emerges, despite the importance of the anticipation of regret in decision-making. We examined whether children will anticipate they will feel regret if they were to find out in a box-choosing game that, had they made a different choice, they would have obtained a better prize. Experiment 1 replicated Guttentag and Ferrell's (2008) study in which children were asked what they hoped was in a non-chosen box. Even 8-to-9-year-olds find this question difficult. However, when asked what might make them feel sadder, 7-to-8-year-olds (but not younger children) predicted that finding the larger prize in the unchosen box would make them feel this way. In Experiments 2 and 3, children predicted how they would feel if the unchosen box contained either a larger or smaller prize, in order to examine anticipation of both regret and of relief. Although 6-to-7-year-olds do experience regret when they find out they could have won a better prize, they do not correctly anticipate feeling this way. By around 8 years, the majority of children are able to anticipate both regret and relief.

Regret is widely considered to be a complex emotion that plays an important role in our mental lives (for review, see Joseph-Williams, Edwards, & Elwyn, 2011; Roese, 2003; Zeelenberg & Pieters, 2007). Much psychological research on regret has been based on the premise that it is a functional emotion that helps shape good decision-making (e.g., Camille et al., 2004; Connolly & Zeelenberg, 2002; Mellers, Schwartz, & Ritov 1999; Tsiros & Mittal, 2000; Zeelenberg & Pieters, 2007). Given the key role that has been accorded to regret, a number of recent developmental studies have investigated when children begin to experience this emotion (Burns, Beck, & Riggs, 2012; O'Connor, McCormack, & Feeney, 2012, in press; Rafetseder & Perner, 2012; Van Duijvenvoorde, Huizenga, & Jansen, 2013; Weisberg & Beck, 2010, 2012).

Regret is typically described as a counterfactual emotion that results from comparing an actual outcome with an outcome that did not obtain, but which could have obtained if one had made a different choice (Connolly & Zeelenberg, 2002; Kahneman & Miller, 1986). Given this, children would not be expected to be able to experience regret until counterfactual thinking abilities have developed. Children have difficulties thinking counterfactually before the age of four years (Beck & Guthrie, 2011; Beck, Robinson, Carroll, & Apperly, 2006; Riggs, Peterson, Robinson, & Mitchell, 1998; though see Harris, German, & Mills, 1996), with some researchers placing this development several years later (Rafetseder, Cristi-Vargas & Perner, 2010; Rafetseder, Schwitalla, & Perner, 2013). Moreover, it is likely that counterfactual thinking is necessary but not sufficient for experiencing regret, because regret involves not just a consideration of a counterfactual alternative but also a comparison between that alternative and the outcome that actually has obtained, plus a revaluation of this outcome in the light of this comparison (Beck, Riggs, & Burns, 2011). Given the need to hold different outcomes in mind, compare them, and reach an evaluative judgment, it is perhaps not surprising that both O'Connor et al. (2012, in press) and Burns et al. (2012) first found

evidence of regret at around 6-7 years. Similarly, in an individual differences study, Van Duijvenvoorde et al. (2013) found evidence of regret in most 7-to-8-year-olds, but very few 5-to-6-year-olds. However, there is disagreement over when this emotion can first be observed: Weisberg and Beck (2012) report some (albeit mixed) evidence of regret in children as young as 4-5, whereas Rafetseder and Perner (2012) argue that it is not present until at least 9 years.

All of these studies involve a similar paradigm, in which children choose between one of two boxes in order to win a prize. Children are then shown that the unchosen box contained a better prize than the one in the box they have chosen. Regret is assessed by asking children to report on their emotions once they have seen the prize in the unchosen box. Children who report feeling less happy than when they initially were shown their actual prize are categorized as experiencing regret. Although all of the studies have used this general procedure, they differ in a variety of important methodological details, most notably in the method used to measure children's self-reported emotions, which may account for the differences between studies in the age at which regret is first observed. In particular, Rafetseder and Perner (2012) argued that questioning children twice about their emotions – once after they have seen the prize in the box they have chosen and once after seeing the counterfactual prize – may lead to false positives. They argued that this double questioning leads to young children being erroneously categorized as capable of experiencing regret because they change their answer about how they feel when asked a second time. They place the emergence of regret at 9 years, based on their findings from a study employing a design in which participants were only asked a single time to report on their emotions.

In our own studies (O'Connor et al., 2012, in press), children were asked twice about their emotions, but we controlled for potential effects of double questioning by using a baseline trial in which both the actual prize and counterfactual prize were the same

magnitude. Using this method, we have consistently found that the majority of children aged 6-7 years report feeling less happy when they find out that their prize would have been better if they had chosen differently. Weisberg and Beck (2012) also demonstrated that 6-to-7-year-olds do not report feeling sadder if the experimenter rather than children themselves selected a box, suggesting that children's emotional response is not merely one of frustration based on comparing the magnitudes of the actual versus counterfactual prize (as suggested by Rafetseder & Perner, 2012), but involves regret associated with having made a decision (see Zeelenberg, van Dijk, & Manstead, 1998). Moreover, O'Connor et al. (in press) found that children who report regret are more likely to make a different decision when faced with the same choice again a day later.

