Distinguishing reality from fantasy in adults with autism spectrum disorder: Evidence from eye movements and reading

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Abstract

Understanding fictional events requires one to distinguish reality from fantasy, and thus engages high-level processes including executive functions and imagination, both of which are impaired in autism spectrum disorder (ASD). We examined how adults with and without ASD make sense of reality-violating fantasy narratives by testing real-time understanding of counterfactuals. Participants were eye-tracked as they read narratives that depicted novel counterfactual scenarios that violate reality (e.g. "If margarine contained detergent, Mum could use margarine in her washing/baking", Experiment 1), or counterfactual versions of known *fictional* worlds (e.g. "If Harry Potter had lost all his magic powers, he would use his broom to sweep/fly", Experiment 2). Results revealed anomaly detection effects in the early moments of processing (immediately in Experiment 1, and from the post-critical region in Experiment 2), which were not modulated by group. We discuss these findings in relation to the constraints from real-world and fantasy contexts that compete to influence language comprehension, and identify a dissociation between ToM impairments and counterfactual processing abilities.

Key words: Fictional narratives, counterfactual thinking, autism, eye-tracking, reading, anomaly detection

Understanding counterfactuals, such as, "If the moon was made of cheese, I could have eaten a slice of the moon for lunch", requires readers to temporarily accept false information as true (*that the moon is made of cheese*) and to accommodate subsequent events according to that hypothetical model of the world (*I ate a slice of the moon for lunch*). However, readers must also integrate the conditional frame to inhibit the sentence's explicit content and infer the implied facts (*that the moon is not made of cheese*) in order to understand the sentence's actual meaning (*I did not eat a slice of the moon for lunch*). Counterfactual thinking therefore relies on peoples' imaginative capacities to consider a fictional version of the world. As such, it engages many of the same specialized cognitive processes as Theory of Mind (ToM) reasoning (Perner, 2000; Riggs, Peterson, Robinson, & Mitchell, 1998; van Hoek, Begtas, Steen, Kestemont, Vandekerckhove, & Van Overwalle, 2014), and implicates the same set of executive functions (e.g. working memory, inhibitory control, and cognitive flexibility; Drayton, Turley-Ames, & Guarjardo, 2011; Van Hoek et al., 2014).

This paper aims to systematically test the relative availability of real-world/fictional knowledge, and therefore makes important contributions to our understanding of real-time fictional language processing and anomaly detection. Previous research in typically developing (TD) adults has shown that a strong discourse context can overrule local lexical-semantic factors when these two conflict, meaning that events that are anomalous or implausible in the real-world can become acceptable within an appropriate fictional context (Creer, Cook, & O'Brien, 2018; Filik, 2008; Filik & Leuthold, 2013; Metusalem, Kutas, Urbach, Hare, McRae, & Elman, 2012; Nieuwland & Van Berkum, 2006; Warren, McConnell, & Rayner, 2008), or counterfactual world (e.g. Ferguson & Sanford, 2008; Ferguson, Sanford, & Leuthold, 2010; Ferguson, Scheepers, & Sanford, 2010; Nieuwland, 2013; Nieuwland & Martin, 2012). However, it remains inconclusive whether readers can integrate the consequences of non-real events in a counterfactual world with no delay, and without interference from the implied factual (or known real-world) version of events (as in Nieuwland, 2013; Nieuwland & Martin, 2012), or whether processing is initially anchored to real-

world knowledge and only later integrated with the counterfactual/fictional context (as in Ferguson & Sanford, 2008; Ferguson et al., 2010). In this paper, we explore these questions by testing comprehension in a group of individuals with autism spectrum disorder (ASD)- a developmental disorder that involves deficits in both ToM and executive functioning.

ASD is diagnosed on the basis of significant behavioural impairments in social communication and behavioural flexibility (American Psychiatric Association, 2013). At the cognitive level, people with ASD experience specific difficulties with ToM and executive functioning (e.g. Adams & Jarrold, 2012; Baron-Cohen, Leslie, & Frith, 1985; Geurts, Bergh, & Ruzzano, 2014). Moreover, children with ASD are known to struggle with the distinction between fiction and reality (e.g. Morison & Gardner, 1978; Skolnick & Bloom, 2006). For example, they are less likely than TD children to distinguish 'silly' statements, such as "I live on the moon", from statements such as "I live in England" (Surian, Baron-Cohen, & Van der Lely, 1996), and include fewer imaginative elements in made up stories compared to TD children (Scott & Baron-Cohen, 1996). Even as adults, people with ASD show a significant preference for reading non-fiction stories over fiction stories (Barnes, 2012), and manifest a significant difficulty in imagining novel scenarios (Lind & Williams, 2012; Lind, Williams, Bowler, & Peel, 2014). Understanding the distinction between reality and fiction is crucial for comprehension of fictional narratives because one must accept events in a non-real fantasy world while maintaining existing knowledge about the real world. In this paper we examine how adults with and without ASD make sense of reality-violating fantasy narratives by testing real-time understanding of counterfactuals (i.e., events that are 'counter to reality' or false and involve the comparison of reality to a hypothetical alternative).

The proposed link between counterfactual reasoning and social/non-social functioning in ASD, and the clear relevance and importance of counterfactual thinking in everyday communication (e.g. Byrne, 2005; Kahneman, 1995; Roese, 1997), has inspired a small but growing body of research in this area. Some of this research suggests that counterfactual reasoning is

impaired in children with ASD relative to TD children, even when language skill is matched, though this impairment is less than that seen on similar tasks that involve ToM (Grant, Riggs, & Boucher, 2004). Children with high-functioning ASD are also poorer at using counterfactuals to reason about others' emotions (e.g. relief; Begeer, De Rosnay, Lunenburg, Stegge, & Terwogt, 2014; c.f. Black, Barzy, Williams, & Ferguson, in press), and loading imagination significantly impairs ability to reason counterfactually in children and adolescents with ASD but enhances it among their TD peers (Scott & Baron-Cohen, 1996; Morsanyi & Handley, 2012). Even among neurotypical adults, individual differences in social skills have been shown to play an important part in establishing counterfactual worlds and linking them with real world knowledge online (Kulakova & Nieuwland, 2016). Other work has shown that children with ASD and TD children are comparably able to generate counterfactuals, though the two groups employ distinct reasoning strategies (e.g. Begeer, Terwogt, Lunenburg, & Stegge, 2009). Most recently, eye-tracking research has revealed undiminished real-time counterfactual understanding in adults with ASD, with comparable or even faster detection of anomalies when reading realistic counterfactual narratives compared to a matched TD group (Black, Williams, & Ferguson, 2018).

In the current paper we present a novel extension of this work by testing understanding of counterfactual worlds that are *impossible* according to real-world constraints, in an eye-tracked natural reading paradigm. In Experiment 1, narratives depicted novel counterfactual scenarios that violate reality (e.g. "If margarine contained detergent, Mum could use margarine in her washing/baking"), and in Experiment 2 narratives depicted counterfactual versions of known *fictional* worlds, meaning that real-world constraints were re-imposed (e.g. "If Harry Potter had lost all his magic powers, he would use his broom to sweep/fly"). Thus, both types of counterfactuals relied on readers suspending their knowledge of what is true in reality, and imagining an alternative version of the world where usually implausible events can occur. The key difference is the degree to which reality/fiction is made explicit in each scenario. For example, in Experiment 1 the fictional

world is defined (*margarine contains detergent*) and reality is implied (*margarine does not contain detergent*), whereas in Experiment 2, real-world constraints are re-imposed on a fictional world (*Harry Potter has no magical powers*) and readers must refer to long-term memory schemas to infer the fictional version of the world (*Harry Potter has magic powers*).

Reality-violating counterfactuals are particularly interesting as they require readers to rapidly evaluate incoming information against real-world knowledge, and therefore make relatively high demands on readers' executive capacities (e.g. inhibiting real-world knowledge) and imagination skills (inferring events in a non-real world). Comprehending impossible counterfactual worlds can therefore be assumed to implicate different processes from those involved in comprehending the kind of possible counterfactual worlds used in Black et al.'s (2018) study, because understanding of the latter can be grounded in knowledge about reality. It is therefore possible that counterfactual processing was preserved among people with ASD in Black et al.'s experiments because of the low demands they made on executive skills and imagination. Here we test whether processing impairments emerge when these demands are increased. In the context of known difficulties with imagination and the fiction/reality distinction in ASD, testing understanding of impossible counterfactuals is particularly valuable as difficulties in counterfactual reasoning may emerge when complexity is increased (e.g. Minshew, Goldstein, & Siegel, 1997; Minshew & Goldstein, 1998; Minshew, Williams, & McFadden, 2008). More broadly, it has been suggested that people with ASD exhibit a reduced drive for global coherence (Frith, 1989; Frith & Happé, 1994; Happé & Frith, 2006), with evidence showing that people with ASD experience difficulty integrating meaning as a whole within a narrative text (Happé, 1997; Jolliffe & Baron-Cohen, 1999; Nuske & Bavin, 2011). More recent research using eye-tracking to examine reading has revealed that adults with ASD are delayed relative to age and IQ-matched TD peers in detecting passage-level anomalies in text (i.e. where global coherence is required; Au-Yeung, Kaakinen, Liversedge, & Benson, 2017), and in detecting implausible words in a sentence (Howard, Liversedge, &

Benson, 2017a). These findings suggest that there may be subtle differences in the speed with which world knowledge is accessed and influences processing during reading in ASD.

