Intact counterfactual emotion processing in autism spectrum disorder: Evidence from eye-tracking

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Abstract

Counterfactual emotions, such as regret and relief, require an awareness of how things could have been different. We report a pre-registered experiment that examines how adults with and without ASD process counterfactual emotions in real-time, based on research showing that the developmental trajectory of counterfactual thinking may be disrupted in people with ASD. Participants were eye-tracked as they read narratives in which a character made an explicit decision then subsequently experienced either a mildly negative or positive outcome. The final sentence in each story included an explicit remark about the character's mood that was either consistent or inconsistent with the character's expected feelings of regret or relief (e.g. "… she feels happy/annoyed about her decision."). Results showed that adults with ASD are unimpaired in processing emotions based on counterfactual reasoning, and in fact showed *earlier* sensitivity to inconsistencies within relief contexts compared to TD participants. This finding highlights a previously unknown strength in empathy and emotion processing in adults with ASD, which may have been masked in previous research that has typically relied on explicit, response-based measures to record emotional inferences, which are likely to be susceptible to demand characteristics and response biases. This study therefore highlights the value of employing implicit measures that provide insights on peoples' immediate responses to emotional content without disrupting ongoing processing.

Lay Summary: Despite known difficulties with empathy and perspective-taking, we found that adults with autism are unimpaired at inferring complex emotions (regret and relief) in others. This finding extends existing evidence showing dysfunctional counterfactual thinking in children with autism. We highlight the value of using implicit measures to identify strengths and abilities in ASD that may be masked by explicit tasks that require participants to interact socially or report their own thoughts.

Keywords: Autism spectrum disorder, counterfactual emotions, regret, relief, eye-tracking, reading, anomaly detection.

Introduction

Considering how things could be different *if only* we had made a different choice is a normal part of human cognition, referred to as counterfactual thinking. Counterfactual thoughts play an important role in managing our emotions in response to decisions we have made, allowing us to imagine ourselves and others at a previous point in time, and therefore helping us learn from our mistakes and plan for future events (Coricelli & Rustichini, 2010; Kahneman & Tversky, 1982). Let's consider a scenario where we miss the bus to work because we stopped to chat to a neighbour. If the hypothetical alternative outcome in this situation is better than reality (an upwards counterfactual, e.g. *you would have arrived at work early if you'd caught that bus, now you will be late*), we tend to feel regret about our actions. Conversely, if the hypothetical alternative outcome is worse than the actual outcome (a downwards counterfactual, e.g. *that bus was involved in a bad accident*), we tend to feel relief about our actions. Thus, regret and relief are two opposing emotions resulting from a comparison of the *actual* outcome of a decision with a hypothetical model of *what could have been*, and are therefore known as counterfactual emotions (Zeelenberg et al., 1998). Research has shown that neurotypical adults regularly consider potential feelings of regret when making decisions (Zeelenberg & Pieters, 2007), which helps them avoid negative outcomes based on poor choices they have made in the past. In this paper we report a pre-registered experiment that examines the real-time processing of counterfactual emotions, regret and relief, in adults with and without ASD.

A great deal of research on counterfactual emotions has focused on identifying the typical developmental trajectory of understanding and use (e.g. Beck & Crilly, 2009; Rafetseder & Perner, 2012; Rafetseder, Schwitalla, & Perner, 2013). This research has shown that counterfactual emotions, such as regret and relief, emerge later than basic counterfactual thinking, from around 5-6 years old (McCormack, O'Connor, Beck, & Feeney, 2016;

O'Connor, McCormack, & Feeney, 2012; Weisberg & Beck, 2012). There is also some evidence that the understanding and experience of regret develops earlier than relief, with 5-year-old children also showing a bias to think counterfactually after a negative event (German, 1999), and 7-year-old children able to identify regret but not relief in a story's protagonist (Guttentag & Ferrell, 2004). It has been suggested that the later development of relief relative to regret is because people are more likely to engage in counterfactual thinking after a negative outcome than a positive outcome, and therefore regret is experienced more often than relief (Roese, 1997). Additionally, identifying regret in others develops later than experiencing regret oneself (Burns, Riggs, & Beck, 2012; Ferrell, Guttentag, & Gredlein, 2009).

The current study is based on research showing that the developmental trajectory of counterfactual thinking may be disrupted in people with ASD. ASD is a pervasive developmental disorder characterised by social difficulties, and restricted and repetitive behaviours and interests (American Psychiatric Association, 2013). Children with ASD show impairments in counterfactual reasoning relative to TD children (Grant, Riggs, & Boucher, 2004), and show different biases when producing counterfactual alternatives (Begeer, Terwogt, Lunenburg, & Stegge, 2009; Levers & Harris, 2000). Moreover, it has been suggested that counterfactuals engage the same network of specialized cognitive processes that underpin understanding of others' mental states (termed Theory of Mind, ToM; Leslie, 1987; Riggs, Peterson, Robinson, & Mitchell, 1998). People with ASD experience broad difficulties with social interactions, including the ability to consider other peoples' mental states (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997), and to identify and interpret emotions in the self and others (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Uljarevic & Hamilton, 2013). In particular, the processing of complex emotions, which requires a contrastive psychological appraisal for another person, is relatively poor in

children with ASD (Begeer, Koot, Rieffe, Terwogt, & Stegge, 2008). These general emotional impairments have been shown to impact the experience and understanding of counterfactual emotions in people with ASD.

For example, Begeer, De Rosnay, Lunenburg, Stegge, and Terwogt (2014) presented children aged 6-12 with and without ASD with short stories containing two protagonists, one of whom made a decision that resulted in a better (relief and contentment conditions) or worse (regret and disappointment conditions) outcome. The other protagonist would have faced the same outcome regardless of their decision. Children were asked which character would feel better or worse, or whether they would feel the same, and to give a reason for their answer. The children with ASD showed a specific deficit in identifying and explaining downward counterfactual emotions in the story characters (contentment and relief), but were not impaired in identifying and explaining upward counterfactual emotions (disappointment and regret). This finding is consistent with the later development of relief and higher frequency of experiencing regret described above for typically developing children. Moreover, it suggests that children with ASD experience a particular difficulty considering counterfactual alternatives to a positive outcome (where comparisons with a more negative situation must be made), but benefit equally from the more obvious utility of upwards comparisons after something bad happens (e.g. learning from mistakes and avoiding future negative outcomes). Further evidence of atypical understanding of emotions based on counterfactual thinking has been shown by Zalla et al. (2014), who tested the relationship between participants' own emotional responses (regret, disappointment, joy and relief) and choice behaviour in a gambling task. Adults with ASD reported experiencing less regret than matched TD controls, and were less able to distinguish feelings of regret and disappointment. This suggests that people with ASD experience a diminished sense of responsibility for the outcome as dependent on their choice, and are less susceptible to the subtle nuances of

counterfactual emotions. Nevertheless, choice behaviour (i.e. avoiding and anticipating regret) was comparable between ASD and TD groups, suggesting that participants with ASD experienced feelings of regret on an internal neurocognitive level, even though they were impaired at labelling and expressing this emotional experience explicitly (i.e. via self-report). This finding is consistent with research that has shown impoverished second-order representations of one's own cognitive activity in adults with ASD, despite intact first-order representations (e.g. Williams, Nicholson, & Grainger, 2018). Moreover, it has been suggested that difficulty identifying emotions in oneself is a characteristic feature of ASD, termed alexithymia (Hill, Berthoz, & Frith, 2004), and that this might explain the impaired ability to reflect and report on one's emotional experience of regret in Zalla et al.'s self-report study (Nicolle, Ropar, & Beck, 2014).

The present study employs an eye-tracked reading task to examine real-time inferences about story characters' counterfactual emotions (regret and relief) in adults with and without ASD. This online approach makes an important contribution to existing research by measuring the impact of counterfactual inferences about others' emotions as they unfold, without interruption from a secondary task. As such, we remove the need for participants to explicitly identify and label emotions for the self or others, or to attribute blame internally. Eye-tracked reading tasks are a well-established way of measuring processing in real-time; difficulty integrating text is reflected in longer reading times and higher incidence of regressive eye movements (Rayner, 1998). This online measure will therefore provide novel insights about the speed with which people with and without ASD are able to infer counterfactual emotions in others. Moreover, this methodology has been successfully applied to test the comprehension of (non-emotional) counterfactual statements (e.g. Ferguson, 2012; Ferguson & Jayes, 2018; Ferguson & Sanford, 2008; Ferguson, Sanford, & Leuthold, 2010),

including in adults with ASD (Black, Williams & Ferguson, in press; Ferguson, Black, & Williams, submitted).