Taken together, the findings of Burns et al. (2012), O'Connor et al. (2012, in press), and Weisberg and Beck (2010, 2012) suggest that children in the 6-to-7-year age range are capable of experiencing regret. However, theoretical and empirical research in the adult literature has primarily focused on the role of *anticipated* rather than *experienced* regret (see Zeelenberg & Pieters, 2007, for this distinction). This has particularly been the case in the decision-making literature, where the basic idea is that when we make choices we try to anticipate in advance whether they are likely to lead to regret. In economics, there is a long-standing tradition of formal models of economic decision-making that have tried to capture the idea that we aim to minimize the future regret we are likely to feel as a result of our choices (Bell, 1982; Loomes & Sugden, 1982). Although these accounts model behaviour from relatively complex tasks in which participants must select between options that vary in risk and reward, a wide variety of other studies have indicated that anticipating regret has important impact on everyday behavior. For example, in the domain of health psychology, risk-avoidance behaviours such as using contraception or obtaining vaccination have been shown to be related to the anticipation of regret (e.g., Joseph-Williams et al., 2005; Richard,

de Vries, & Van der Plight, 1998). Thus, Zeelenberg and Pieters (2007) have argued that we systematically attempt to regulate the amount of regret that we feel, and that much of this regulation involves acting in ways to avoid or minimize future regret.

Despite the importance accorded to the anticipation of regret in the adult literature, we are aware of only one study that has examined when children are capable of anticipating regret. Guttentag and Ferrell (2008) conducted a study in which children and adults were initially shown three boxes and informed that one box contained a small prize, one a medium prize, and one a large prize, although they did not know which box contained which prize. One box was then removed, leaving two boxes. Following this, participants selected one of the two boxes in order to win its prize, and their box was opened to reveal the medium prize. At this point, participants did not know what was contained in the unchosen box. The experimenter then asked participants whether they wanted to find out what was in the other box (declining to look in the other box allowed participants to avoid potential regret) and what they hoped it contained. Even adults tended to judge that they wanted to find out what was in the other box; therefore, of most interest are answers to the question about what participants hoped was in the unchosen box. Guttentag and Ferrell found that whereas the majority of adults said that they hoped it contained the smaller prize, this was not the case for children. Even amongst their 9-to-10 year-old group, only 44% the children gave this answer, and children younger than this overwhelming said that they hoped that it contained the larger prize.

Given their findings, these authors argued that the ability to anticipate regret develops relatively late. If they are correct, it would appear that there is a considerable lag between the ability to experience regret and the ability to anticipate the same emotion. Such a lag might be thought to be unsurprising given the additional cognitive demands of Guttentag and Ferrell's (2008) task. In studies of experienced regret, children's emotional responses are

based on a comparison between the actual outcome and the counterfactual outcome that would have obtained if they had chosen differently. However, although the alternative outcome is a counterfactual one, the consequences of choosing differently in those studies are visibly apparent to children when they make their judgments. Thus although children may have to bear in mind a counterfactual world, the task itself does not have high imaginative demands. By contrast, in Guttentag and Ferrell's task, children have to imagine an alternative outcome, one that is not perceptually available and that may or may not obtain in the future.

In fact, the task is more complex than this because although Guttentag and Ferrell describe their task as one that taps anticipation of regret, it could be argued that giving the right answer depends not just on children realizing that if the larger prize was in the unchosen box they would experience regret, but also that if the smaller prize was in the box they would experience relief. Recall that children are asked what they hope the contents of the other box will be; the correct answer is to say that they hope the smaller prize will be there. This is pertinent because existing research indicates that experienced relief may emerge somewhat later than regret, albeit considerably earlier than 9-10 years (Weisberg & Beck, 2010, 2012). Even if being able to anticipate relief is not strictly necessary to pass their task, children do have to compare the emotions that would result from each of the outcomes and choose the least aversive, and this comparison process itself may be demanding (Amsel, Cottrell, Sullivan, & Bowden, 2005).

In the current study, we addressed the issue of when children can first anticipate regret using the same basic three-boxes paradigm used by Guttentag and Ferrell (2008). In the first experiment, we attempted to replicate Guttentag and Ferrell's results, but we used two conditions. In one condition, children were asked which prize they would like to see in the unchosen box, which is similar to the question used by Guttentag and Ferrell (the Like condition). However, in the other condition (the Sadder condition), we asked children what

might be in the other box that would make them feel sadder about their prize. To answer this question, children did not need to evaluatively compare the emotional consequences of both outcomes, but simply choose the one that would make them feel sad. Moreover, the question itself alerted children to the possibility that they might feel regret in the future, whereas this was, at best, only implicit in Guttentag and Ferrell's (2008) original question. Unlike Guttentag and Ferrell, we used prizes that differed quantitatively (numbers of tokens) rather than qualitatively (they used toys differing in desirability), because qualitative differences may be more subjective. In Experiments 2 and 3, we used a similar task, but we asked children directly how they might feel if the unchosen box contained the larger (or the smaller) prize, a procedure that more closely resembles that used in studies of experienced regret.

Experiment 1

Participants

Forty nine 5-to-6-year-olds ($M = 70$ months, Range = 61-83 months), 44 7-to-8-year-olds ($M = 94$, Range = 85-107 months, and 40 9-to-10-year-olds ($M = 118$ months, Range = 109-129 months) participated. Seventy six of the children were female. Children were randomly assigned to one of two conditions. Of the 5-to-6-year-olds, 24 were assigned to the Like condition and 25 to the Sadder condition, of the 7-to-8-year-olds, 22 were assigned to each condition, and of the 9-to-10-year-olds, 19 were assigned to the Like condition and 21 to the Sadder condition. In this and subsequent experiments, children were recruited and tested individually in their schools.

Materials

Three identical colored boxes with removable lids were used to contain the prizes. A set of small plastic tokens were used as prizes which the children could exchange for stickers at the end of the task.