The experiments reported here therefore test the speed with which readers can access real-world knowledge and narrative context during language processing, and address a gap in the literature on counterfactual thinking in adults with ASD. Thus, if *all* real-time counterfactual processing is truly intact in this disorder we would expect to replicate the effects seen in Black et al. (2018), with no between group differences in anomaly detection. Alternatively, it may be that difficulty with counterfactual reasoning emerges among people with ASD when a more substantial change to reality is required, since increased demands on executive functions and imagination disproportionally disrupt processing in people with ASD. This account would predict specific impairments in anomaly detection of impossible counterfactual worlds in the ASD group relative to their TD peers, as people with ASD experience greater interference from real-world knowledge and more difficulty adopting the fantasy world as the basis for understanding. In other words, people with ASD would continue to interpret events according to real-world constraints, and thus experience persistent reading disruption (i.e. longer reading times and increased regressions) for "Mum could use margarine in her washing" compared to "baking" or "Harry Potter could use his broom to sweep" compared to "fly", despite an appropriate (but impossible) counterfactual world context ("If margarine contained detergent" or "If Harry Potter lost all his magic powers").Experiment 1 addresses this question directly by replicating Ferguson and Sanford's (2008, Experiment 2) study to test whether the difficulty that is typically associated with real-world violations (e.g. feeding a cat carrots) can be completely eliminated within a novel counterfactual context that makes the anomaly acceptable, or whether the reality violation continues to disrupt incremental processing despite the counterfactual setting. Here, the design was improved by reducing experimental materials to a single sentence to provide a stronger test of real-time counterfactual context effects, replacing the real-world conditional frame with a factual context (i.e.

"Because…"), and matching the plausibility of critical words between factual and counterfactual contexts to ensure that the two types of context were equally constraining for the unfolding narrative. Experiment 2 asks the reverse question for the first time- whether long-term fictional schemas that reverse typical real-world constraints (e.g. flying broomsticks in Harry Potter) can be overruled by a counterfactual context. Thus, Experiment 2 probes whether the fictional world violation continues to disrupt incremental processing despite the counterfactual context that re-imposes real-world constraints.

If non-real counterfactual worlds can be processed without interference from reality we expected to see comparable anomaly detection effects for inconsistent critical words within factual and counterfactual contexts in both experiments, with disruption to reading emerging immediately on the critical word itself (as in typical anomaly detection studies, e.g. Braze, Shankweiler, Ni, & Palumbo, 2002; Ni, Fodor, Crain, & Shankweiler, 1998; Rayner, Warren, Juhasz, & Liversedge, 2004). For example, reading would be comparably disrupted when the sentence, "Mum could use margarine in her…" was completed with *baking/washing*, within a counterfactual context ("If margarine contained detergent") or a factual context ("Because margarine contains detergent…"), respectively. In contrast, if real-world constraints have an earlier influence on incremental processing regardless of the fictional (counterfactual) context, then we expected to see a context x consistency interaction on early measures at the critical word, reflecting a reversed consistency effect within a counterfactual context in Experiment 1, and a reversed consistency effect within a factual context in Experiment 2 (in line with Ferguson & Sanford, 2008; Ferguson et al., 2010; Warren et al., 2008). Here, we would expect that "Mum could use margarine in her washing" would elicit early disruption to reading compared to "baking", even when a counterfactual context made this anomaly plausible in the fictional world. In contrast, we would expect that "Harry Potter could use his broom to fly" would disrupt early reading processes compared to "sweep", even when a factual context ("Because Harry Potter has magic powers…") established the fictional cartoon

world as the basis for interpretation. Overall effects of consistency with the context would be observed on later measures of processing, and in subsequent regions of text.

Experiment 1

Method

Participants

Twenty five adults with ASD (17 males) and 25 age-, sex-, and IQ-matched TD adults took part (see Table 1), all of whom gave written, informed consent before participating. Sample size was chosen *a priori* to match or exceed the sample size used in previous research that has examined eye movements in reading in ASD and TD groups (e.g. Au-Yeung et al., 2015, 2017; Black et al., 2018; in press; Howard et al., 2017abc). IQ was assessed in all participants using the Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999). Participants in the ASD group had all received formal diagnoses of autistic disorder (n = 12), or Asperger's Syndrome (n = 13), according to DSM-IV/5 or ICD-10 criteria (American Psychiatric Association, 2013; World Health Organization, 1993). Diagnostic reports were verified by the researchers. Current ASD features were assessed by a trained research-reliable assessor among participants in the ASD group using the Autism Diagnostic Observation Schedule-Generic (ADOS, Lord et al., 2000).

---------- Insert Table 1 here ----------

All participants completed the Autism-spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), a self-report questionnaire that assesses ASD/ASD-like features. Mean scores for the AQ in each group are shown in Table 1. All participants were over the age of 18, were native English speakers, had normal or corrected to normal vision, and did not have a diagnosis of dyslexia or intellectual disability. Participants in the TD group did not report any

current psychiatric diagnoses. Both experiments 1 and 2 were approved by the School of Psychology Research Ethics Committee, University of Kent.

Materials

Thirty-two experimental sentences were modified from Ferguson and Sanford (2008), as in (1) below (full set of experimental sentences are provided in the Appendix). Each item consisted of a single sentence in one of four conditions. The antecedent in the first clause introduced a novel counterfactual ("If…") or factual ("Because…") context, and the consequent in the second clause contained a critical word (underlined in the examples below) that was either consistent or inconsistent with this preceding context.

(1) a. If margarine contained soap, Mum could use margarine in her <u>washing</u> and be pleased with the results. *(Counterfactual consistent)*

b. If margarine contained soap, Mum could use margarine in her <u>baking</u> and be pleased with the results. *(Counterfactual inconsistent)*

c. Because margarine contains oil, Mum can use margarine in her <u>baking</u> and be pleased with the results. *(Factual consistent)*

d. Because margarine contains oil, Mum can use margarine in her <u>washing</u> and be pleased with the results. *(Factual inconsistent)*

Critical words were matched across conditions for length, written frequency (from the MRC Psycholinguistics database; Wilson, 1988) and semantic relatedness with the preceding context (using Latent Semantic Relatedness; Landauer & Dumais, 1997), all Fs < 0.90, all ps > .30. Experimental items were also pre-tested for cloze probability and critical word plausibility.

Cloze probability was established via ratings made by 28 students from the University of Kent using an online questionnaire platform (Qualtrics). Items were presented one at a time, truncated before the critical word, and participants were instructed to complete the sentence with the first sensible word coming to mind. Cloze probability was computed as the percentage of trials that elicited the intended consistent or inconsistent critical words, and the ANOVA was conducted allowing generalization to items. Participants were significantly more likely to complete sentences with consistent critical words (M_{FACT} = 41.2%; M_{COUNT} = 36.3%) than with inconsistent critical words (M_{FACT} = 2.5%; M_{COUNT} = 2.7%), $F(1, 31) = 86.0$, $p < .001$, $\eta_p^2 = .74$, and context (counterfactual *vs.* factual) did not modulate this difference, Fs < 1, ps > .04.

Critical word plausibility was assessed by a different set of 50 students from the University of Kent using Qualtrics. Items were presented in full, and participants were asked to rate the plausibility of each sentence using a five-point sliding scale from -2 (highly implausible) to +2 (highly plausible). The ANOVA was conducted allowing generalisation by items. Sentences containing consistent critical words were rated as significantly more plausible (M_{FACT} = 1.37; M_{COUNT} = 1.18) than sentences containing inconsistent words (M_{FACT} = -1.22; M_{COUNT} = -1.42), $F(1, 31) = 636.6$, $p < .001$, $\eta_p^2 = .95$, but context or the context x consistency interaction did not influence ratings, Fs < 3.1, ps > .09. Thus, our items carefully matched the cloze probability and critical word plausibility across factual and counterfactual contexts, as in Nieuwland (2013).