In contrast to research showing that counterfactual reasoning is impaired among children with ASD, Black et al.'s in press and submitted eye-tracking papers suggest that basic counterfactual processing may be intact in adults with ASD. Across four experiments in those studies, eye movements were recorded as participants read short narratives that depicted counterfactual versions of reality (e.g. "If the Titanic had not hit an iceberg…") or fiction (e.g. "If Harry Potter lost all his magic powers…"), and ranged in the demands they placed on readers' executive capacities and imagination. Results showed that adults with ASD were sensitive to anomalies within counterfactual narratives, and elicited anomaly detection responses (longer reading times and increased regressions) in a comparable or even faster timecourse than a matched TD group. This suggests that adults with ASD do not struggle with counterfactual thinking per se, but that difficulty might emerge when narratives depict an emotionally charged situation where understanding requires an inference about other peoples' emotions.

We address this question directly by eye-tracking participants while they read narratives that describe mildly negative or positive outcomes of a character's explicit decision (e.g. *Jenny was able to buy the last pair of boots in the sale because she chose to visit the store first thing in the morning*). This context should prompt readers to consider how things 'could have been different' (i.e. whether a better or worse outcome than reality could have occurred if the character had made a different choice), which therefore elicits feelings of regret or relief for this character. For example, being able to buy the last pair of boots in the sale because she went to the store in the morning should make Jenny feel relieved (i.e. the counterfactual alternative is a worse outcome- if she'd gone later they would have sold out). In contrast, missing out on the boots because she waited till lunchtime to visit the store

should make Jenny feel regretful (i.e. the counterfactual alternative is a better outcome- if she'd gone earlier they would have had some left). The final sentence in each story included an explicit remark about the character's mood following the earlier decision (e.g. "Because Jenny chose to go to the shoe store first thing in the morning, instead of on her lunch break, she feels happy/annoyed about her decision."). The polarity of this emotion word was either consistent with feelings of relief (e.g. happy, good, happy) or regret (e.g. annoyed, bad, frustrated). Thus, we compared conditions where the emotion word (underlined in example above) was consistent or inconsistent with the expected mood of the character (following an inference about the experience of regret or relief), with the aim of establishing how quickly readers detect the incongruency, and how they recover from such difficulty.

We predicted that inconsistent words would elicit longer reading times and more regressions compared to consistent words, reflecting inferences about the character's mood, based on their experience of regret or relief. Importantly, we tested whether these inconsistency effects on an *implicit* reading task would be reduced in adults with ASD compared to TD adults, in line with results previous research that has employed *explicit* measures and revealed atypical understanding of counterfactual emotions in ASD (e.g. Begeer et al., 2014; Zalla et al., 2014), and more general impairments in ToM and emotional experience. In addition, given the earlier development and more frequent occurance of regret in everyday life, we expected the inconsistency effect within regret contexts to emerge earlier than that for relief contexts. Thus, we expected inconsistent words to disrupt reading immediately within regret contexts (i.e. first-pass reading times on the critical word), but to emerge on later processing measures at the critical word (i.e. total reading time), or on early measures at subsequent text regions, within relief contexts.

Methods

All methodological procedures were pre-registered on the Open Science Framework (OSF) web pages (see www.osf.io/vcunf).

Participants

Twenty four adults with ASD and 24 TD adults completed the experiment. Participants were matched at group level for sex, age, and IQ (see Table 1 for demographic information). Sample size was chosen *a priori* to match previous research of this kind (e.g. Black et al., in press; Howard et al., 2017). All participants had full scale IQs greater than 70 (as measured by the Wechsler Abbreviated Scale of Intelligence; WASI; Wechsler, 1999), were native English speakers, and did not have a diagnosis of dyslexia or reading comprehension impairment. Participants in the TD group did not report any current psychiatric diagnoses. All participants completed the Autism Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) to measure self-reported autistic traits.

[INSERT TABLE 1 HERE]

Diagnostic reports for participants with ASD were checked by the researcher. Current ASD symptomology was assessed by a research-reliable trained researcher using module 4 of the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000). Within the ASD group, 13 participants had received a diagnosis of Asperger's Syndrome, 1 of Pervasive Developmental Disorder Not Otherwise Specified, 5 of Autistic Disorder (as per DSM IV criteria), and 3 with Autism Spectrum Disorder (as per DSM 5 criteria, American Psychiatric Association, 2013).

Materials

Experimental items were modified from Guttentag and Ferrell (2004). Each item described either a mildly positive or negative outcome following a decision made by the story character, where one would expect the character to feel either regret or relief. Passages were between 6 and 8 sentences in length, and began by introducing the context and character, then the character's two choices were specified. The stories were set up so that in each case, the outcome was a 'near miss', e.g. the character was doing something different to what they usually do, or they 'only just' missed out on or gained something, in order to make the counterfactual alternative salient. The penultimate sentence of each passage always reiterated the character's choice and the consequence, but the counterfactual alternative consequent was not explicitly stated. The final sentence followed the general structure, "Because [character] did X, instead of Y, they felt…", followed by the critical word which was either a positive or negative emotion word. In consistent conditions, the valence of the emotion word matched the polarity of the decision outcome, and in inconsistent conditions, this was mismatched. Each scenario, therefore, crossed emotion with consistency to depict four conditions: Relief Consistent, Relief Inconsistent, Regret Consistent, and Regret Inconsistent. An example item is shown in Table 2, and the full stimulus list can be found in the Appendix.

[INSERT TABLE 2 HERE]

Critical words were matched across conditions for length, $F(1, 92) = 2.70$, $p = .104$, $\eta_p^2 = .028$. A significant interaction between emotion and consistency on written frequency (Burgess & Livesay, 1998), $F(1, 92) = 20.13$, $p < .001$, $\eta_p^2 = .179$, revealed that consistent critical words were more frequent than inconsistent words within the relief condition, but the pattern reversed in the regret condition. Word frequency was therefore included in statistical models for the critical word region.

Experimental items were further pre-tested for the critical word plausibility (i.e. a rating of how plausible the word is in the sentence context) and cloze probability (i.e. the likelihood that that word is provided as a sentence continuation). 38 undergraduate students from the University of Kent rated the plausibility of each sentence using an online questionnaire platform (Qualtrics), on a five-point sliding scale from -2 (highly implausible) to +2 (highly plausible). Consistent critical words were rated significantly more plausible than inconsistent critical words, $F(1, 92) = 822.36$, $p < .001$, $\eta_p^2 = .899$. Plausibility did not differ between regret and relief conditions, $F(1, 92) = 2.26$, $p = .136$, $\eta_p^2 = .024$. However, there was a significant interaction between emotion and consistency, $F(1, 92) = 5.16$, $p = .025$, $\eta_p^2 = .053$, which reflected a larger consistency effect for relief contexts, $t(46) = 30.87$, $p < .001$, compared to regret contexts, $t(46) = 15.26$, $p < .001$. A different set of 41 undergraduate students from the University of Kent completed sentences, truncated before the critical word, with the first sensible word coming to mind using Qualtrics. Cloze probability was significantly higher for consistent critical words ($M = .13$) than inconsistent critical words ($M = .01$), $F(1, 92) = 35.31$, $p < .001$, $\eta_p^2 = .277$. Neither emotion, $F(1, 92) = 0.15$, $p = .704$, $\eta_p^2 = .002$, or the interaction between emotion and consistency, $F(1, 92) = 0.77$, $p = .384$, $\eta_p^2 = .008$, influenced cloze probability.

Finally, we compared valence and arousal ratings for the critical words using Warriner, Kuperman and Brysbaert's (2013) database of affective ratings. As expected, negative words had significantly lower valence ratings ($M = 2.56$) than positive words ($M = 7.52$), $t(14) = -17.43$, $p < .001$, but arousal ratings did not differ, $t(14) = 0.66$, $p = .518$.