Procedure

The initial procedure for both conditions was identical. Children were introduced to the three boxes and were told that they were going to play a game in which they could win tokens that they could exchange for stickers of their choice. Children were shown examples of what the tokens and stickers looked like. The experimenter then explained that the boxes differed in terms of the number of tokens they contained, with one box containing no tokens, one containing 1 token, and one containing 10 tokens (in fact, all three boxes contained one token). The experimenter subsequently said to children: “If you pick the box with nothing in it you will win nothing, if you pick the box with one token in it you will win one sticker and if you pick the box with ten tokens in it you will win ten stickers.” She then said that three boxes were “too many” and that children needed to pick one box to take out of the game. Children selected one of the boxes, which was then set aside. The experimenter then said “So we now have two boxes left. I want you to choose very carefully which box you want to open and get your prize from.” Once children had chosen their box, the experimenter showed them that it had one token inside. She then drew children’s attention to the other unchosen box and said “This is the box you haven’t chosen. Imagine I opened it.” After this, she asked the test question, which differed for the two conditions. For the Like condition, the experimenter said “How many tokens would you like to see in this box that you haven’t chosen?” For the Sadder condition, the experimenter said “This is the box you haven’t chosen, you might feel sadder about your prize when you see what is in this box that you haven’t chosen. What might be in this box when I open it up that would make you feel sadder about your prize?”

Results and Discussion

Figure 1 shows the percentage of children of each age who gave each answer for each condition. Children of all ages found the Like question difficult, with the majority of younger children saying that they would like to see 10 tokens in the unchosen box, and only around half of the children in the two older groups stating that they would like to see no tokens in the

other box. The majority of children answered the Sadder question correctly, although the older children were more likely to answer correctly than the younger ones. In the Like condition, there was a significant association between age group and response, $\chi^2 (2, N = 65) = 9.78, p < .01$. In this condition, binomial tests showed that in neither of the older two groups did children give one of the two responses more often than would be expected by chance; the 5-to-6-year-old group said that they would like to see the bigger prize in the unchosen box more often than chance, $p < .001$. In the Sadder condition, the association between age and response was not significant, $\chi^2 (2, N = 68) = 3.59, p = .17$. However, binomial tests showed that the 5-to-6-year-olds did not predict that the bigger prize would make them feel sadder more often than would be expected by chance ($p = .23$), but both the older groups performed at above-chance levels ($p < .01$ in both cases).

The youngest and oldest groups' responses to the Like question were very similar to those found by Guttentag and Ferrell (2008), who asked children what they hoped would be in the unchosen box. These authors also found that only around half of 9-to-10-year-olds answered that they would like to see the smaller prize in the unchosen box and that the vast majority of 5-to-6-year-olds judged that they would prefer to see the larger prize in the unchosen box. Our results differ from Guttentag and Ferrell's only in terms of the performance of the 7-to-8-year-olds: Guttentag and Ferrell found that 89% of this age group also preferred to see the larger prize, whereas we found that only around half of this age group gave that response.

The tendency of 5-to-6-year-olds to answer that they would like to see the larger prize suggests that they may be adopting what has been termed a summative approach (i.e., any "more" was better, even if the larger outcome was not one they obtained) to evaluating the outcomes (McCloy & Strange, 2009). Alternatively, the youngest children in our study may have been glossing the question in the Like condition to being one about what they

would actually like to win, rather than one that required considering their feelings about their own prize given the counterfactual outcome. In addition, we note that the correct answer to the test question “How many tokens would you like to see in the box you haven’t chosen” is “none”, and it may be that younger children believe that this question asks them to specify a number that is not zero.

The results of the Sadder condition seem to paint a different picture of children’s ability to anticipate regret: by 7-8 years, children predict that they would feel sad if the unchosen box contained a better prize. Although this was true for the majority of children in the youngest age group, as a whole this group did not perform significantly above chance. As they stand, these results suggest that 7-to-8-year-olds can anticipate that they would feel unhappy if they were to find out that an alternative outcome that they could have chosen was better than the one they did choose. However, the nature of the question that children were asked differed from that used in studies of the development of experienced regret. In those studies, children were shown the unchosen outcome, and asked how that made them feel, whereas in the current study of anticipated regret, children were alerted to the possibility that they might feel sadder and then asked what might make them feel that way.

Experiment 2

In Experiment 2, we carried out a more direct comparison of the development of experienced and anticipated regret by administering very similar tasks that differed only in terms of whether children reported an emotional response on seeing an unchosen outcome (experienced regret) or reported how they expected to feel if a particular unchosen outcome obtained (anticipation of regret). In the anticipated regret task, we asked children how they would feel if the unchosen outcome was better than that which they had obtained. We also asked children how they would feel if the unchosen outcome was worse than that which they obtained, which is a measure of the ability to anticipate relief. As mentioned above, the small

number of developmental studies conducted on the development of relief (Weisberg & Beck, 2010, 2012) suggest that children might first anticipate relief at a somewhat older age than which they anticipate regret. Including this trial also allows us to ensure that if children report they expect to feel sadder in the anticipate regret trial, this is not due to a general bias to give this response.

The method used in the experienced regret task was designed to carefully control for the difficulties Rafetseder and Perner (2012) have argued occur when children are asked to rate their emotions twice. Children completed two trials in which they chose between two boxes to win a prize. They indicated their emotional response on discovering their prize using a five-point scale, and then their response on subsequently seeing the prize in the unchosen box using a three-pronged arrow, in which one prong indicated feeling the same as before, one feeling sadder, and one feeling happier (O'Connor et al., 2012, in press; Weisberg & Beck, 2012). This allowed children to indicate the direction of change (if any) of their emotions. O'Connor et al. used this method because they found that the vast majority of very young children (4-to-5-year-olds) tended to indicate emotional responses at the end of the scale, meaning that if they were asked to rate their emotions a second time, there was only one direction in which they could shift their response on the scale. Use of the three-pronged arrow circumvented this difficulty, as it allowed children to indicate that they felt happier/sadder even if they were already at the end of the scale (see Van Duijvenvoorde et al., 2013, for an alternative solution to this difficulty involving an expanding scale).