Four presentation lists were created, with each list containing thirty-two experimental sentences, eight in each of the four conditions. Across both Experiments 1 and 2, these experimental sentences (64 sentences, in total) were randomly interleaved with each other and an additional 64 filler items. These filler items were all single sentences and did not contain any anomalies, or conditional structures. Half described everyday events (e.g. “Hubert was fanatical about soap operas and never missed an episode”) and half described general knowledge facts (e.g. “New York is a big city, it has lots of taxis and restaurants"). This created a random order such that each participant

only saw each experimental sentence once, in one of the four conditions. Participants were randomly assigned to read each list. All sentences were presented over two lines of text, with one blank line in between. The critical word was never the first or last word in a line, and appeared in the same position across all conditions. Comprehension questions (e.g. Who do you visit if you have a toothache? Mechanic < > Dentist; What colour does the Incredible Hulk turn when he is angry? Green < > Blue) followed half of the experimental (i.e., 16 each for Experiments 1 and 2, testing participants' factual or fictional knowledge respectively) and filler (i.e. 32) trials. The full set of questions for experimental sentences are provided in the Appendix. Accuracy on these comprehension questions was very high at 93.5% overall (Expt 1 items M = 96.5%, Expt 2 items M = 95.5%), and did not differ between groups (Expt 1 t = .28, p = .39, Expt 2 t = .98, p = .17).

In addition, to obtain a comparative measure of Theory of Mind ability across groups, participants completed the Animations Task, based on Heider and Simmel (1944), in which they watched a series of silent video clips and had to describe interactions between a large red triangle and a small blue triangle. Four clips were designed to prompt an explanation of the triangles' behaviour in terms of epistemic mental states, such as beliefs, intentions, and deception. Each clip was presented to participants on a computer screen. After the clip was finished, participants described what had happened in the clip. An audio recording of participants' responses was made for later transcription.

Procedure

Participants' gaze location and movement from their dominant eye was recorded using an EyeLink 1000 Plus eye-tracker (viewing was binocular). All sentences were presented in black size 20 Arial font style on a VDU screen with white background, 60cm from the participants' eyes. Prior to the experiment, the procedure was explained and participants were instructed to read silently at their normal rate. Participants were seated at the eye-tracker and a chin rest was used to stabilize

participants' head position. The eye-tracker was calibrated using a nine point procedure. Before each sentence, participants performed a drift correction using a central fixation point. Once this calibration check was completed accurately, the experimenter advanced the screen and the text for the next item was presented in the top left quadrant of the screen (note that the first fixation in each trial was deleted to allow participants to move their eyes). Adjustments to the calibration were made whenever necessary. After reading each sentence, participants clicked a button on the mouse that either led to the presentation of a comprehension question (after 50% of trials) or the next trial.

The reading task took approximately 30 minutes to complete, and participants always completed the eye-tracking task prior to completing the AQ and WASI, and the animations task was conducted in a sperate testing session. Participants with ASD returned on a separate occasion to take part in the ADOS. Testing took place in a quiet research lab at the University of Kent.

Results

Animations Task

To verify that ToM competency was compromised in our ASD sample, each verbal transcription was scored on a scale of 0–2 for accuracy (including reference to specific mental states), based on the criteria outlined in Abell, Happe, and Frith (2000). This resulted in a total score for each participant between 0 and 8. Twenty percent of transcripts were scored by two independent raters. Inter-rater reliability across all clips was excellent according to Cicchetti's (1994) criteria (intra-class correlation = .85). Results[1] showed that participants with ASD were significantly impaired at describing the animations in terms of their mental states compared to the TD participants (*Ms* = 3.95 *vs.* 5.81 respectively; $t(41) = 3.0$, $p = .005$, $d = .92$).

[1] Note: Three participants from the ASD group, and four participants from the TD group did not return to complete the animations task, thus data for this task are reported for 22 ASD participants and 21 TD participants.

Methods of Analysis

The experimental passages were divided into three regions for analysis, as shown in (2). The consistent or inconsistent critical word was always presented mid-sentence. Regions were equated for length across conditions.

(2) If margarine contained soap, Mum could | use it in her PRE-CRITICAL| washing/ baking CRITICAL| and be pleased with the results. POST-CRITICAL|

An automatic procedure using UMass EyeDoctor 0.6.5 software (http://blogs.umass.edu/eyelab/software/), 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. A baseline comparison of global eye movement data across all trials in both experiments revealed that TD and ASD groups did not differ in average fixation duration (209ms *vs.* 214ms, $p = .47$), saccade amplitude (3.06° *vs.* 3.02°, $p = .75$), or % skipping of the critical word (0.21 *vs.* 0.22, $p = .73$). However, full sentence reading times were significantly longer among participants with ASD than among TD participants (4711ms (SD 22) *vs.* 3862ms (SD 19)), *Est.* = 849, $t = 2.62$, $p = .012$, and participants in the ASD group made significantly more fixations per sentence than participants in the TD group (21.93 (SD 7.0) *vs.* 18.58 (SD 3.6)), *Est.* = 3.36, $t = 2.14$, $p = .038$. This pattern is consistent with recent research showing that adults with ASD adopt a slower, more deliberative processing style compared to TD controls (Brosnan, Chapman, & Ashwin, 2014; Brosnan, Lewton, & Ashwin, 2016), including during reading (Black et al., 2018; Howard, Liversedge, & Benson, 2017a,b,c).

For the main analyses, three early measures and two later measures of language processing are reported, selected to replicate the measures used in comparable previous research (i.e. Black et al., 2018; in press; Ferguson & Sanford, 2008; Ferguson et al., 2010, Experiment 2; Howard et al.,

2017a,b,c). *First fixation duration* is the duration of the first fixation on a region. *First-pass reading time* is the sum duration of fixations made on first entering a region of text until an eye-movement exits the region to either the left or right. *First-pass regressions out* is the percentage of regressive saccades made from the current most rightward fixation with a region of text, indicating the degree to which left to right movement was disrupted during the first sweep of the eyes through a region of text. These measures provide an indication of the difficulty experienced by participants as they initially process a region of text. *Regression path* is the sum duration of all fixations from first entering a region on the left, to exiting the region on the right (this includes any initial regressions back to previous regions). *Total reading time* is the sum duration of all fixations made within a region and provides an indication of the overall amount of time spent processing text in that region. Means were computed for each measure in each of the three regions for all four conditions in each group (see Table 2). For transparency, the full datasets and analysis scripts for both experiments are available on the Open Science Framework (OSF) web pages (see https://osf.io/29cvu/).

---------- Insert Table 2 here ----------

The eye movement data was analysed separately for each region and measure using the lmer function in the lme4 package (Bates, Mächler, Bolker, & Walker, 2015) using R (version 3.5.1, R Core Team, 2018). Data from the four reading time measures (first fixation, first-pass, regression path and total) was log-transformed to increase normality in the data due to positively skewed reading times, as recommended by Baayen (2008). Each model included fixed effects of Group, Context, 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, Context and Consistency within Items, and Context and Consistency within participants (as suggested by

Barr, Levy, Scheepers, & Tily, 2013). Random effects were only removed where they lead to non-convergence due to overparameterization; models were simplified following the hierarchy principle where more complex interaction terms were removed from the items effects until the model converged. Details of the final models are available in the R script on OSF. Statistical effects from these models are shown in Table 3.

---------- Insert Table 3 here ----------

First Fixation Duration

The first thing to note is there was no significant main effect of Group, nor any significant interactions involving Group, indicating that initial processing was similar among both participant groups.

A significant interaction between Context and Consistency was found in the critical region. Further analyses revealed significantly longer first fixation durations on inconsistent compared to consistent critical words within a counterfactual context, *Est.* = -.037, *SE* = .013, *t* = -2.76, *p* = .009, but no significant difference between consistent and inconsistent critical words within a factual context, *Est.* = .009, *SE* = .011, *t* = 0.81, *p* = .416.

First-pass reading time

As in first fixation data, Group did not appear as a significant effect by itself, or as an interaction, in any region.

At the critical region, the Context x Consistency interaction was significant (see Figure 1). Follow-up analyses showed that within a *factual* context first-pass reading times were significantly longer for inconsistent than consistent critical words, *Est.* = -.040, *SE* = .018, *t* = -2.23, *p* = .034. However, within a *counterfactual* context the pattern was reversed, with a trend for longer reading

times on consistent compared to inconsistent critical words, *Est.* = .025, *SE* = .013, *t* = 1.84, *p* = .070.

In the post-critical region, a significant effect of Consistency showed that first-pass reading times were longer following a consistent than an inconsistent critical word. This effect was qualified by a significant context x consistency interaction, which showed that the consistency effect (consistent > inconsistent) was only significant within a factual context, *Est.* = .064, *SE* = .018, *t* = 3.56, *p* < .001, and not within a counterfactual context, *Est.* = .013, *SE* = .017, *t* = 0.75, *p* = .456.

---------- Insert Figure 1 here ----------

First-pass regressions out

In the post-critical region, a significant effect of Consistency showed that participants were more likely to make regressive eye movements when the critical word was inconsistent with the context, compared to when it was consistent.