Procedure

The present study received ethical approval from the University of Kent School of Psychology Ethics Committee. Testing took place in a quiet lab at the University of Kent.

Participants' dominant eye was tracked during the reading of passages with an EyeLink 1000 Plus eye-tracker. Head movement was minimised with the use of a fixed chin rest. Passages were presented in size 18 Arial font on a VDU approximately 70cm in front of the participants' eyes. Participants were instructed to read the passages as naturally as possible so that they understood them. Calibration was performed using a 9-point procedure. Passages were displayed onscreen until the participant clicked the mouse to move on, or 60 seconds had elapsed. Following a 500ms blank screen, a comprehension question with two possible answers was displayed on screen and participants were required to click the mouse on the answer they thought was correct (e.g. When else could Jenny have gone to the shoe store today? Lunch < > Morning). Following another 500ms blank screen, the subsequent item was displayed. The first four items were practice trials to ensure participants understood the task. Following presentation of these, the 24 experimental items were randomly interleaved with 12 filler items (depicting a character making a decision resulting in a neutral outcome). Participants saw each item once, in one of the four conditions. Item order and condition was randomised across four lists, and the presentation of each list was randomised among participants.

Results

Data Preparation

All analysis procedures were pre-registered in line with previous research of this kind (e.g. Black et al., in press; Howard et al., 2017), and the full datasets and analysis scripts are available on the Open Science Framework web pages (see www.osf.io/eyztp). An automatic procedure pooled fixations shorter than 80ms with larger adjacent fixations, excluded fixations shorter than 40ms that were not within three characters of another fixation and truncated fixations longer than 1200ms.

First, we conducted exploratory (not pre-registered) analyses of global reading times across the full passage to characterise group differences in reading style. These showed that participants with ASD spent longer overall reading the passages (*M* 23,549ms *vs* 19,830ms, $t(46) = 2.27$, $p = .028$), and made more fixations (*M* 111 *vs* 94, $t(46) = 2.21$, $p = .032$), compared to TD participants. We also verified reading comprehension by checking participants' accuracy on the comprehension questions. Accuracy was very high, with all participants scoring at or above 90%, and did not differ between groups ($t < 1$).

The main pre-registered analyses examined effects during the final critical sentence in four regions: the sentence context region (the opening of the final sentence, e.g. "Because [character] did X, instead of Y"), pre-critical region (two words preceding the critical word, "s/he feels"), critical region (the consistent or inconsistent word, e.g. "happy/annoyed"), and post-critical region (sentence wrap up, e.g. "about her decision."). Three early reading measures are reported. First-pass reading time indicates the amount of time spent fixating within a region from first entering it to first leaving it. Regression path reading time measures the amount of time from first entering a region on the left, to first leaving it on the right, and therefore includes re-reading time of all previous text (including the longer narrative context). Regressions out measures the proportion of trials for which participants left the region on the left before exiting on the right, and therefore measures the proportion of trials in which participants re-read the preceding text. Finally, total reading time provides an overall measure of total amount of time fixating within each region across a whole trial. Mean reading times were computed for each measure in each of the four regions for all four conditions in each group (see Table 3).

[INSERT TABLE 3 HERE]

The eye movement data was log-transformed and analysed separately for each region and measure using the lmer function in the lme4 package, and the glmer function for the binomial Regressions Out variable (Bates, Mächler, Bolker, & Walker, 2015) using R (version 3.4.2, R Core Team, 2017). Each model included fixed effects of Group, Emotion, and Consistency. The two levels of each fixed effect were deviation coded (-.5 *vs* .5) to ensure they could be directly compared. Models included the maximal random effects structure, including random effects for participants and items, and crossed random slopes for Group, Emotion and Consistency within Items, and Emotion and Consistency within participants (as suggested by Barr, Levy, Scheepers, & Tily, 2013). In addition, analyses on the critical word included the continuous predictor of word frequency (centred). Random effects were only removed where they lead to non-convergence due to overparameterization. Statistical effects from these models are shown in Table 4.

[INSERT TABLE 4 HERE]

Sentence context region

Participants spent longer in total reading the sentence context when the critical word was inconsistent (M = 3,010ms) compared to consistent (M = 2,407ms) with the emotion implied by the preceding narrative. Total reading times were also significantly longer in the ASD group (M = 2,970ms) compared to the TD group (M = 2,457ms).

Pre-critical region

A significant effect of Emotion on regressions out revealed that participants were more likely to regress back to re-read the preceding narrative when it depicted a relief context (M = .04) compared to when it described a regret context (M = .03). In addition, a significant effect of

Consistency emerged on total reading times, with participants spending longer overall reading the pre-critical region when the passage contained an inconsistent critical word (*M* = 406ms) compared to a consistent critical word (*M* = 283ms).

Critical region

First-pass reading times showed that, overall, participants spent longer fixating an inconsistent (*M* = 253ms) compared to a consistent (*M* = 232ms) critical word. However, this effect was qualified by a significant interaction between Emotion and Consistency, which was subsumed under a significant three-way interaction between Emotion, Consistency and Group (see Figure 1). Follow-up analyses examined effects for ASD and TD groups separately. The ASD group showed no effect of Emotion, *Est.* < .01, $t = .35$, $p = .73$, but a significant effect of Consistency (consistent < inconsistent), *Est.* = -.05, $t = -2.67$, $p = .012$, and a significant Emotion x Consistency interaction, *Est.* = -.12, $t = -2.79$, $p = .011$. Posthoc tests further explored this interaction and revealed a significant consistency effect in the relief condition, *Est.* = -.10, $t = -3.77$, $p = .001$ (*M*s 278ms *vs* 211ms), but no difference between consistent and inconsistent conditions in the regret condition, *Est.* = .02, $t = 0.85$, $p = .40$ (*M*s 241ms *vs* 244ms). This shows that, on average, autistic participants detected the inconsistency with the character's expected feelings of relief immediately, but were delayed in detecting regret. In the TD group, none of the effects reached significance (all *Est.* < .02, *ts* < 1, *ps* > .34), suggesting that they were not immediately sensitive to inconsistency with the character's emotions.

Total reading times showed that all participants spent longer overall reading consistent (*M* = 289ms) *versus* inconsistent (*M* = 399ms) critical words. Thus, all participants were sensitive to the critical word's fit with the character's counterfactual emotion on later measures.

[INSERT FIGURE 1 HERE]

Post-critical region

A significant effect of Consistency was found across all four reading measures, with longer first-pass reading times (*M*s 338ms *vs* 321ms), regression path reading times (*M*s 3,184ms *vs* 1,920ms), and total reading times (*M*s 530ms *vs* 387ms) following an inconsistent critical word than a consistent critical word. Participants also made significantly more regressions out of the post-critical region following an inconsistent critical word ($M = 0.88$) than a consistent critical word ($M = 0.79$). Thus, by this post-critical region, all participants showed early sensitivity to fit with the counterfactual emotion, indicating that they have made the necessary inference about the character's mood, based on their experience of regret or relief.

In addition, regression path reading time and total reading time measures revealed a significant effect of Emotion, with longer times for regret contexts compared to relief contexts (regression path: *Ms* 2,687ms *vs* 2,430ms; total reading time: *Ms* 481ms *vs* 439ms).

Finally, regression path reading times were significantly longer for participants with ASD ($M = 3{,}413$ms) than TD participants ($M = 1{,}731$ms; see Figure 2).

[INSERT FIGURE 2 HERE]

Discussion

We sought to understand how adults with and without ASD infer counterfactual emotions in real-time. Participants were eye-tracked while they read narratives that elicited feelings of regret or relief in a character (based on their decisions), followed by an explicit remark about the character's mood that was either consistent or inconsistent with their expected emotions

(e.g. “Because Jenny chose to go to the shoe store first thing in the morning, instead of on her lunch break, she feels happy/annoyed about her decision.”).