Although this method overcomes potential difficulties with regard to children's use of a scale to make comparative ratings, it does not in itself deal with Rafetseder and Perner's criticism that children are likely to report feeling sadder if asked to rate their emotions a second time, potentially yielding false positives. To control for this, we used a baseline trial in which it was incorrect to report feeling sadder on the second rating: in this trial both the

actual prize children received and the prize in the unchosen box were the same. Passing this trial ensures that children do not have a general tendency to report that they feel sadder even when this is not the appropriate response. The second trial children completed was the experienced regret trial, in which children completed a similar task, but were shown that the unchosen box contained a better prize than the prize they actually received. Children were judged to have experienced regret if they reported feeling sadder in this trial but not in the baseline trial. In our view, this method is preferable to using a measure that compares children's rating after seeing just their own prize in one trial with their rating after seeing the prize in the unchosen box in a separate regret trial (cf. Rafetseder & Perner, 2012, who took these measures in separate testing sessions). In addition to the three-pronged arrow method circumventing the problems identified by Rafetseder & Perner (2012) in children's use of the scale, because our method allows us to measure participants' emotion in the same testing session with reference to the same outcome, it ensures control of task and situational variables that could otherwise obscure effects of experienced regret.

Participants

Twenty one 6-to-7-year-olds ($M = 79$ months, Range = 72-83 months), 22 7-to-8-year-olds ($M = 91$ months, Range = 84-95 months), and 19 8-to-9-year-olds ($M = 100$ months, Range = 96-103 months) participated in the study. There were 32 females in total.

Materials

For the experienced regret task, two sets of three different colored boxes were used. For the baseline trial, each of these boxes contained a smaller silver box which held one token; for the regret trial these larger colored boxes each contained two smaller silver boxes, one of which contained a single token and the other of which contained five tokens. The two smaller silver boxes could be distinguished by touch to enable the experimenter to select the appropriate prize regardless of which of the larger colored boxes the child selected. Three

different colored boxes were used for the anticipate regret task. In addition, we used an emotion rating scale in this experiment identical to that used by O'Connor et al. (2012, in press), which was a picture of five faces ranging from “very happy” (far left of scale) to “very sad”. A three-pronged arrow was used with this scale, with one prong used to indicate one of the faces on the scale, and the other two prongs pointing left and right from the central prong. Two small wooden dolls with some toy props were used in the pretraining phase in which children were taught to use the scale and the three-pronged arrow.

Procedure

The pretraining phase was identical to that used successfully in our earlier studies (O'Connor et al., 2012, in press). Children were initially introduced to the emotion rating scale, with the faces described as “very happy”, “a little bit happy”, “not sad or happy”, “a little bit sad” and “very sad”. They were shown the three-pronged arrow, and it was explained to them that the middle prong could be used to point to the face on the scale that showed how they felt. They were then taught, by means of several examples involving the wooden dolls, to use the three-pronged arrow to report how emotions change after an initial outcome is followed by a subsequent event. In all of the examples, it was demonstrated using the five-point scale that the dolls initially felt one emotion on receiving or losing a toy and then children were shown that the three-pronged arrow could be used to indicate that the doll felt “even happier now” or “even sadder now” on gaining or losing additional toys.

Children always completed the experienced regret task first. This was because in the anticipate regret task, unlike the experienced regret task, children are explicitly told what the possible prizes are; if they had received this task first, it was likely that they would have carried over expectations about the magnitude of prizes or the availability of prize information to the experienced regret task, potentially affecting children's self-reported emotions. We note, though, that it is possible that completing the experienced regret task first

could potentially facilitate subsequent performance on the anticipate regret task by providing children with an analogous situation on which to base their anticipate regret judgments.

Given that we were predicting the anticipate regret task to be harder than the experienced regret task, such a facilitation effect would run contrary to the direction of our prediction.

For the experienced regret task, children were initially told that they would be playing a game in which they could win tokens that could be exchanged for stickers. The emotion scale was re-introduced to children, and the experimenter explained that they would use this scale to indicate how they felt during the game, before moving on to administer the two trials of the task. The baseline trial was administered first. The two boxes were placed in front of children and they were asked to choose one of the boxes in order to win a prize. The experimenter opened the selected box and showed the participant that they had won a prize of one token. Children were then asked to use upward-pointing prong of the three-pronged arrow to indicate how they felt on the 5-point scale. Following this, the experimenter said “Now I am going to open the other box that you didn’t choose, to see what you could have won”. The experimenter opened the other box and showed children that there was also 1 token in it. She then said “If you had chosen this box, you would have won one token. How do you feel about choosing your box now?”, indicating each of the three prongs of the arrow. After this trial, the boxes were removed and children got to keep their one token. The regret trial was identical, except that the experimenter revealed that the non-chosen box contained five tokens.

The procedure for the anticipate regret/relief task was identical to that used in Experiment 1 up until the point at which children saw what was in the box they had chosen. Once children had chosen their box, the box was opened and children were asked to use the scale to indicate how they felt about their prize. For the anticipate regret trial, the experimenter then said to children “Here is what you felt about choosing your box (indicating

face on the scale selected by the child). Now, can you show me how you would feel if there were five tokens in the other box that you haven't chosen?", with the experimenter indicating the three prongs of the arrow. For the anticipate relief question, children were asked how they would feel if there were no tokens in the other box. The order of questions was counterbalanced.