Regression path reading time

A significant effect of Consistency in the post-critical region showed that participants took longer to move past this region when the critical word was inconsistent compared to when it was consistent with the context.

Total reading time

Analysis of total reading times revealed a significant effect of Consistency in the critical region, reflecting longer reading times when the sentence contained an inconsistent critical word compared to when it contained a consistent critical word. Interestingly, Consistency also interacted

significantly with Context in this critical region. Follow-up analyses in this region revealed a significant consistency effect (inconsistent > consistent) within a factual context, *Est.* = -.073, *SE* = .026, *t* = -2.85, *p* = .008, but no difference within a counterfactual context, *Est.* = .009, *SE* = .016, *t* = 0.57, *p* = .57.

Finally, a significant effect of Group was found on the critical region; participants with ASD spent longer overall reading this critical region than TD participants.

Summary

Results showed that initial processing of the critical word reflected fit with reality, regardless of the preceding context. That is, words that were anomalous with respect to real-world knowledge elicited longer first fixation and first-pass reading times compared to true words, even when the preceding counterfactual context depicted an alternative version of the world where usually implausible events can occur. This effect replicates that seen in Ferguson and Sanford (2008). Nevertheless, readers quickly accommodated the novel counterfactual context (evident at the post-critical region), with longer reading times and increased regressive eye movements when the critical word was inconsistent, compared to consistent, with the wider context. Although these consistency effects clearly show that context was later adopted as the basis of incremental processing, readers continued to experience interference from reality, as disruption was greater within a factual than counterfactual context. Importantly, group did not modulate anomaly detection effects on any measure or region, thus reflecting the patterns seen for realistic counterfactual narratives in Black et al. (2018), and providing further evidence for intact counterfactual language processing in adults with ASD. Thus, contrary to expectations, increasing demands on executive functions and imagination did not disproportionally disrupt counterfactual thinking in people with ASD, despite significant impairments in ToM among this group.

Experiment 2

Method

Experiment 2 was run concurrently with Experiment 1. Therefore the methodology was as described in Experiment 1, bar the materials which are detailed below.

Materials

Sentences depicted well-known fictional worlds, such as fairy tales and Disney stories. Thirty-two experimental items were created in the same four conditions as Experiment 1, as in (3) below (full set of experimental sentences are provided in the Appendix).

(3) a. If Harry Potter lost his magic powers, he would use a broom to sweep around Hogwarts.
(Counterfactual consistent)

b. If Harry Potter lost his magic powers, he would use a broom to fly around Hogwarts.
(Counterfactual inconsistent)

c. Because Harry Potter has magic powers, he uses a broom to fly around Hogwarts.
(Factual consistent)

d. Because Harry Potter has magic powers, he uses a broom to sweep around Hogwarts.
(Factual inconsistent)

As in Experiment 1, critical words were matched across conditions for length, written frequency, and semantic relatedness with the preceding context, all Fs < .80, all ps > .30. Cloze probability of experimental items was rated by 29 undergraduate students at the University of Kent, and sentence plausibility was rated by 47 different undergraduate students at the University of Kent. ANOVAs were conducted allowing generalization to items. As expected, cloze probability for consistent critical words (M_{FACT} = 38.3%; M_{COUNT} = 41.2%) was significantly higher than for

inconsistent critical words (M_{FACT} = 0%; M_{COUNT} = 2.5%, $F(1, 31) = 65.33$, $p < .001$, $\eta_p^2 = .68$), and context did not modulate this difference, Fs < 1, ps > .4. Plausibility ratings were also significantly higher for sentences where the critical word was consistent (M_{FACT} = 1.37; M_{COUNT} = 1.16) than inconsistent (M_{FACT} = -1.50; M_{COUNT} = -1.29; $F(1, 31) = 1241.1$, $p < .001$, $\eta_p^2 = .98$). A significant interaction between context and consistency ($F(1, 31) = 9.51$, $p = .004$, $\eta_p^2 = .24$) showed that this consistency effect was significantly larger within a factual (M_{diff} = 2.87) than counterfactual context (M_{diff} = 2.45; $t(31) = 3.09$, $p = .004$).

Fictional World Knowledge Assessment

To ensure that participants were familiar with the fictional stories and characters used in Experiment 2, they completed a questionnaire after the main task. One question per experimental item (e.g. "What was Pinocchio made of?", "What happens to the Incredible Hulk when he gets angry?") was presented on a computer, and participants were required to type a short answer, or write "I don't know". Responses were scored as either correct or incorrect. Both groups of participants showed a high level of familiarity with the fictional worlds, although familiarity scores were significantly higher among TD participants (M = 83.9%, SD = 9.0) than participants with ASD (M = 70.3%, SD = 24.2), $t(46) = -2.57$, $p = .01$, $d = -0.74$[2].

Results

Methods of Analysis As in Experiment 1, stimuli were divided into three regions for analysis, as in (4), with the consistent/inconsistent word always appearing mid-sentence. Regions were equated for length across conditions.

[2] Note: we were unable to obtain fictional knowledge data from one participant in each group.

(4) If Harry Potter lost his magic powers, he could | use a broom to PRE-CRITICAL| sweep/ fly CRITICAL| around Hogwarts. POST-CRITICAL|

Eye movement data was prepared and analysed as in Experiment 1. In addition, participants' accuracy score on the fictional world knowledge questionnaire was centred and included in all lmer models as a random factor, to control for the significant difference in fictional world knowledge between groups. The resulting reading times for each measure, region and condition are shown in Table 4, and statistical effects are shown in Table 5.

---------- Insert Tables 4 and 5 here ----------

First fixation duration

No significant effects were found on this measure, in any region.

First-pass reading time

No significant effects were found on this measure, in any region.

First-pass regressions out

A significant effect of Context in the critical region showed that participants were more likely to regress back in the text following a factual context than a counterfactual context.

In the post-critical region, a significant effect of Consistency showed that participants were more likely to make regressive eye movements when the critical word was inconsistent with the context, compared to when it was consistent.

Regression path time

At the critical region, there was a marginal Context x Consistency interaction (p = .065; see Figure 2), consistent with our predictions and to that seen on first-pass reading times in Experiment 1. Exploratory analyses revealed that following a counterfactual context participants took significantly longer to move past an inconsistent critical word than a consistent critical word (*Est.* = -.065, *SE* = .023, t = -2.30, p = .029), but consistency did not influence regression path reading times following a factual context (*Est.* = .005, *SE* = .025, t = .20, p = .839).

A significant effect of Consistency in the post-critical region revealed that participants took longer to move past this region when the preceding critical word was inconsistent compared to consistent with the context. In addition, a significant effect of Group emerged in this region, which reflected longer overall reading times for participants in the ASD group compared to the TD group.

---------- Insert Figure 2 here ----------

Total reading time

All three regions showed a significant effect of Group, as participants with ASD spent longer in total reading than TD participants. In addition, a significant effect of Consistency emerged in both the pre-critical and critical regions, reflecting longer total reading times when the critical word was inconsistent with the context compared to when it was consistent.

Summary

Experiment 2 provided further evidence that fit with reality influences initial processing of narratives, regardless of the preceding context. Here, the reality bias *facilitated* processing of the counterfactual premise, as critical words that violated real-world constraints (but were congruent with the original fictional world) elicited longer regression path reading times compared to true words (that were incongruent with the original fictional world). Within a factual context however,

this reality bias *interfered* with fictional processing, with no difference in regression path reading times between consistent and inconsistent critical words. Nevertheless, the counterfactual context was eventually accommodated, with longer reading times and increased regressive eye movements when the critical word was inconsistent, compared to consistent, with the wider factual/counterfactual context. In contrast to Experiment 1, later measures provided converging evidence that overall processing was driven by context, as disruption was comparable within factual and counterfactual contexts. Similar to Experiment 1, these anomaly detection effects were not modulated by group on any measure. However, overall reading times were typically longer in the ASD group compared to the TD group in this experiment, suggesting that comprehending these fictional events required greater cognitive effort for individuals with ASD.

General Discussion

We have reported data from two eye-tracked reading experiments that examined how adults with and without ASD make sense of 'impossible' counterfactual events. In Experiment 1, narratives depicted novel scenarios that violate real-world knowledge, and thus required a relatively high degree of imagination (e.g. "If margarine contained soap, mum could use margarine in her washing/ baking…"). In Experiment 2, narratives described counterfactual alternatives to well-known fictional worlds, thus establishing a conflict between reality and fantasy (e.g. "If Harry Potter lost his magic powers, he would use his broom to sweep/ fly…"). These experiments allowed us to examine the relative contributions of real- and fictional-world constraints, and whether these constraints influence incremental processing in the same way for TD adults and adults with ASD. Specifically, we tested whether adults with ASD would show intact processing of impossible counterfactual events (i.e. replicating comprehension for possible counterfactuals in Black et al., 2018), or whether difficulty would emerge among people with ASD when a more substantial change to reality was required (due to increased demands on executive functions and imagination).