As predicted, reading was disrupted when the critical word was inconsistent with the implied counterfactual emotion for the character, as reflected in longer reading times and increased regressions. Since critical words were not anomalous with the local sentence (i.e. they were semantically coherent), these anomaly detection effects can only be explained by readers having inferred the character’s emotions based on the preceding context (i.e. the character’s choices and the final outcome), and evaluated the fit between this expected mood and the incoming critical word. This shows that participants used their knowledge from the story context to rapidly infer the character’s emotional perspective in relation to their choice behaviour (i.e. inferring relief or regret), and updated their expectations of subsequent events based on this knowledge. However contrary to our predictions (and previous research), we did not find any evidence that adults with ASD show impaired sensitivity to emotions based on counterfactual reasoning. In fact, participants with ASD showed *earlier* sensitivity to inconsistencies within relief contexts compared to TD participants (i.e. disruption emerged immediately upon encountering the critical word), and disruption to inconsistent critical words was evident in both groups and contexts on later measures (i.e. on total reading times at the critical word and effects on the post-critical region). Thus, we have shown that adults with ASD can process regret and relief in real-time, and can infer these emotions in others to the same degree as TD adults.

The finding that participants with ASD were *faster* to detect inconsistencies within a relief scenario than participants in the TD group (disruption first emerged on the critical *versus* post-critical region, respectively) is consistent with recent research showing that adults with ASD are able to process possible and impossible counterfactual sentences within a comparable, or even enhanced, time-frame as TD adults (Black et al., in press; Ferguson et

al., submitted). Moreover, it demonstrates that this ability is intact even when understanding requires a contrastive inference about other peoples' *emotions*. This is particularly interesting given previous evidence that people with ASD show broad impairments in ToM (e.g. Happé, 1994; Baron-Cohen et al., 1997) and emotional experience (e.g. Baron-Cohen et al., 2001; Uljarevic & Hamilton, 2013; Begeer et al., 2008), alongside a reduced drive for global coherence (Frith, 1989; Frith & Happé, 1994; Happé & Frith, 2006). Thus, our findings reveal that adults with ASD can employ sophisticated processes to adopt someone else's perspective, and use this in real-time as the reference for future processing. To exhibit appropriate anomaly detection in the present task, readers had to understand the character's desired goal, understand that their actions lead to that goal either being met (relief) or not met (regret), and infer the emotional state of the protagonist as a result.

This undiminished processing at first appears at odds with the two previous studies that have shown atypical processing of counterfactual emotions in people with ASD (Begeer et al., 2014; Zalla et al., 2014). However, it is likely that this discrepancy reflects the different paradigms and measures employed, particularly whether inferences were observed on explicit or implicit measures. For example, Begeer et al. (2014) used similar vignettes to the present study, but counterfactual thinking was measured by directly asking the children to identify and explain the character's feelings. Children with ASD were poorer at than TD children at explaining relief and contentment emotions, but did not differ when explaining regret and disappointment. Similarly, Zalla et al. (2014) directly probed participants' own emotions (regret, disappointment, joy and relief) during a gambling task, and found that adults with ASD reported experiencing less regret than matched TD controls, and were less able to distinguish feelings of regret and disappointment. Crucially, these impairments were observed when explicit, response-based, measures were used to record emotional inferences, which are likely to be susceptible to demand characteristics and response biases (e.g.

compensatory strategies, Livingston & Happé, 2017). In contrast, the current task measured eye movements in a relatively natural reading context, which allowed us to tap immediate responses to the emotional content without disrupting ongoing processing, and therefore reduced the influence of response biases (see also Howard, Liversedge, & Benson, 2017a, b, c). In line with this explicit/implicit distinction, it is interesting to note that although adults with ASD were impaired at explicitly reporting their own counterfactual emotions in Zalla et al. (2014)'s study, they showed implicit evidence for intact counterfactual thinking as they modified their choice behaviour in the gambling task to avoid negative feelings (i.e. anticipating regret). These findings suggest that the previously observed difficulty with complex counterfactual emotions may be tied specifically to difficulties with the explicit expression of emotions (i.e. defining or describing emotions when directly questioned), rather than any difficulty experiencing them implicitly at a neurocognitive level. Moreover, our findings are consistent with Begeer et al., (2014)'s proposal that ability in counterfactual emotions improves with age (as general intellectual skills improve), so that any developmental delay is caught up by adulthood. This account suggests that the impaired counterfactual emotions processing seen among children in Begeer et al.'s study simply reflects a protracted period of development, whereby adults with ASD do reach a fully functioning ability in counterfactual thinking, just later than TD individuals (see Beck & Riggs, 2013; 2014).

Contrary to our predictions, TD adults showed the same timecourse of sensitivity to inconsistencies within regret and relief contexts, with the first evidence of disruption emerging on first-pass reading times at the post-critical region. This suggests that processing of regret and relief reach comparable levels through typical development. However, participants with ASD exhibited *superior* anomaly detection in the relief condition, showing longer first-pass reading times to inconsistent words on the critical word itself (disruption

within regret contexts was delayed to the post-critical region), and thus suggesting superior downward counterfactual reasoning in this group. This pattern is surprising since the ability to identify relief is thought to develop later than regret (Guttentag & Ferrell, 2004; Weisberg & Beck, 2010), downward counterfactual reasoning is less prevalent than upward (Roese, 1997), and understanding relief has been shown to be particularly impaired in children with ASD (Begeer et al., 2014). However, it is possible that this 'enhanced' relief processing in ASD reflects superior emotion recognition for positive relative to negative emotions (Ashwin, Chapman, Colle, & Baron Cohen, 2006), which suggests that people with ASD process positive emotions easier than negative emotions. Within a relief context, positively-valenced critical words were consistent with the character's emotions and negatively-valenced words were inconsistent with the character's emotions, meaning that processing for the relief-consistent condition was facilitated by both positivity and consistency. It is therefore possible that participants with ASD were more sensitive to these processing costs and benefits during reading. Future research should compare reading of passages depicting counterfactual and non-counterfactual emotions to elucidate whether the present findings indicate a true downward counterfactual emotion processing superiority in ASD, or whether it is indicative of enhanced sensitivity to processing costs and benefits during reading.

Finally, we note that eye movements did show some evidence for distinct reading patterns for regret and relief emotions. Participants spent longer reading the post-critical region following regret contexts than relief contexts. We suggest that this pattern reflects known processing costs when reading negatively-valenced text relative to positively-valenced texts (Scott, O'Donnell & Sereno, 2012; Knickerbocker, Johnson & Altarriba, 2014). Whilst this post-critical region did not contain a valenced word, it contained a neutral conclusion to passages that were overall positively or negatively valenced (i.e. they depicted a good or bad outcome for the character). Lüdtke and Jacobs (2015) have shown that positively-valenced

sentences are processed faster during reading than negatively-valenced sentences, or sentences combining both positive and negative words. This suggests that valence plays a role not only in the rapid automatic processing of a single word, but also in the later emerging integration of meaning across a text. Our findings are therefore consistent with a positivity processing advantage, as suggested by Lüdtke and Jacobs (2015).

In conclusion, we have presented evidence from one eye-tracking reading experiment to show that adults with ASD are unimpaired at inferring counterfactual emotions for others (regret and relief). Our data showed comparable disruption to reading for ASD and TD groups when a critical word was inconsistent with the implied counterfactual emotion for the character. In fact, early reading measures on the critical word suggest that people with ASD may be *superior* to their TD peers when processing positive counterfactual emotions (i.e. larger inconsistency effect within a relief context). These findings highlight preserved counterfactual thinking at a neurocognitive level in adults with ASD, and previously overlooked strengths in empathic ability and emotion processing.