Results and Discussion

Figure 2 shows the percentage of children reporting whether they felt happier, sadder, or the same in the baseline and regret trials of the experienced regret task. The vast majority of children in each age group reported feeling the same in the baseline trial but sadder in the regret trial. There was no association between age and the distribution of responses on either of these trial types, $\chi^2(4, N = 62) = 5.75, p = .22$ and $\chi^2(4, N = 62) = 4.58, p = .33$ respectively. The distribution of responses across the three categories of happier, sadder, and same differed significantly from chance for all three age groups in each of the two trial types, all $ps < .001$. Children were classified as experiencing regret if they reported feeling sadder in the regret trial only; the majority of children in each age-group experienced regret (20/21 of the 6- to 7-year-olds, 17/22 of the 7- to 8-year-olds and 14/19 of the 8- to 9-year-olds).¹

Figure 3 shows the percentage of children who reported feeling happier, sadder, or the same on the anticipate regret and anticipate relief trials. There was a significant association between age and response choice in the anticipate regret trial, $\chi^2(4, N = 62) = 25.20, p < .001$, and the anticipate relief trial, $\chi^2(4, N = 62) = 34.03, p < .001$. In the 6-to-7-year-old group, the distribution of responses differed from chance in the anticipate regret trial, $\chi^2(2, N = 21) = 10.57, p < .01$ and in the anticipate relief trial, $\chi^2(2, N = 21) = 11.14, p < .01$. This was not, though, because children in this age group were likely to give the correct answers; rather it can be seen from Figure 3 that 6-to-7-year-olds were likely to report that they would either feel the same or happier in the anticipate regret trial and the same or sadder in the anticipate

relief trial. In the 7-to-8-year-old group, the distribution of responses on the anticipate regret trial differed significantly from chance, $\chi^2(2, N = 22) = 9.36, p < .01$. The majority of children of this age group correctly reported that they would feel sadder in this trial. However, the distribution of responses on the anticipate relief trial did not differ significantly from chance, $\chi^2(2, N = 22) = 1.18, p = .55$. In the 8-to-9-year-olds, the distribution of responses differed from chance for both the anticipate regret trial, $\chi^2(2, N = 19) = 10.84, p < .01$, and the anticipate relief trial, $\chi^2(2, N = 19) = 27.29, p < .01$. The majority of children in this age group gave the correct answer in both trial types.

We also examined children's patterns of performance across each trial type. We might predict that anticipating regret depends on a pre-existing ability to experience regret, therefore we would not expect to see children passing the anticipate regret task who did not pass the experienced regret task. Of the 27 children who passed the anticipated regret trial, only 3 were classified as not experiencing regret; the other 8 children who were not classified as experiencing regret did not pass the anticipate regret trial. These data are compatible with the idea that experiencing regret is a necessary precursor for anticipation of regret (assuming a small number of children pass the anticipate regret task by chance). In terms of the two anticipate emotion trials, 31 children failed both trials and 21 passed both trials; a further 10 children only passed one of the two trial types.

The developmental pattern of findings in the experiment is straightforward. Children in all three age groups appropriately report experiencing regret when they learn that they could have had a better prize if they had chosen differently. This finding is consistent with the findings of other recent studies of experienced regret, which also indicate that 6-to-7-year-olds experience regret (O'Connor et al., 2012, in press; Weisberg & Beck, 2010, 2012; but see Rafetseder & Perner, 2012). However, the performance of the age groups is quite different when their task is to anticipate how they would feel if a counterfactual outcome

were to be better or worse than the actual outcome. Children aged 7-8 years onwards correctly predict that they would feel worse if the box they did not choose contained a better prize, but younger children are not able to accurately predict their response. Moreover, even 7- to-8-year-olds do not judge that they would feel better if the counterfactual outcome were worse than the actual outcome. Only the 8-to-9-year-olds were able to predict that they would feel relieved under these circumstances.

The results of this experiment are consistent with those of Experiment 1 in suggesting that children begin anticipate regret from around 7-8 years. Moreover, the performance of the 6- to-7-year-olds in this study is reminiscent of the youngest group in the Like condition in Experiment 1. In that experiment, many children reported that they would like to see 10 tokens in the unchosen box, suggesting they adopted a summative approach to the outcomes (any “more” is better). Around half of the six- to seven-year olds in Experiment 2 seem to have adopted a similar approach, in that they predicted feeling happier if the counterfactual outcome was a better one than the actual one and sadder if the counterfactual outcome was a worse one than the actual one. The findings of Experiment 2 indicate that 6-to-7-year-olds’ answers on the anticipate regret trial are prediction errors: when they are shown what prize they would have obtained if they had made a different choice, 6-to-7-year-olds will report that they feel sadder. Thus, the findings indicate that children can experience regret before they can accurately anticipate it.

Interestingly, in this experiment children seemed to be able to anticipate regret around a year before they can anticipate relief (7-8 years for regret, 8-9 years for relief), a finding that is reminiscent of those of Weisberg and Beck (2010, 2012) regarding experienced relief. These researchers reported that children first began to experience relief around a year or so after they first began to experience regret. They interpret this finding as consistent with studies of adults that suggest people are more likely to think counterfactually when an

outcome is negative than when it is positive. Weisberg and Beck's findings also suggest that children in the 7-to-8-year-old age range, the middle age range in our study, should be capable of experiencing relief. This would suggest that this group in Experiment 2 also made a prediction error in the anticipate relief trial.

Experiment 3

The findings of Experiment 2 suggest that children first begin to experience regret around 7-8 years and relief around 8-9 years. In our final experiment, we tested a sample of children ranging from young 7-year-olds to old 8-year-olds in an attempt to replicate the findings of Experiment 2. We also administered a standardized test of verbal ability in order to examine whether chronological age or verbal ability were better predictors of anticipated regret/relief. A further difference between this study and Experiment 2 was that we did not administer the experienced regret task in advance of the anticipate regret/relief task. It is possible that children's answers to the anticipate regret task in Experiment 2 might have been based on their memory for how they felt in the experienced regret task, and we wanted to rule out this possibility.