Results showed that participants detected inconsistent continuations in the early moments of processing. In Experiment 1, factual inconsistencies were detected immediately, with longer first fixation durations and first-pass reading times on inconsistent than consistent critical words, while in Experiment 2 detection of factual inconsistencies was slightly delayed, with inconsistent critical words leading to higher incidence of first-pass regressions out from the post-critical region. Counterfactual inconsistencies disrupted processing at the same point in both experiments[3], with more first-pass regressions out from the post-critical region following an inconsistent critical word.

These findings therefore reveal novel insights on the processing of fictional language. Both experiments provide strong evidence that language processing is grounded in knowledge about reality, and suggest that constraints from the real-world are prioritised for the online integration of text. Experiment 1 replicated effects seen in Ferguson and Sanford (2008; see also Ferguson et al., 2008; Warren et al., 2008), by showing that initial processing of a word is based on fit with real-world constraints, even when a prior fantasy context neutralised this real-world violation. Specifically, a Context x Consistency interaction showed that words that were inconsistent with readers' real-world knowledge elicited longer first-pass reading times than consistent words (first fixation durations showed no difference), even when the preceding counterfactual context depicted a fictional world where usually implausible events can occur. In Experiment 2, processing was facilitated when a counterfactual frame overruled the fantasy context to re-establish real-world constraints; readers took longer to move past critical words that violated real-world knowledge, and showed no evidence of interference from the original fictional world. These findings support the proposal that incoming discourse is automatically mapped onto general world knowledge, and that this process is fundamental to language understanding (Sanford & Garrod, 1981, 1998; Sanford, 1983).

[3] We will return to the marginal Context x Consistency interaction in Experiment 2, which suggests that counterfactual inconsistencies may have been first detected on the critical word itself, later in the Discussion.

Interestingly, when known fictional worlds were presented in a factual frame (Experiment 2), initial processing of the critical word was unaffected by fit with the fictional context or real-world knowledge, though context-based disruption emerged on early measures in the post-critical region (as seen in Filik, 2008). This suggests that although reality was not taken as the *preferred* basis for understanding these sentences (i.e. real-world violations did not significantly disrupt reading), knowledge of reality did interfere with initial processing of the critical word within the fantasy context. The absence of an initial real-world bias is consistent with findings from Filik's (2008; Filik & Leuthold, 2013) eye-tracking studies of known cartoon-like scenarios (e.g. Tom and Jerry, the incredible hulk), but contrasts with effects seen for comparable cartoon-like contexts in Warren et al. (2008). We attribute this difference to the nature of fictional anomalies being tested in each study. Specifically, the fictional world anomalies in our Experiment 2 (similarly for Filik's studies) violated some integral aspect of that known fantasy world (e.g. that broomsticks can fly in Harry Potter, or that the pumpkin was turned into a carriage in Cinderella), whereas items in Warren et al. manipulated properties that were *relevant* to the fictional world but not integral to their existence (e.g. that Cat Woman would use an adhesive to glue cars to the road). This suggests that real-world constraints can be attenuated when readers can refer to long-term fictional schemas that establish specific constraints for that known fantasy world. Taken together, these findings suggest that anomaly detection within fictional contexts is delayed relative to impossible real-world anomalies (which are typically detected on the critical word itself, e.g. Braze et al., 2002; Ni et al., 1998), and is therefore more comparable to the detection of events that are *implausible* (but possible) with respect to real-world constraints (e.g. Ferguson & Jayes, 2018; Joseph, Liversedge, Blythe, White, Gathercole, & Rayner, 2007; Rayner et al., 2004; Staub et al., 2007; Warren & McConnell, 2007). Thus, readers can access and evaluate knowledge based on known fictional worlds in the same timeframe as real-world knowledge.

These results also contribute to ongoing debates about the factors that influence competition between contextual information and readers' general world knowledge. Memory-based views of text processing suggest that both context and general world knowledge are immediately available to the reader, meaning that both have the potential to influence the earliest moments of text understanding (e.g. Albrecht & O'Brien, 1993). The RI-Val model of comprehension extends this proposal further by distinguishing integration and validation processes (Cook & O'Brien, 2014; O'Brien & Cook, 2016a,b). According to this account, while both context and general world knowledge can influence processing, priority for integrating information is given to the most recently encoded information, which is then validated for fit with other aspects of memory in a second step. Our results are therefore consistent with the view that context (even a non-real fantasy one) can dominate processing over general world knowledge when it is sufficiently elaborated, or supported by long-term memory schemas. This effect can be seen by the overall consistency effects that eliminate typical disruption from general world knowledge violations in total reading times and at the post-critical region. Importantly, thanks to the time-sensitive eye-tracking measures employed here, our data provide the first evidence for temporally distinct influences of context and general world knowledge on integration and validation in the RI-Val model. Specifically, even when contextual information was strengthened in memory (i.e. in the antecedent clause of the counterfactual), early integration of text was dominated by general world knowledge (interaction effects seen on the critical word), although a strong fantasy context dominated validation, leading to no measureable disruption on later measures of reading (e.g. total reading time). Further research is needed that employs time-sensitive measures of reading to test whether this early bias to integrate according to general world knowledge can be fully eliminated within much longer and more elaborate fictional contexts.

Importantly, group did not modulate any of these inconsistency detection effects, meaning that adults with ASD were sensitive to inconsistent information in a comparable time-frame as TD

participants. This pattern therefore provides very clear evidence (similar to that reported in Black et al., 2018) that adults with ASD do not experience a gross difficulty with counterfactual processing, and that even impossible counterfactual events can be processed rapidly, in a comparable time-course to that employed by TD adults. Importantly, the data suggest that adults with ASD have an intact ability to infer, use and manipulate knowledge about real-world constraints during online language comprehension (as reported by Saldaña & Frith, 2007), and have a sufficiently rich mapping of the incoming discourse onto existing real-world and fictional-world knowledge. These abilities are an important part of successful language comprehension, because world knowledge is fundamental to inferring information that is not provided in a text, and evaluating this implied meaning against other available information (e.g. discourse context, long-term memory, etc). Our results are also consistent with previous eye-tracking reading studies that have reported rapid use of world knowledge to detect sentence-level anomalies in adults with ASD (Au-Yeung et al., 2018; Howard et al., 2017a). Importantly, our results shed further light on these effects by demonstrating that world knowledge violations can disrupt normal reading in people with ASD, even when the verb's selectional restrictions have been met (c.f. Howard et al., 2017a). We note that this rapid influence of world knowledge during reading in ASD conflicts with the delayed detection of implausible thematic relations reported in Howard et al. (2017a). However, the group differences in Howard et al. were only evident on first and single fixation measures on the critical word, and not on gaze duration (referred to as first-pass reading time here) or go past time (referred to as regression path reading time here). The fact that the group effects in Howard et al. were so short-lived, and that group did not influence reading on any early measures here, suggests that any delay in accessing real-world knowledge in ASD is very subtle, and might be specific to violations of thematic relations (as tested in Howard et al.).

Further, we note that the absence of a delay in inconsistency detection among our ASD participants supports earlier findings that have demonstrated intact global coherence and ability to

integrate information during text comprehension in adults with ASD (Au-Yeung et al., 2018; Howard et al., 2017c; Black et al., 2018). At first glance, this finding appears at odds with earlier work showing that people with ASD experience a general impairment in making bridging inferences during discourse comprehension (e.g. Happé, 1997; Jolliffe & Baron-Cohen, 1999; Nuske & Bavin, 2011; Sansoniti, Was, Rawson, & Remaklus, 2013). However closer consideration of the approaches taken in these studies suggests that impaired inferencing may only be evident when explicit, response-based methodologies (which are more susceptible to demand characteristics and response biases), or global measures of online processing (which do not allow analysis of incremental effects) are employed. In our study, when linguistic inferencing was tested in real-time, under relatively natural constraints (i.e. using a passive reading task and online eye movement measures), participants with ASD showed no impairment in the ability to integrate information. Nevertheless, we acknowledge that necessary restrictions on sample size in studies with people with ASD mean that we may not have enough power to reliably detect higher order interactions involving group.