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Table 1. *Demographic information for ASD and TD groups, M (SD), with comparison statistics.*

	ASD (n = 24)	TD (n = 24)	t	p	Cohen's d
Sex (m: f)	17: 7	17: 7			
Age (years)	33.84 (10.74)	33.61 (11.97)	0.07	.944	0.02
Verbal IQ	105.58 (12.19)	100.88 (8.50)	1.55	.127	0.45
Performance IQ	111.58 (19.79)	104.04 (11.70)	1.61	.115	0.46
Overall IQ	109.08 (15.24)	102.92 (9.48)	1.68	.099	0.49
Total AQ score	31.25 (8.44)	17.96 (6.96)	5.95	< .001***	1.72
ADOS-2 Module 4 algorithm total	8.08 (4.82)				

Table 2. *Example item showing relief and regret scenarios, with consistent and inconsistent critical words underlined for illustration.*

	Consistent	Inconsistent
Relief	Jenny likes to collect designer shoes and is always on the lookout for a bargain. There is a 50% off sale in her favourite shoe store today. She can either visit the store first thing in the morning before work, or wait until her lunch break. Jenny decides to go in quickly before work. When Jenny gets to the shoe store in the morning, she finds that they are very busy and have just one pair left in her size. Jenny can take advantage of the 50% off sale today because she visited the store before work. Because Jenny chose to go to the shoe store first thing in the morning, instead of on her lunch break, she feels <u>happy</u> about her decision.	Jenny likes to collect designer shoes and is always on the lookout for a bargain. There is a 50% off sale in her favourite shoe store today. She can either visit the store first thing in the morning before work, or wait until her lunch break. Jenny decides to go in quickly before work. When Jenny gets to the shoe store in the morning, she finds that they are very busy and have just one pair left in her size. Jenny can take advantage of the 50% off sale today because she visited the store before work. Because Jenny chose to go to the shoe store first thing in the morning, instead of on her lunch break, she feels <u>annoyed</u> about her decision.
Regret	Jenny likes to collect designer shoes and is always on the lookout for a bargain. There is a 50% off sale in her favourite shoe store today. She can either visit the store first thing in the morning before work, or wait until her lunch break. Jenny decides to wait until her lunch break when she will have more time. When Jenny gets to the shoe store at lunch time, she learns that they have sold the last pair of shoes in her size an hour earlier. Jenny could not take advantage of the 50% off sale today because she visited the store on her lunch break. Because Jenny chose to go to the shoe store in her lunch break, instead of first thing in the morning, she feels <u>annoyed</u> about her decision.	Jenny likes to collect designer shoes and is always on the lookout for a bargain. There is a 50% off sale in her favourite shoe store today. She can either visit the store first thing in the morning before work, or wait until her lunch break. Jenny decides to wait until her lunch break when she will have more time. When Jenny gets to the shoe store at lunch time, she learns that they have sold the last pair of shoes in her size an hour earlier. Jenny could not take advantage of the 50% off sale today because she visited the store on her lunch break. Because Jenny chose to go to the shoe store in her lunch break, instead of first thing in the morning, she feels <u>happy</u> about her decision.

Table 3. *Mean (SD) reading time measures for ASD and TD groups across regions and conditions.*

	ASD				TD			
	Regret		Relief		Regret		Relief	
	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent
First Pass Reading Time (ms)								
Sentence context	1847 (1082)	1860 (1158)	1734 (919)	1634 (993)	1893 (978)	1815 (997)	1832 (1132)	1760 (871)
Pre-critical region	256 (116)	278 (153)	233 (91)	266 (127)	264 (111)	235 (79)	258 (148)	252 (101)
Critical word region	245 (80)	241 (114)	212 (93)	278 (105)	229 (80)	244 (114)	237 (77)	249 (91)
Post-critical region	335 (210)	329 (225)	303 (176)	329 (177)	351 (252)	361 (207)	298 (152)	333 (183)
Regression Path (ms)								
Sentence context	2122 (1257)	2181 (1384)	2146 (1785)	2452 (3079)	2051 (1011)	2196 (1534)	2150 (1202)	2075 (1252)
Pre-critical region	333 (391)	431 (1091)	683 (3354)	340 (414)	275 (135)	282 (272)	282 (190)	287 (187)
Critical word region	901 (3803)	575 (1389)	667 (1662)	1046 (3515)	336 (258)	429 (596)	427 (708)	414 (405)
Post-critical region	3176 (5453)	3985 (4834)	2430 (4497)	4023 (4897)	1100 (1892)	2506 (2839)	1034 (1061)	2263 (2882)
Regressions Out (prop)								
Sentence context	.10 (.31)	.09 (.28)	.10 (.30)	.14 (.35)	.06 (.23)	.09 (.28)	.10 (.30)	.11 (.31)
Pre-critical region	.09 (.28)	.01 (.11)	.05 (.23)	.02 (.12)	.02 (.12)	.01 (.12)	.03 (.18)	.06 (.24)
Critical word region	.25 (.43)	.30 (.46)	.36 (.48)	.28 (.45)	.29 (.46)	.29 (.46)	.29 (.45)	.32 (.47)
Post-critical region	.86 (.35)	.89 (.32)	.85 (.36)	.92 (.28)	.69 (.47)	.83 (.37)	.76 (.43)	.87 (.34)
Total Reading Time (ms)								
Sentence context	2748 (1460)	3343 (1798)	2526 (1357)	3245 (2043)	2128 (950)	2762 (1536)	2246 (1115)	2695 (1612)
Pre-critical region	298 (168)	410 (267)	283 (161)	439 (327)	270 (135)	385 (258)	281 (162)	392 (248)
Critical word region	326 (202)	438 (330)	292 (234)	417 (275)	260 (126)	393 (271)	282 (150)	351 (199)
Post-critical region	428 (260)	541 (354)	381 (209)	533 (412)	394 (255)	553 (329)	347 (195)	494 (325)

Table 4. *Model Estimate, Standard Error (SE) and t/z value for each measure in each region (*p < .05, **p < .01, ***p < .001).*

	First-pass Reading Time			Regression Path			Regressions Out			Total Reading time		
	Est.	*SE*	*t-value*	*Est.*	*SE*	*t-value*	*Est.*	*SE*	*z-value*	*Est.*	*SE*	*t-value*
Sentence Context												
Emotion	-0.037	0.025	-1.47	0.000	0.014	-0.00	0.465	0.492	0.95	-0.014	0.012	-1.15
Consistency	0.014	0.019	0.73	-0.002	0.015	-0.12	-0.107	0.466	-0.23	-0.077	0.013	-5.90***
Group	0.025	0.039	0.62	0.002	0.041	0.04	-0.410	0.457	-0.90	-0.076	0.036	-2.12*
Emotion x Consistency	-0.009	0.041	-0.23	0.010	0.025	.039	-1.507	0.914	-1.65	0.021	0.027	0.77
Emotion x Group	0.032	0.037	0.89	0.003	0.029	0.11	0.427	0.726	0.59	0.035	0.024	1.46
Consistency x Group	0.000	0.045	0.01	0.016	0.028	0.57	0.407	0.717	0.57	0.001	0.027	0.04
Emotion x Consistency x Group	-0.059	0.087	-0.68	0.061	0.055	1.10	0.880	1.265	0.70	0.045	0.050	0.90
Pre-Critical Region												
Emotion	0.000	0.016	0.02	-0.007	0.025	-0.26	5.572	2.294	2.43*	0.016	0.021	0.73
Consistency	-0.003	0.015	-0.18	-0.011	0.021	-0.53	0.654	0.783	0.84	-0.122	0.018	-6.63***
Group	0.008	0.031	0.26	-0.036	0.037	-0.98	-0.252	1.357	-0.19	-0.017	0.031	-0.56
Emotion x Consistency	-0.014	0.028	-0.15	-0.006	0.040	-0.15	-0.684	1.553	-0.44	-0.031	0.039	-0.79
Emotion x Group	0.013	0.029	0.45	0.030	0.049	0.62	1.567	2.601	0.60	0.010	0.035	0.28
Consistency x Group	0.027	0.034	0.81	0.011	0.042	0.26	-2.705	1.564	-1.73	0.006	0.035	0.17
Emotion x Consistency x Group	0.009	0.051	0.18	-0.019	0.089	-0.22	1.546	3.139	0.49	0.022	0.059	0.38
Critical Region												
Emotion	0.007	0.012	0.60	0.03	0.02	1.06	-0.020	0.264	-0.08	-0.010	0.017	-0.60
Consistency	-0.033	0.012	-2.71*	-0.04	0.02	-1.56	-0.130	0.240	-0.54	-0.111	0.018	-6.07***
Group	-0.010	0.021	-0.36	-0.06	0.05	-1.18	-0.070	0.430	-0.16	-0.037	0.027	-1.39
Emotion x Consistency	-0.061	0.021	-2.98**	-0.03	0.05	-0.53	0.073	0.496	0.15	-0.009	0.048	-0.18
Emotion x Group	0.020	0.021	0.95	0.01	0.05	0.17	-0.323	0.480	-0.67	0.038	0.035	1.10
Consistency x Group	0.031	0.022	1.42	-0.01	0.05	-0.1	-0.319	0.468	-0.68	0.001	0.034	0.04
Emotion x Consistency x Group	0.135	0.042	3.24**	0.12	0.10	1.18	-1.450	0.897	-1.62	0.102	0.063	1.61
Post-Critical Region												
Emotion	-0.020	0.015	-1.37	-0.06	0.03	-2.17*	0.279	0.305	0.91	-0.039	0.018	-2.24*
Consistency	-0.034	0.014	-2.38*	-0.28	0.02	-11.31***	-0.896	0.353	-2.54*	-0.127	0.017	-7.51***
Group	0.020	0.041	0.50	-0.25	0.08	-2.95**	-0.802	0.469	-1.71	-0.020	0.041	-0.48
Emotion x Consistency	-0.024	0.034	-0.70	-0.01	0.05	-0.22	-0.479	0.560	-0.86	-0.004	0.036	-0.11
Emotion x Group	-0.025	0.029	-0.88	0.03	0.05	0.52	0.393	0.555	0.71	-0.027	0.035	-0.76
Consistency x Group	-0.021	0.031	-0.69	-0.05	0.05	-1.05	-0.388	0.655	-0.59	-0.039	0.037	-1.06
Emotion x Consistency x Group	0.043	0.053	0.81	0.117	0.099	1.19	0.506	0.990	0.51	0.049	0.078	0.63