Participants

Fifty six children took part in the study ($M = 99$ months, Range = 85-108 months; 25 females).

Materials

Materials were similar to those used in Experiment 2 except that the prizes were either no tokens, 1 token or 10 tokens. In addition, the BPVS II (Dunn, Dunn, Whetton, & Burley, 1997) was administered to all children. This is a test of receptive vocabulary standardized on a British population.

Procedure

Children were seen twice in two testing sessions. In the first session, they completed the BPVS and in the second session the anticipation of regret/relief task; in both sessions they also received other unrelated cognitive tasks not reported here. The anticipation of regret/relief task was very similar to that used in Experiment 2. At test, the experimenter said “The box that is still sitting on the table has the prize that you didn’t win inside it. Can you use the arrows to show me how you would feel if there were 10 (or no) tokens inside the box that you didn’t choose? Would you feel happier, sadder, or the same?”, with the order of the anticipate regret and anticipate relief questions counterbalanced.

Results and Discussion

One child who scored very poorly (more than 2 *SD* lower than the group mean) on the BPVS was removed from the sample. Figure 4 shows the distribution of responses for the sample as a whole on the anticipate regret/relief task. The majority of children anticipated feeling sadder in the anticipate regret trial and happier in the anticipate relief trial. In both cases, the distribution of responses differed significantly from that expected by chance, $\chi^2(2, N = 55) = 40.62, p < .01$ for anticipate regret and $\chi^2(2, N = 55) = 23.71, p < .01$ for anticipate relief. Looking at performance across trial types, 31 children were correct on both trials, 11 incorrect on both trials and a further 13 correct on one of the two trial types.

The mean age and raw BPVS scores of children are presented in Table 1. Children who correctly anticipated regret were significantly older than those who did not, $t(53) = 4.40, p < .01$, and of those children who failed to anticipate regret, two-thirds were 7-year-olds. The raw BPVS scores of children who failed to anticipate regret did not differ significantly from the scores of those who correctly anticipated regret, $t(53) = 1.67, p = .10$. Although children who correctly anticipated relief were not significantly older than those who did not, $t(53) = -0.99, p = .33$, the raw BPVS scores of children who failed to anticipate relief were significantly lower than the scores of those who anticipated relief, $t(53) = -2.53, p < .05$.

Binary logistic regressions examined whether chronological age or BPVS raw scores were predictive of whether or not children correctly anticipated regret and relief. Table 2 shows the results of these regressions. Even in this narrow age range, chronological age but not BPVS raw score was a significant predictor of whether children anticipated regret. The model comprised of age in months and BPVS raw score did not capture whether children anticipated relief particularly well. Nonetheless BPVS raw scores, but not age in months, were a significant predictor of whether children anticipated relief.

The findings of this study indicate that the vast majority of children will anticipate regret once they reach 8 years: 87% of children aged 8 answered the anticipate regret question correctly, compared to 38% of children aged 7. While the ability to anticipate regret was related to chronological age, children's verbal ability was not a predictor. Although the average age of children who answered the anticipate relief question correctly was very similar to that of those who answered the anticipate regret question correctly, performance was less tightly associated with chronological age (50% of children aged 7 answered this question correctly compared to 70% of children aged 8), and was instead related to verbal ability (albeit relatively weakly). Children's performance on verbal ability measures such as the BPVS is sometimes taken as a proxy measure of general intelligence, and we do not know whether the association reported here between the ability to anticipate relief and BPVS scores reflects a role for specifically verbal skills in this developmental achievement, or a more general relationship with level of cognitive development.

General Discussion

The results of the experiments reported here indicate that by the time children are 8, the majority of them can anticipate both regret and relief. Children aged 6-to-7 years do not anticipate these emotions. Experiment 2 provided some indication that children begin to anticipate regret before they can anticipate relief, but the findings of Experiment 3 did not

straightforwardly support this suggestion. Instead, they suggested that children's level of verbal ability may be a better predictor of whether they can anticipate relief than chronological age. The findings of Experiment 2 indicate that there is a developmental lag between when children first experience regret (around 6 years) and when they first anticipate regret. Thus, children's failure to anticipate regret is a prediction error: children do not realize the emotional consequences of finding out that if they had made a different choice, the outcome would have been better.

We suggested in the introduction that the ability to anticipate regret requires additional cognitive abilities over and above the ability to experience regret. In particular, it requires that children imagine an as-yet-unknown outcome, and then consider its emotional consequences. Beck et al. (2011) and Burns et al. (2012) suggest that even the ability to experience regret may require certain cognitive resources over and above the ability to thinking counterfactually. In particular, they argue that children must be able to disengage from the actual outcome and then switch flexibly between considering the counterfactual outcome and the actual outcome in order in order to appropriately compare and evaluate them. They found that switching, as measured by a separate executive function task, predicted whether or not children experienced regret over and above chronological age and verbal ability. Anticipating regret seems to make still further demands on children's cognitive abilities, in that it requires generating representations of unobserved, and indeed unknown, states of affairs, but we do not yet know whether these further demands are also best viewed as executive function abilities, and if so which aspect of executive function may be important. Burns et al. (2012) found that children's working memory abilities were not predictive of experienced regret, and they suggest that the working memory demands of holding in mind a single counterfactual representation may not be particularly taxing for children of this age. Potentially, giving the correct answer in our anticipated regret may place additional demands

on working memory that are not present in the experienced regret task, in which the counterfactual alternative to be compared to the actual outcome is visually apparent.