The finding that participants with ASD did not differ from their TD peers in responding to fictional events, and yet were significantly impaired at judging intentions in the animations task, demonstrates a dissociation between counterfactual thinking and ToM, and therefore makes an important contribution to debates on this relationship. Previous work has revealed impairments in counterfactual reasoning in children with ASD relative to TD children (Begeer et al., 2014; Grant et al., 2004; Morsanyi & Handley, 2012; Scott & Baron-Cohen, 1996). These difficulties have been assumed to underlie the broader difficulties children with ASD experience with ToM, either because of a shared mechanism of simulation (i.e. imagining another person's belief is analogous to imagining the world counterfactually; Peterson & Riggs, 1999; Riggs et al., 1998), or because of the shared need to relate the derivation process to actual events (i.e. one has to reason from a belief in a counterfactual state of the world to an action aimed at achieving something in the real world;

Perner, Sprung, & Steinkogler, 2004). Our results demonstrate that adults with ASD possess the necessary cognitive processes to simulate multiple versions of the world, and relate incoming information to the real world, thus difficulty with ToM must depend on more specific social reasoning processes. This dissociation is further supported by evidence that TD adults generate much earlier expectations for events within counterfactual worlds than beliefs (Ferguson et al., 2010), and that processing of counterfactual emotions (e.g. regret and relief) is intact or even enhanced among adults with ASD (Black et al., in press). Taken together, our results suggest that counterfactual thinking involves reasoning based on the logical constraints of a fictional world, and that this is distinct from social reasoning elicited by ToM tasks.

Finally, it is interesting to note that although people with and without ASD employed comparable strategies to comprehend counterfactual events and detect inconsistencies, between-group differences were evident in overall reading times. Adults with ASD were generally slower to read the passages than TD adults. This pattern emerged on total reading times at the critical region in Experiment 1, but was more widespread in Experiment 2, with group differences influencing total reading times at the critical and post-critical regions, and regression path times at the critical region (this pattern was also evident for overall sentence reading time and number of fixations). Since group differences were not evident on early reading measures and did not interact with the other variables, we can infer that the increased reading times in the ASD group reflects an overall increase in the likelihood of re-reading, rather than different language processing strategies. This slower text processing is therefore consistent with Howard et al. (2017a,b,c; see also Au-Yeung et al., 2015; Black et al., 2018; Sansosti et al., 2013) who observed a more 'cautious' reading strategy in adults with ASD compared to their TD counterparts, suggesting that adults with ASD are more likely to re-read complex texts to verify understanding and increase their confidence in the intended meaning. This interpretation also fits with emerging research indicating individuals with ASD tend to wait for more information before making a decision compared to TD peers (Brosnan et al., 2014),

and that people with ASD exhibit a slower, more deliberative reasoning style compared to TD controls who often adopt a faster, more intuitive reasoning strategy (Brosnan et al., 2016). In the present study, it's likely that the process of deliberately checking what has been read before moving on is enhanced due to the presence of inconsistencies and comprehension questions, which increase uncertainty around what has been read and prompt deeper reading. Moreover, the finding that participants with ASD engaged in more re-reading in Experiment 2, where understanding required an inference about a known fictional world, compared to Experiment 1 is likely to reflect the greater demands that these inferences make on participants' long-term memory and imagination, as well as lower familiarity with the fictional worlds in the ASD group (though note that familiarity was included in all models for this experiment).

In conclusion, across two eye-tracking reading experiments we have provided clear evidence that readers experience an early, perhaps default, bias to relate incoming text to constraints based on real-world knowledge. Crucially, we have shown that this real-world preference can be tempered if a sufficiently rich fantasy context activates long-term schemas with alternative constraints. Moreover, we have shown that adults with ASD are not impaired in comprehending counterfactuals, including when the counterfactual depicts a reality-violating fictional world. Reading was disrupted when a critical word was inconsistent with the wider context, and these anomaly detection responses were comparable in magnitude and time-course for ASD and TD adults. This finding suggests a dissociation, whereby impairments in ToM are not tied inextricably with counterfactual processing abilities.

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References

Adams, N.C. & Jarrold, C. (2012). Inhibition in autism: Children with autism have difficulty inhibiting irrelevant distractors but not prepotent responses. *Journal of Autism and Developmental Disorders, 42*, 1052-1063.

Albrecht, J.E., & O'Brien, E.J. (1993). Updating a mental model: Maintaining both local and global coherence. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 1061-1069.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®).* American Psychiatric Pub.

Au Yeung, S., Kaakinen, J.K., Liversedge, S., & Benson, V. (2018). Would adults with autism be less likely to bury the survivors? An eye movement study of anomalous text reading. *The Quarterly Journal of Experimental Psychology, 24*, 1-27.

Au-Yeung, S.K., Kaakinen, J.K., Liversedge, S.P., & Benson, V. (2015). Processing of written irony in Autism Spectrum Disorder: An eye-movement study. *Autism Research*, *8*, 749-760.

Barnes, J.L. (2012). Fiction, imagination, and social cognition: Insights from autism. *Poetics*, *40*, 299-316.

Baron-Cohen, S., Leslie, A.M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition, 21*, 37-46.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5-17.

Barr, D.J., Levy, R., Scheepers, C., & Tily, H.J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language, 68*, 255-278.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using lme4. *arXiv Preprint arXiv:1406.5823.*

Baayen, R.H. (2008). *Analyzing linguistic data: A practical introduction to statistics using R*. Cambridge University Press, Cambridge, UK.

Begeer, S., De Rosnay, M., Lunenburg, P., Stegge, H., & Terwogt, M.M. (2014). Understanding of emotions based on counterfactual reasoning in children with autism spectrum disorders. *Autism, 18*, 301-310.

Begeer, S., Terwogt, M.M., Lunenburg, P., & Stegge, H. (2009). Brief report: Additive and subtractive counterfactual reasoning of children with high-functioning autism spectrum disorders. *Journal of Autism and Developmental Disorders, 39*, 1593-1597.

Black, J., Barzy, M., Williams, D., & Ferguson, H.J. (in press). Intact counterfactual emotion processing in adults with autism spectrum disorder: Evidence from eye-tracking. *Autism Research*.

Black, J., Williams, D., & Ferguson, H.J. (2018). Imagining counterfactual worlds in autism spectrum disorder. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 44*, 1444-1463.

Braze, D., Shankweiler, D., Ni, W., & Palumbo, L.C. (2002). Readers' eye movements distinguish anomalies of form and content. *Journal of Psycholinguistic Research*, *31,* 25-44.

Brosnan, M., Chapman, E., & Ashwin, C. (2014). Adolescents with autism spectrum disorder show a circumspect reasoning bias rather than 'jumping-to-conclusions'. *Journal of autism and developmental disorders*, *44*, 513-520.

Brosnan, M., Lewton, M., & Ashwin, C. (2016). Reasoning on the autism spectrum: a dual process theory account. *Journal of autism and developmental disorders*, *46*, 2115-2125.

Byrne, R.M.J. (2005). *The Rational Imagination: How People Create Alternatives to Reality*. Cambridge, M.A.: MIT Press.

Cook, A.E., & O'Brien, E.J. (2014). Knowledge activation, integration, and validation during narrative text comprehension. *Discourse Processes, 51*, 26-49.

Creer, S.D., Cook, A.E., & O'Brien, E.J. (2018). Competing activation during fantasy text comprehension. *Scientific studies of reading, 22*, 308-320.

Drayton, S., Turley-Ames, K.J., & Guarjardo, N.R. (2011). Counterfactual thinking and false belief: the role of executive function. *Journal of Experimental Child Psychology, 108,* 532-548.

Ferguson, H.J. & Jayes, L. (2018). Plausibility and perspective influence the processing of counterfactual narratives. *Discourse Processes, Special Issue in honor of Tony Sanford, 55*, 166-186.

Ferguson, H.J., Scheepers, C., & Sanford, A.J. (2010). Expectations in counterfactual and theory of mind reasoning. *Language and Cognitive Processes, 25*, 297-346.

Ferguson, H.J., & Sanford, A.J. (2008). Anomalies in real and counterfactual worlds: An eye-movement investigation. *Journal of Memory and Language, 58*, 609-626.

Ferguson, H.J., Sanford, A.J., & Leuthold, H. (2008). Eye-movements and ERPs reveal the time course of processing negation and remitting counterfactual worlds. *Brain Research, 1236*, 113-125.

Filik, R. (2008). Contextual override of pragmatic anomalies: evidence from eye movements. *Cognition, 106*, 1038-1046.

Filik, R. & Leuthold, H. (2013). The role of character-based knowledge in online narrative comprehension: Evidence from eye movements and ERPs. *Brain Research, 1506*, 94-104.

Frith, U. (1989). *Autism: Explaining the enigma*. Oxford, UK Blackwell Publishing.

Frith, U. & Happé, F. (1994). Autism: Beyond "theory of mind". *Cognition, 50*, 115-132.

Geurts, H.M., Bergh, S.F., & Ruzzano, L. (2014). Prepotent response inhibition and interference control in autism spectrum disorders: Two meta-analyses. *Autism Research, 7*, 407-420.

Grant, C., Riggs, K.J., & Boucher, J. (2004). Counterfactual and mental state reasoning in children with autism. *Journal of Autism and Developmental Disorders, 34*, 177-188.

Happé, F.G.E. (1997). Central coherence and theory of mind in autism: Reading homographs in context. *British Journal of Developmental Psychology, 15*, 1-12.