Figures

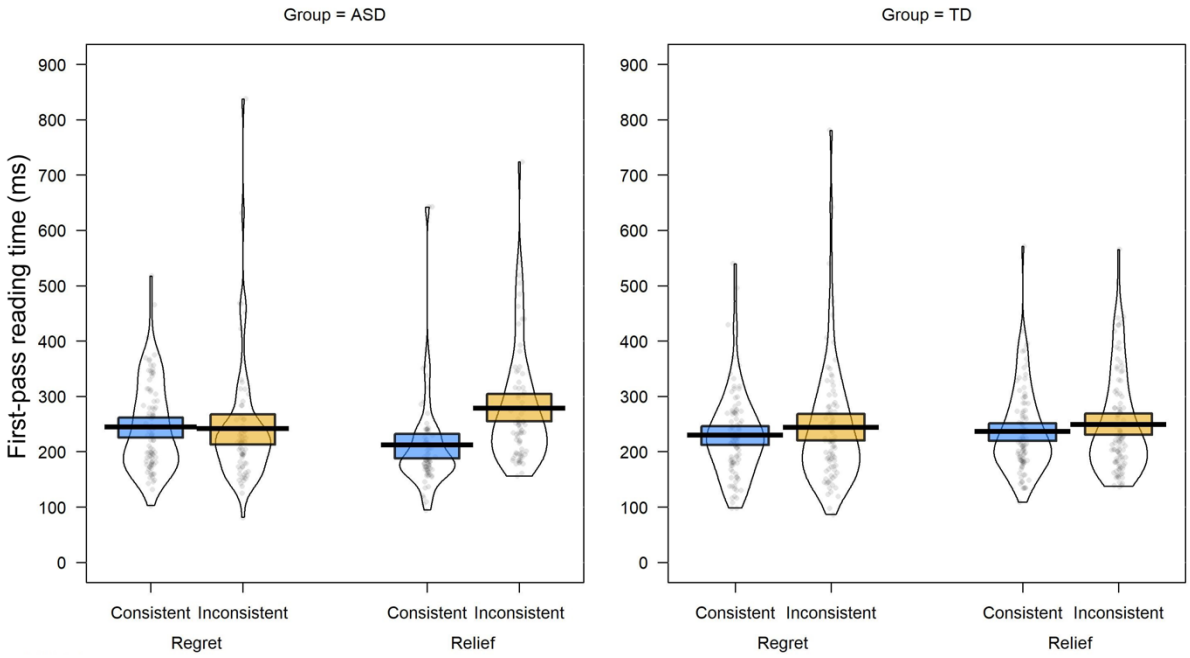

Figure 1. First-pass reading times (ms) on the critical word for ASD and TD groups across emotion and consistency conditions.

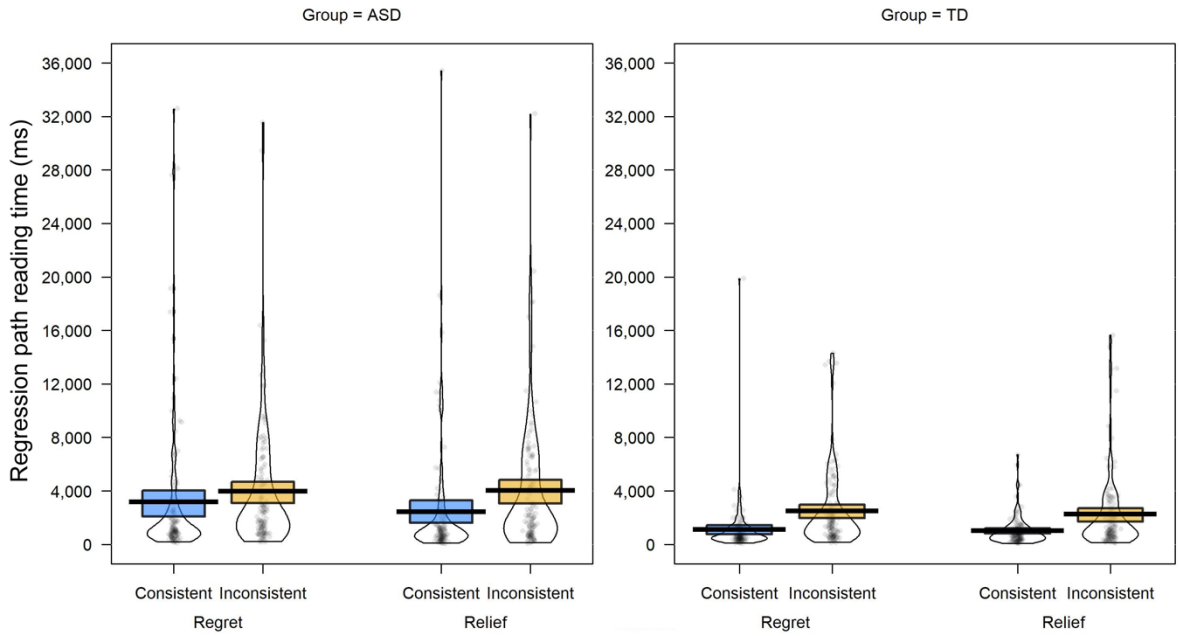

Figure 2. Regression path reading times (ms) for the post-critical region for ASD and TD groups across emotion and consistency conditions.

Appendix

Full set of experimental items in each condition. Note that for each of the items below, conditions are listed in the order: relief-consistent, relief-inconsistent, regret-consistent, regret-inconsistent, with the critical word underlined for clarity here.

1

Amneet is hosting a dinner party for several of her friends. She has plenty of food and wine and is looking forward to the evening. She has two sets of wine glasses, one cheap set from a supermarket, and one expensive set that was a gift from her parents. Amneet would like to impress her friends with the expensive wine glasses, but she knows they like to drink a lot and can get a bit clumsy so she lays out the cheap ones. Her friends arrive and they all sit down to enjoy the meal. By the end of the main course, one of Amneet's friends has become quite drunk. As he gets up to go to the bathroom, he staggers into the table causing several of the cheap wine glasses to fall over and break. Because Amneet decided to use her cheap wine glasses, instead of her expensive ones, she feels glad about her decision.

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2

Angeli is taking a flight to Bangkok. She enjoys flying and always likes to sit by the window so she can look out. On this flight, a mother with her two children have been seated

separately. They ask Angeli if she will swap seats with the eldest child, who is seated in an aisle seat several rows behind, so the family can sit together. Angeli says yes, even though it means losing her window seat. During the flight, the youngest child is upset and cries for most of the 11 hour flight. Angeli is now several rows behind the family and doesn't hear it through her headphones. Angeli has a peaceful flight because she swapped seats with the eldest child. Because Angeli decided to swap seats, instead of staying in her window seat, she feels good about her decision.