We note that there is potentially an interesting parallel between our findings regarding a delay between experiencing and anticipating regret and the findings of Weisberg and Beck (2010) that indicated a lag between when children are first capable of experiencing regret and first capable of correctly attributing regret to another individual. In their study, they found that 6-to-7-year-olds were able to experience regret but were unable to accurately judge when another character would feel regret (or relief). Using a more complex paradigm, Ferrell, Guttentag, and Gredlin (2009) also found that children younger than 8 could not judge which of two characters would experience regret: one whose choice led to a poor outcome and one whose choice was irrelevant to the poor outcome (though see Guttentag and Ferrell, 2004, for evidence that some 7-year-olds can make this distinction). Interestingly, Ferrell et al. (2009) found that amongst verbal ability, working memory, and second-order theory of mind, there was no single predictor of children's ability to judge which of two characters would feel regret, over and above age. What is not yet clear is whether anticipating one's own regret requires the same cognitive abilities as judging that someone else feels regret; a study directly comparing these abilities in the same population of children would be a first step towards answering this question.

Although further research is required to identify why younger children have difficulty anticipating but not experiencing regret, as they stand our findings are already relevant to interpreting research on how regret may impact on decision making. The work of O'Connor et al. (in press) has found an association between experienced regret and children's decision making, in that children in the boxes task who experienced regret were more likely to make a different choice when asked to choose between the boxes again the next day. O'Connor et al. argued that experienced regret facilitates better subsequent decision making, at least in part,

by the fairly simple mechanism of facilitating spontaneous recall of the different outcomes associated with different decisions. The findings of the current study seem to rule out an alternative explanation of the relationship between experienced regret and decision-making in O'Connor et al.'s study, in that they imply that children do not make a different choice second time round because they anticipate feeling regret if they make the same choice again. The children in their study were 6-to-7-year-olds, and the findings reported here strongly indicate that these children would find it difficult to accurately anticipate their emotions. Thus, the findings of O'Connor et al., when viewed in the light of the current findings, suggest that the experience of regret itself can impact on decision-making, without requiring anticipatory regret. This finding is relevant to debates over whether emotions such as regret impact on behavior directly through experiencing the emotion or indirectly through anticipation of the emotional consequences of different choices (see Baumeister, Vohs, DeWall, & Zhang, 2007, for an influential defense of the latter claim).

Our results indicate that by the time children are around 8 years they have the cognitive resources to deal with the inherent uncertainty in the anticipate regret task, appropriately imagine one of two possible counterfactual outcomes when instructed to, and evaluate that outcome relative to the actual outcome to correctly predict their emotional response. Thus, the ability to anticipate regret seems to develop somewhat earlier than the 9-to-10 years claimed by Guttentag and Ferrell (2008). However, it is one thing to be able in principle to anticipate that a specific outcome might lead to regret, and quite another to use anticipated regret effectively in one's decision-making. As Amsel et al. (2005) point out, using anticipated regret requires at least four component processes: (i) generating the different possible outcomes that might obtain for each possible decision; (ii) systematically, and correctly, anticipating the emotional response associated with each outcome; (iii) rank-ordering outcomes in terms of these emotional response; and (iv) deciding on the best

decision given this rank-ordering. Amsel et al. (2005) argue that even if children have each of these component skills, it is a further, and metacognitive task, to coordinate these skills and use them in appropriate contexts. Arguably, our anticipate regret task only required the second of these skills.

To conclude, across three studies we have provided consistent evidence that children begin to anticipate regret and relief around 8 years, and have shown that there is a lag of 1-2 years between first being able to experience regret and being able to anticipate it. These findings set the stage for further research into the development of anticipated counterfactual emotions. In particular, research that examines when children start to use the anticipation of regret in their decision making and the cognitive changes that facilitate this developmental change may shed new light on the development of decision making.

Footnote

1. There was a small minority of children ($N = 7$) who reported feeling sadder on the regret trial but happier on the baseline trial. There are two ways of interpreting this pattern of performance: it may be that these children feel relief on the baseline trial because they could not have obtained a better prize (O'Connor et al., 2012, in press). Alternatively, it may be that these children have a general tendency to shift their response. We believe that the former interpretation is more likely because we have found this tendency to increase with age (O'Connor et al., 2012, and see Figure 2), thus we classify these children as experiencing regret. Note that the majority of children in each age group remain categorized as experiencing regret even if we were to re-classify these 7 children as failing the task.
2. O'Connor et al. (2012) and Van Duijvenvoorde et al. (2013), found that administering this trial first increased the possibility that children experienced regret, possibly because this trial sets up the expectation, subsequently disconfirmed when the unchosen box is opened, that all boxes contain one token; however it should be noted that the age patterns for experienced regret found by O'Connor et al. are not dependent on trial order.

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Table 1. *Mean age and raw BPVS scores of children in Experiment 3 broken down by whether they anticipated regret and relief*

		<i>N</i>	Mean age (in months)	Age range	Mean BPVS score	BPVS range
Anticipate regret	Yes	40	102	89-108	79	57-111
	No	15	94	85-106	74	62-90
Anticipate relief	Yes	35	100	85-108	81	57-111
	No	20	98	86-108	74	62-88

Table 2. *Results of the binary logistic regressions on anticipated regret and relief from Experiment 3.*

		95% CI for exp b		
	B(SE)	Lower	exp b	Upper
<i>Model 1. Regret</i>				
Age in months	1.88 (.06)	1.07	1.21	1.36
Raw BPVS scores	0.23 (.04)	.95	1.02	1.10
Constant	-19.14 (5.86)		< .001	
<i>Model 2. Relief</i>				
Age in months	0.13 (.05)	.93	1.01	1.11
Raw BPVS scores	.07 (.03)	1.00	1.07	1.14
Constant	-5.83 (4.60)		.003	

Note. For model 1, regret, $R^2 = .24$ (Hosmer & Lemeshow), .25 (Cox & Snell), .36 (Nagelkerke) and model $\chi^2(2) = 15.52, p < .001$. For model 2, relief, $R^2 = .08$ (Hosmer & Lemeshow), .10 (Cox & Snell), .14 (Nagelkerke) and model $\chi^2(2) = 5.69, p < .06$.