Happé, F. & Frith, U. (2006). The weak coherence account: Detail-focused cognitive style in autism spectrum disorders. *Journal of Autism and Developmental Disorders, 36*, 5-25.

Howard, P.L., Liversedge, S.P., & Benson, V. (2017a). Investigating the Use of World Knowledge During On-line Comprehension in Adults with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders, 47*, 2039-2053.

Howard, P.L., Liversedge, S.P., & Benson, V. (2017b). Benchmark eye movement effects during natural reading in autism spectrum disorder. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 43*, 109-127.

Howard, P.L., Liversedge, S.P., & Benson, V. (2017c). Processing of co-reference in autism spectrum disorder. *Autism Research, 10*, 1968-1980.

Jolliffe, T. & Baron-Cohen, S. (1999). A test of central coherence theory: linguistic processing in high-functioning adults with autism or Asperger syndrome: is local coherence impaired? *Cognition, 71*, 149-185.

Joseph, H.S., Liversedge, S.P., Blythe, H.I., White, S.J., Gathercole, S.E., & Rayner, K. (2008). Children's and adults' processing of anomaly and implausibility during reading: Evidence from eye movements. *The Quarterly Journal of Experimental Psychology, 61*, 708-723.

Kahneman, D. (1995). Varieties of Counterfactual Thinking. In Neal J. Roese and James M. Olson (Eds.), *What Might Have Been: The Social Psychology of Counterfactual Thinking.* Hillsdale, NJ: Erlbaum, 375-96.

Kulakova, E. & Nieuwland, M.S. (2016). Pragmatic skills predict online counterfactual comprehension: Evidence from the N400. *Cognitive, Affective, & Behavioral Neuroscience, 16*, 814-824.

Landauer, T.K., & Dumais, S.T. (1997). A solution to plato's problem: The latent semantic analysis theory of acquisition, induction, and representation of knowledge. *Psychological Review, 104*, 211.

Lind, S.E. & Williams, D.M. (2012). The association between past and future oriented thinking: Evidence from autism spectrum disorder. *Learning and Motivation, 43*, 231-240.

Lind, S., Williams, D., Bowler, D., & Peel, A. (2014). Episodic memory and episodic future thinking impairments in high-functioning autism spectrum disorder: An underlying difficulty with scene construction or self-projection? *Neuropsychology*, *28*, 55-67.

Lord, C., Risi, S., Lambrecht, L., Cook Jr, E.H., Leventhal, B.L., DiLavore, P.C., . . . Rutter, M. (2000). The autism diagnostic observation Schedule—Generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders, 30*, 205-223.

Metusalem, R., Kutas, M., Urbach, T.P., Hare, M., McRae, K., & Elman, J.L. (2012). Generalized event knowledge activation during online sentence comprehension. *Journal of Memory and Language, 66*, 545-567.

Minshew, N.J. & Goldstein, G. (1998). Autism as a disorder of complex information processing. *Mental Retardation and Developmental Disabilities Research Reviews, 4*, 129-136.

Minshew, N.J., Goldstein, G., & Siegel, D.J. (1997). Neuropsychologic functioning in autism: Profile of a complex information processing disorder. *Journal of the International Neuropsychological Society, 3*, 303-316.

Minshew, N.J., Williams, D.L., & McFadden, K. (2008). Information processing, neural connectivity, and neuronal organization. In A. Zimmerman (Ed.), *Autism: Current theories and evidence* (pp. 381-405). Totowa, NJ: Humana Press.

Morison, P. & Gardner, H. (1978). Dragons and Dinosaurs: The Child's Capacity to Differentiate Fantasy from Reality, *Child Development, 49*, 642-8.

Morsanyi, K., & Handley, S.J. (2012). Reasoning on the basis of fantasy content: Two studies with high-functioning autistic adolescents. *Journal of Autism and Developmental Disorders, 42*, 2297-2311.

Ni, W., Fodor, J.D., Crain, S., & Shankweiler, D.P. (1998). Anomalous strings: Eye movement patterns. *Journal of Psycholinguistic Research*, *27,* 515-539.

Nieuwland, M.S. (2013). "If a lion could speak …": Online sensitivity to propositional truth-value of unrealistic counterfactual sentences. *Journal of Memory & Language, 68*, 54-67.

Nieuwland, M.S. & Martin, A.E. (2012). If the real world were irrelevant, so to speak: The role of propositional truth-value in counterfactual sentence comprehension. *Cognition, 122*, 102-109.

Nieuwland, M.S. & Van Berkum, J.J.A. (2006). When peanuts fall in love: N400 evidence for the power of discourse. *Journal of Cognitive Neuroscience*, *18,* 1098-1111.

Nuske, H.J. & Bavin, E.L. (2011). Narrative comprehension in 4-7-year-old children with autism: Testing the weak central coherence account. *International Journal of Language & Communication Disorders, 46*, 108-119.

O'Brien, E.J., & Cook, A.E. (2016a). Coherence threshold and the continuity of processing: The RI-Val model of comprehension. *Discourse Processes, 53*, 326-338.

O'Brien, E.J., & Cook, A.E. (2016b). Separating the activation, integration, and validation components of reading. In B. H. Ross (Ed.), *The psychology of learning and motivation* (Vol. 65, pp. 249-276). Cambridge, MA: Academic Press.

Perner, J. (2000). About + Belief + Counterfactual. In P. Mitchell and K. J. Riggs (Eds.). *Children's reasoning and the min*d (pp. 367-401). Hove, East Sussex: Psychology Press.

Perner, J., Sprung, M., & Steinkogler, B. (2004). Counterfactual conditionals and false belief: a developmental dissociation. *Cognitive Development, 19*, 179-201.

R Core Team. (2016). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.

Rayner, K., Warren, T., Juhasz, B., & Liversedge, S. (2004). The effects of plausibility on eye movements in reading. *Journal of Experimental Psychology: Learning, Memory and Cognition, 30*, 1290-1301.

Riggs, K.J., Peterson, D.M., Robinson, E.J., & Mitchell, P. (1998). Are errors in false belief tasks symptomatic of a broader difficulty with counterfactuality? *Cognitive Development, 13,* 73-91.

Roese, N.J., Sanna, L.J., & Galinsky, A.D. (2005). The mechanics of imagination: Automaticity and control in counterfactual thinking. In R.R. Hassin, J.S. Uleman & J.A. Bargh (Eds.), *The New Unconscious* (pp. 138-170). New York: Oxford University Press.

Saldaña, D. & Frith, U. (2007). Do readers with autism make bridging inferences from world knowledge? *Journal of Experimental Child Psychology, 96*, 310-319.

Sanford, A.J. (1983). *The Mind of Man*. New Haven: Yale University Press.

Sanford, A.J. & Garrod, S.C. (1981). *Understanding Written Language*. Chichester: John Wiley & Sons.

Sanford, A.J. & Garrod, S.C. (1998). The role of scenario mapping in text comprehension, *Discourse Processes, 26,* 159-190.

Sansosti, F.J., Was, C., Rawson, K.A., & Remaklus, B.L. (2013). Eye movements during processing of text requiring bridging inferences in adolescents with higher functioning autism spectrum disorders: A preliminary investigation. *Research in Autism Spectrum Disorders, 7*, 1535-1542.

Scott, F. & Baron-Cohen, S. (1996). Imagining real and unreal objects: an investigation of imagination in autism. *Journal of Cognitive Neuroscience, 8*, 400-411.

Skolnick, D. & Bloom, P. (2006). What does Batman think about SpongeBob? Children's understanding of the fantasy/ fantasy distinction. *Cognition, 101*, B9-B18.

Staub, A., Rayner, R., Pollatsek, A., Hyönä, J., & Majewski, H. (2007). The time course of plausibility effects on eye movements in reading: Evidence from noun-noun compounds. *Journal of Experimental Psychology, 33*, 1162-1169.

Surian, L., Baron-Cohen, S., & Van der Lely, H. (1996). Are children with autism deaf to Gricean maxims? *Cognitive Neuropsychiatry, 1*, 55-71.

Van Hoeck, N., Begtas, E., Steen, J., Kestemont, J., Vandekerckhove, M., & Van Overwalle, F. (2014). False belief and counterfactual reasoning in a social environment. *NeuroImage, 90*, 315-325.

Warren, T. & McConnell, K. (2007). Investigating effects of selectional restriction violations and plausibility violation severity on eye-movements in reading. *Psychonomic Bulletin & Review, 14*, 770-775.

Warren, T., McConnell, K., & Rayner, K. (2008). Effects of context on eye movements when reading about plausible and impossible events. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 34*, 1001-1010.

Wechsler, D. (1999). *Wechsler abbreviated scale of intelligence*. Psychological Corporation.

World Health Organization. (1993). The ICD-10 classification of mental and behavioural disorders: Diagnostic criteria for research.

Table 1. Demographic information for ASD and TD groups (M (SD)) in Experiments 1 and 2, showing between group t-tests.