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3

Anna has two shirts she can wear to work as a waitress. One is black and one is white. Both are clean and smart, but she normally wears the white shirt as she feels it is smarter. However, today, she decides to wear the black shirt. Later that day, Anna is taking a plate of spaghetti bolognaise to one of her tables and she trips. Some tomato sauce gets spilt on her shirt. She wipes it off and the stain is barely noticeable because of the dark colour of her black shirt. Because Anna chose to wear her black shirt today, instead of her usual white shirt, she feels good about her decision.

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4

Becky is on holiday in Spain. She loves sitting in a sun lounger by the pool getting a tan. Today, when she goes down to the pool, there are only two sun loungers left. One is in the shade at the side, and the other will be in the sun all day as it is right by the pool. Becky decides to take the lounger in the shade as she thinks the sun will come round to it later on. Becky settles down on the lounger and starts to read her book. She is very tired, though, and she accidentally falls asleep. She wakes up one hour later to find that she is still in the shade and the sun is just coming over. Becky did not get sun burnt because she was on the lounger in the shade. Because Becky decided to sit on the sun lounger in the shade, instead of the one in the sun, she feels happy about her decision.

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5
Bill and his wife go to their favourite restaurant every Saturday. Bill always orders a burger because it is really good there. This evening, Bill places his usual order, but the waiter recommends that he tries the new special of the day, BBQ chicken. Bill changes his order and goes with the special recommended by the waiter. When their meals come, Bill's chicken is absolutely delicious. His wife ordered the burger and, unusually, it was overcooked and tough so she couldn't finish it. Bill ate all his dinner because he chose the BBQ chicken. Because Bill decided to have the BBQ chicken special, instead of his usual burger, he feels happy about his decision.

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6

Caroline loves to travel and is always off on some new adventure. Whenever she leaves home for the airport, she always makes sure to double check her passport is in her bag. Today, she is flying to South America. As she leaves the house, she feels confident she has everything and decides to leave as quickly as possible rather than doing her usual checks. When Caroline has locked her front door, she changes her mind and searches her bag for her passport. She finds that it is not there and goes back in to get it. Caroline has no problem boarding her flight because she checked she had her passport before she left. Because Caroline decided to check her passport before leaving home, instead of rushing out the door, she feels happy about her decision.

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7

Even though she has a permit for her road, Poppy always has trouble finding a car parking spot there, so always parks a 20 minute walk from her house. Today, she drives to where she normally parks and sees there is one space left for her. However, she decides to try and find a space a little closer to home. As Poppy turns into her road, she sees that another car is pulling out from the space right in front of her house. Poppy parks her car in that space. Poppy does not have to walk 20 minutes from her car parking space because she chose to look closer to home. Because Poppy chose to look for a space near her house, instead of taking her usual space 20 minutes away, Poppy feels happy about her decision.

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8
Every week, Toby spends £5 playing the lottery, and he always uses the same numbers. He has never won more than £10. Toby is running low on money so this week he considers saving £5 by not playing the lottery. However, when he goes to the shop later, he changes his mind and buys his usual ticket. That evening, Toby checks the lottery numbers and sees that 5 of his numbers have come up. Toby won £56,000 because he played his usual numbers in the lottery this week. Because Toby played the lottery this week, instead of choosing to save £5 by not buying a ticket, he feels ecstatic about his decision.

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usual numbers in the lottery this week. Because Toby decided not to play the lottery this week, instead of buying his usual numbers, he feels furious about his decision.

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9

It takes half an hour for Julia to get to work whether she walks or takes the bus. Julia chooses to walk to work every day as she likes the exercise. However, today, Julia felt tired so she decided to take the bus to work. Once Julia had found a seat on the bus it started pouring with rain outside. Julia stayed dry because she was inside the bus. Because Julia chose to take the bus to work today, instead of walking to work as usual, she feels glad about her decision.

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It takes half an hour for Julia to get to work whether she walks or takes the bus. Julia chooses to take the bus to work every day. However, today, Julia wanted some exercise so she decided to walk to work. After Julia had been walking for 10 minutes, it started pouring with rain. Julia was soaking wet by the time she arrived at work because she walked. Because Julia chose to walk to work today, instead of taking the bus as usual, she feels upset about her decision.

It takes half an hour for Julia to get to work whether she walks or takes the bus. Julia chooses to take the bus to work every day. However, today, Julia wanted some exercise so she decided to walk to work. After Julia had been walking for 10 minutes, it started pouring with rain. Julia was soaking wet by the time she arrived at work because she walked. Because Julia chose to walk to work today, instead of taking the bus as usual, she feels glad about her decision.

10

James is a keen photographer and keeps a lot of videos and photos on his laptop. He makes sure he backs them up on an external hard drive every 3 months so he doesn't lose any of them. It has only been two months since James last backed up his files, but he decides to do it early as he took some particularly nice photos he is proud of last week. Later that day, James takes his laptop to the coffee shop, as he often does. Whilst he is in the bathroom, his laptop is stolen. Because James backed up his files early, he does not lose any of his photographs. Because James decided to back up his files today, instead of waiting one more month, he feels happy about his decision.

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James is a keen photographer and keeps a lot of videos and photos on his laptop. He makes sure he backs them up on an external hard drive every 3 months so he doesn't lose any of them. It has been three months since James last backed up his files, but he decides to wait until tomorrow, even though he took some particularly nice photos he is proud of last week. Later that day, James takes his laptop to the coffee shop, as he often does. Whilst he is in the bathroom, his laptop is stolen. Because James waited an extra day to back up his files, he loses all of his new photographs. Because James decided to wait one more day to back up his files, instead of doing it today, he feels angry about his decision.

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11
Jenny likes to collect designer shoes and is always on the lookout for a bargain. There is a 50% off sale in her favourite shoe store today. She can either visit the store first thing in the morning before work, or wait until her lunch break. Jenny decides to go in quickly before work. When Jenny gets to the shoe store in the morning, she finds that they are very busy and have just one pair left in her size. Jenny can take advantage of the 50% off sale today because she visited the store before work. Because Jenny chose to go to the shoe store first thing in the morning, instead of on her lunch break, she feels happy about her decision.

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12

Jim likes to go swimming several times a week. In his town, there is one pool at the university, and one pool across town. Both are the same distance from Jim's house, and are both pleasant to swim in, but Jim always goes to the pool at the university. Today, Jim decided that he would go to the pool across town for a change. Today, too many chemicals had been put into the university pool and everyone who went swimming in it developed a painful rash. Jim did not get the rash because he went swimming at the other pool. Because Jim chose to swim at the pool across town, instead of at the university pool as usual, he feels pleased about his decision.

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13

Linda is going on a date tonight and wants to look nice. She can't decide whether to wear her high heels, or her comfortable flat shoes. In the end, she decides to wear the comfortable flats. Her date comes to pick her up and they walk to the restaurant. The restaurant is at the end of a long cobbled street, but Linda has no trouble walking along it in her flat shoes.

Because Linda chose to wear her flat shoes, instead of her high heels, she feels happy about her decision.

Linda is going on a date tonight and wants to look nice. She can't decide whether to wear her high heels, or her comfortable flat shoes. In the end, she decides to wear the comfortable flats. Her date comes to pick her up and they walk to the restaurant. The restaurant is at the end of a long cobbled street, but Linda has no trouble walking along it in her flat shoes. Because Linda chose to wear her flat shoes, instead of her high heels, she feels foolish about her decision.

Linda is going on a date tonight and wants to look nice. She can't decide whether to wear her high heels, or her comfortable flat shoes. In the end, she decides to wear the high heels as she thinks they look better. Her date comes to pick her up and they walk to the restaurant. The restaurant is at the end of a long cobbled street, and Linda is unsteady in her heels. She turns her ankle and falls over in front of her date. Linda hurt her ankle because she was wearing high heels. Because Linda chose to wear her high heels, instead of her flat shoes, she feels foolish about her decision.

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14
Lisa and Stella have decided to book a last minute holiday to the Bahamas. They can either go this weekend, or wait until the following weekend when the flights are £20 cheaper. They decide to go this weekend. When Lisa and Stella arrive in the Bahamas, it is a lovely hot day, and the weather stays nice for the rest of their holiday. However, as they are leaving, one week later, a huge storm moves in and lashes the islands for a week. Lisa and Stella got to enjoy the sunshine on their holiday because they took the earlier flights. Because Lisa and Stella chose to take a flight that weekend, instead of waiting till the next weekend for cheaper flights, they feel good about their decision.