Figure 1

Percentage of children in each group who gave each response in Experiment 1 as a function of condition.

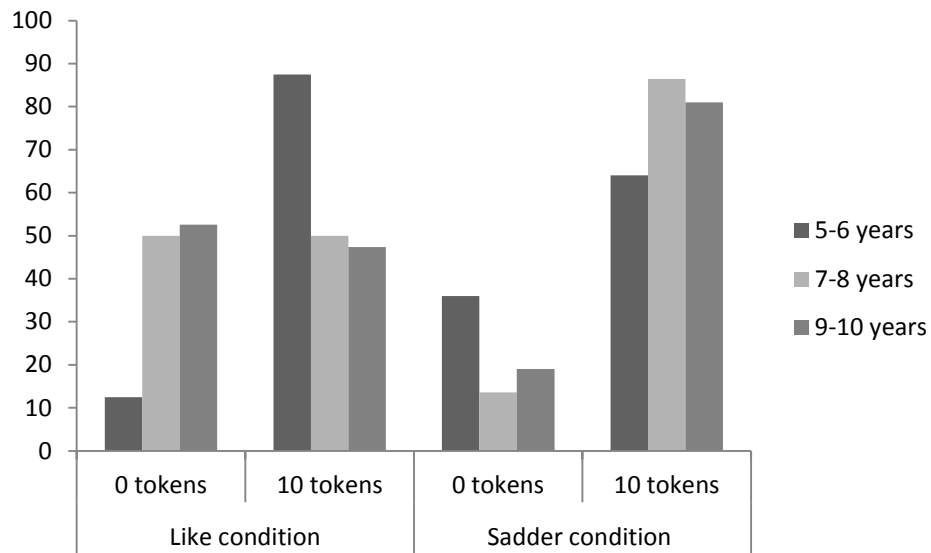


Figure 2

The percentages of children giving each response for each trial type in the experienced regret task of Experiment 2 as a function of age group.

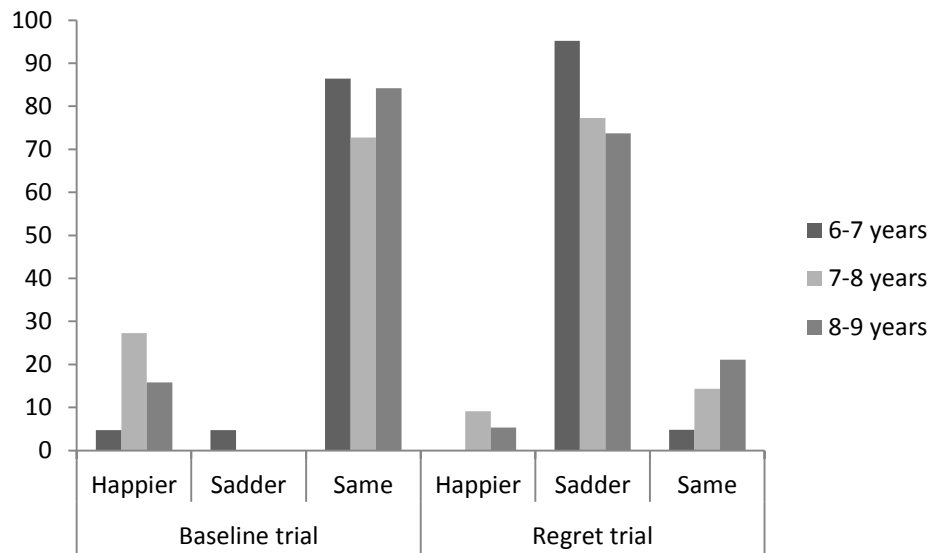


Figure 3

The percentages of children giving each response for the anticipate regret/relief task of Experiment 2 as a function of age group.

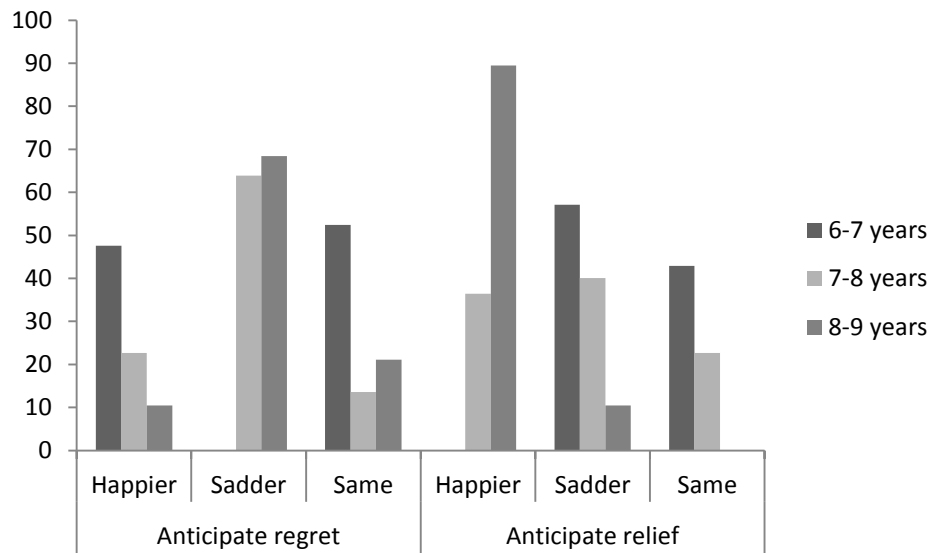


Figure 4

The percentages of children giving each response for the anticipate regret/relief task of Experiment 3.