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from the weather in their hotel because they chose the flights on the later date. Because Lisa and Stella chose to wait an extra week for the cheaper flights, instead of taking the flight that weekend, they feel good about their decision.

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15
Lucy is a receptionist in a busy PR company in London. Lucy always walks the same route to get to her office. However today, the street she normally walks down looks really crowded so she takes a different route down side streets. Later, when Lucy is reading the news, she sees that a sign fell from a building on her normal route to work at the time she would have been there. Lucy was not injured by the sign because she took a different route down the side streets. Because Lucy decided to walk down the side streets, instead of taking her normal route to work, she feels good about her decision.

Lucy is a receptionist in a busy PR company in London. Lucy always walks the same route to get to her office. However today, the street she normally walks down looks really crowded so she takes a different route down side streets. Later, when Lucy is reading the news, she sees that a sign fell from a building on her normal route to work at the time she would have been there. Lucy was not injured by the sign because she took a different route down the side streets. Because Lucy decided to walk down the side streets, instead of taking her normal route to work, she feels bad about her decision.

Lucy is a receptionist in a busy PR company in London. Lucy always walks the same route to get to her office. However today, the street she normally walks down looks really crowded so she takes a different route down side streets. As Lucy walks down the side street, a sign falls from a building, hitting her hard on the shoulder and knocking her to the floor. Lucy was injured by the sign because she took a different route down the side streets. Because Lucy decided to walk down the side streets, instead of taking her normal route to work, she feels bad about her decision.

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16
Nick is expecting a parcel to be delivered today. Mail is normally delivered between 9 and 11 so he plans to wait at home until 11, then go out to the shops. Nick feels disappointed when the parcel still hasn't arrived by 11:00, so he decides to wait another 10 minutes just in case.

As Nick is about to head out the door at 11:10, the doorbell rings. It is his parcel delivery. Nick was able to receive his parcel because he waited an extra 10 minutes. Because Nick waited another 10 minutes, instead of leaving the house at 11 like he planned, he feels pleased about his decision.

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Nick is expecting a parcel to be delivered today. Mail is normally delivered between 9 and 11 so he plans to wait at home until 11, then go out to the shops. Nick feels impatient when the parcel still hasn't arrived by 11:00, so he heads out to the shops thinking that it will arrive tomorrow. When Nick returns from the shops he sees a note saying that he missed the parcel delivery at 11:10. Nick was unable to receive his parcel because he left the house at 11. Because Nick left the house at 11, instead of waiting all morning like he planned, he feels annoyed about his decision.

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17

Paul is going to catch a train to visit the seaside today. It takes him 10 minutes to walk to the train station. When Paul takes the train, he always buys his ticket at the station when he gets there. However, this time Paul was particularly organised and bought his ticket in advance. Paul left for the station a little later than he would normally like, meaning he had to rush. As he arrived at the station, he saw his train was just pulling in. Paul had his advance ticket ready in his hand so went straight through the barrier, and he did not miss his train. Because Paul chose to buy his ticket in advance, instead of buying it at the station as he normally would, he feels pleased about his decision.

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time, Paul decided he would just buy his ticket at the station when he got there. Paul left for the station a little later than he would normally like, meaning he had to rush. As he arrived at the station, he saw his train was just pulling in. Paul did not have his ticket yet so had to stop to buy one, and he ended up missing his train. Because Paul chose to buy his ticket at the train station, instead of buying it in advance as he normally would, he feels frustrated about his decision.

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18
Paula is getting ready for a night out. She prides herself on being more fashionable than the rest of her friendship group so she always strives for a unique and original look. Paula has two nice dresses she could wear tonight. One is pale pink and the other is yellow. She prefers the pink dress but decides to wear the yellow one today to be different. When Paula meets her group of friends, she sees that one of them is dressed in the exact same pale pink dress that she has. Paula and her friend are in different outfits all night because Paula wore the yellow dress. Because Paula chose to wear the yellow dress, instead of her preferred pink one, she feels happy about her decision.

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Because Paula chose to wear the yellow dress, instead of her preferred pink one, she feels happy about her decision.

19
Ron has just moved house and needs to buy a new sofa. He has found the perfect one in a second hand furniture store for £200. It is a little more than he wanted to spend so he decides not to buy it right away and to look around elsewhere. The next day, while looking online, Ron finds the exact same sofa in good condition for just £50. He buys it immediately. Ron paid £50 for his sofa because he did not buy the first one he saw. Because Ron chose to wait and look around some more, instead of paying £200 for the first sofa he saw, Ron feels good about his decision.

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20
Russ is driving to Cornwall to visit friends for the bank holiday weekend. He plans to leave at 2pm on Friday. However, on Friday, Russ decides to get packed up early, and leaves at 10am instead. When Russ reaches the motorway, he finds that it is nice and clear from traffic because most people are still at work. Russ has an easy journey and arrives at his friends' earlier than planned. Russ avoided the bank holiday traffic because he left at 10am. Because Russ decided to get packed up early and leave at 10am, instead of leaving at 2pm, he feels content about his decision.

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Russ is driving to Cornwall to visit friends for the bank holiday weekend. He plans to leave at 10am on Friday. However, on Friday, Russ decides to sleep in, and doesn't end up leaving till 2pm. When Russ reaches the motorway, he finds there are long tailbacks from all the people going away for the weekend. Russ ends up in traffic for hours and doesn't arrive at his friends until later than planned. Russ gets stuck in traffic because he left at 2pm. Because Russ decided to sleep in and not leave till 2pm, instead of leaving at 10am, he feels annoyed about his decision.

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21
Sam likes to place a bet on the grand national every year. This year, she had her eye on two horses: Definitely Red and Hedge Hunter. She did some research and decided that she would place her bet on Definitely Red. When she got to the betting shop, the sales assistant advised her that she would get better odds on Hedge Hunter, so Sam changed her mind and placed a £10 bet on Hedge Hunter. Sam watched the race and saw that Definitely Red fell early on and was out of the running. Hedge hunter was the winner so Sam won £50. Because Sam placed her bet on Hedge Hunter, instead of her original choice of Definitely Red, she feels delighted about her decision.

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was out of the running. Definitely red was the winner so Sam lost her £10. Because Sam placed her bet on Hedge Hunter, instead of her original choice of Definitely Red, she feels delighted about her decision.

22
Steve has been looking for a new flat for some time, but none have been suitable so far. One day, Steve is just about to leave the house when his mobile phone rings from an unknown number. He is running late for an important meeting but he decides to pick it up anyway. The estate agents are calling to inform him that a perfect flat has come up for him. Because Steve answered the phone, he is able to view the flat that afternoon. Because Steve chose to pick up the phone call, instead of ignoring it, he feels pleased about his decision.

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Steve has been looking for a new flat for some time, but none have been suitable so far. One day, Steve is just about to leave the house when his mobile phone rings from an unknown number. He is running late for an important meeting so he decides to ignore it rather than picking it up. After the meeting, Steve rings the number back to find out who it was. It was an estate agent informing him that a perfect flat has come up for him. However, because Steve did not answer the call earlier, the flat has already been let to someone else. Because Steve chose to ignore the phone call, instead of picking it up, he feels frustrated about his decision.

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23
There are two ways that John can drive to work, one way he turns left out his driveway, and the other he turns right. They both take him the same amount of time to get to work, but he always takes the route starting with the left hand turn. Today, he decided to take the right hand turn out of his driveway. When John got to work, he learned that there had been a bad accident along the left hand route causing lots of traffic. John did not get stuck in traffic today because he took the right hand route. Because John chose the right hand route today, instead of his usual left hand route, he feels pleased about his decision.

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24
There is a new movie out that Richard is very excited to see and he wants to book himself a ticket. There are two showings that Richard could go to. One is at 3pm and the other at 6pm. Richard decides to book a ticket for the 3pm showing. When Richard gets to the cinema, he finds that the theatre is practically empty and he can sit in the best seats with a great view. When he comes out of the movie, he sees that people are queuing out the door for the 6pm showing. Richard got to sit in the best seats because he went to the earlier showing. Because Richard decided to see the movie at 3pm, instead of 6pm, he feels pleased about his decision.

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