	ASD (n = 25)	TD (n = 25)	t	p	Cohen's d
Sex (m:f)	17:8	17:8			
Age (years)	36.19 (8.44)	37.56 (9.72)	-0.42	.68	-0.15
Verbal IQ	101 (15.23)	105 (11.37)	-1.03	.31	-0.30
Performance IQ	102 (20.43)	105 (11.76)	-0.73	.47	-0.18
Overall IQ	101 (17.81)	105 (10.47)	-1.01	.32	-0.27
Total AQ score	32.00 (8.44)	16.24 (6.39)	7.45	< .001***	2.11
ADOS-2 Module 4 algorithm total	8.58 (4.92)	-			

Table 2. Mean (SD) values for each reading measure, sentence region, and condition for ASD and TD groups, Experiment 1.

	ASD				TD			
	Counterfactual		Factual		Counterfactual		Factual	
	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent
Pre-critical region								
First fixation duration (ms)	240 (113)	237 (104)	241 (108)	228 (96)	233 (98)	233 (103)	241 (100)	233 (88)
First-pass reading time (ms)	714 (468)	689 (450)	747 (507)	728 (425)	700 (364)	690 (403)	744 (407)	772 (423)
First-pass regressions out (%)	15 (35)	20 (40)	21 (41)	16 (37)	14 (35)	19 (39)	18 (39)	16 (36)
Regression path reading time (ms)	922 (588)	950 (762)	995 (600)	930 (567)	890 (519)	938 (570)	970 (466)	940 (507)
Total reading time (ms)	1136 (806)	1343 (982)	1203 (679)	1203 (797)	988 (463)	1065 (569)	1069 (491)	1132 (661)
Critical region								
First fixation duration (ms)	229 (89)	220 (78)	220 (87)	247 (109)	229 (82)	226 (80)	211 (70)	229 (84)
First-pass reading time (ms)	258 (134)	234 (91)	247 (124)	305 (258)	256 (121)	239 (91)	224 (84)	246 (105)
First-pass regressions out (%)	17 (38)	22 (42)	24 (43)	21 (41)	23 (42)	20 (40)	23 (42)	21 (41)
Regression path reading time (ms)	330 (248)	340 (264)	371 (308)	396 (308)	333 (206)	321 (224)	312 (190)	332 (297)
Total reading time (ms)	374 (249)	377 (252)	381 (267)	472 (408)	320 (178)	307 (172)	279 (151)	378 (339)
Post-critical region								
First fixation duration (ms)	240 (94)	239 (89)	246 (125)	230 (98)	236 (97)	232 (97)	239 (97)	241 (104)
First-pass reading time (ms)	557 (337)	539 (330)	555 (359)	455 (274)	550 (332)	537 (295)	544 (285)	518 (325)
First-pass regressions out (%)	41 (49)	48 (50)	38 (49)	52 (50)	35 (48)	41 (49)	37 (48)	45 (50)
Regression path reading time (ms)	1363 (1503)	1680 (2040)	1376 (1484)	1417 (1577)	978 (859)	1114 (1084)	933 (721)	1290 (1552)
Total reading time (ms)	825 (464)	897 (544)	921 (650)	850 (522)	686 (367)	736 (387)	666 (328)	782 (537)

Table 3. Model Estimate, Standard Error (SE) and t-value for first pass reading time, regression path and total reading time in each region for Experiment 1, where * $p < .05$, ** $p < .01$, *** $p < .001$.

	First fixation duration			**First-pass reading time**			**First-pass regressions out**			**Regression path reading time**			**Total reading time**		
	Est.	*SE*	*t-value*	*Est.*	*SE*	*t-value*	*Est.*	*SE*	*z-value*	*Est.*	*SE*	*t-value*	*Est.*	*SE*	*t-value*
Pre-critical region															
Context	0.004	0.008	0.42	0.027	0.014	1.89	-0.037	0.197	-0.19	0.022	0.012	1.79	0.021	0.011	1.89
Consistency	0.010	0.008	1.35	0.000	0.013	0.03	-0.068	0.184	-0.37	0.000	0.011	-0.03	-0.021	0.011	-1.85
Group	0.000	0.022	0.02	0.027	0.032	0.84	0.045	0.261	0.17	0.018	0.034	0.55	-0.033	0.034	-0.97
Context:Consistency	0.011	0.018	0.59	-0.029	0.028	-1.05	0.453	0.395	1.15	0.026	0.023	1.14	0.040	0.023	1.72
Context:Group	0.014	0.016	0.86	0.010	0.026	0.38	-0.037	0.336	-0.11	0.017	0.026	0.65	0.024	0.020	1.23
Consistency:Group	-0.006	0.015	-0.39	0.009	0.032	0.29	-0.181	0.361	-0.50	0.003	0.020	0.13	0.011	0.024	0.47
Context:Consistency:Group	-0.010	0.031	-0.33	-0.027	0.052	-0.52	-0.505	0.716	-0.71	0.015	0.047	0.32	-0.061	0.047	-1.30
Critical region															
Context	-0.006	0.009	-0.63	-0.005	0.010	-0.49	0.010	0.194	0.05	0.011	0.015	0.77	0.006	0.019	0.30
Consistency	-0.014	0.009	-1.58	-0.008	0.010	-0.82	0.001	0.199	0.01	-0.008	0.015	-0.52	-0.030	0.013	-2.28 *
Group	-0.002	0.020	-0.12	-0.012	0.023	-0.53	-0.036	0.290	-0.13	-0.024	0.028	-0.84	-0.069	0.029	-2.38 *
Context:Consistency	-0.050	0.020	-2.53 *	-0.068	0.028	-2.39 *	0.412	0.411	1.00	-0.039	0.034	-1.17	-0.082	0.040	-2.07 *
Context:Group	-0.017	0.017	-1.01	-0.030	0.019	-1.60	0.118	0.357	0.33	-0.029	0.028	-1.02	-0.008	0.026	-0.32
Consistency:Group	0.002	0.017	0.13	0.007	0.021	0.31	0.227	0.381	0.60	0.022	0.031	0.69	-0.006	0.025	-0.22
Context:Consistency:Group	0.022	0.042	0.51	0.026	0.052	0.51	-0.647	0.737	-0.88	-0.002	0.054	-0.04	-0.036	0.054	-0.67
Post-critical region															
Context	0.001	0.008	0.07	-0.023	0.014	-1.66	0.075	0.181	0.41	-0.006	0.017	-0.37	0.003	0.011	0.23
Consistency	0.008	0.008	1.01	0.039	0.014	2.74 **	-0.700	0.181	-3.87 ***	-0.042	0.017	-2.45 *	-0.019	0.013	-1.49
Group	0.001	0.020	0.06	0.020	0.035	0.57	-0.295	0.340	-0.87	-0.076	0.050	-1.52	-0.064	0.041	-1.58
Context:Consistency	0.008	0.015	0.56	0.052	0.025	2.05 *	-0.278	0.354	-0.79	-0.002	0.046	-0.05	0.009	0.024	0.37
Context:Group	0.017	0.018	0.95	0.020	0.029	0.70	0.159	0.296	0.54	0.047	0.033	1.41	0.001	0.022	0.05
Consistency:Group	-0.010	0.015	-0.70	-0.025	0.028	-0.90	0.249	0.363	0.69	-0.018	0.033	-0.55	-0.030	0.024	-1.23
Context:Consistency:Group	-0.027	0.030	-0.90	-0.016	0.051	-0.32	0.082	0.620	0.13	-0.103	0.070	-1.47	-0.066	0.049	-1.36

Table 4. Mean (SD) values for each reading measure, sentence region, and condition for ASD and TD groups, Experiment 2.

	ASD				TD			
	Counterfactual		Factual		Counterfactual		Factual	
	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent
Pre-critical region								
First fixation duration (ms)	213 (82)	214 (75)	231 (99)	213 (80)	217 (75)	216 (84)	208 (89)	211 (99)
First-pass reading time (ms)	392 (272)	381 (241)	405 (216)	398 (238)	356 (217)	375 (244)	369 (221)	385 (204)
First-pass regressions out (%)	16 (37)	24 (43)	15 (36)	16 (37)	20 (19)	19 (39)	17 (38)	15 (36)
Regression path reading time (ms)	515 (407)	550 (522)	516 (334)	530 (459)	462 (291)	490 (450)	465 (288)	458 (253)
Total reading time (ms)	574 (397)	645 (402)	646 (436)	657 (439)	471 (294)	550 (316)	472 (283)	526 (306)
Critical region								
First fixation duration (ms)	233 (90)	221 (84)	222 (97)	227 (90)	216 (73)	228 (93)	222 (81)	212 (70)
First-pass reading time (ms)	284 (140)	285 (142)	262 (152)	270 (131)	253 (116)	270 (138)	269 (130)	252 (109)
First-pass regressions out (%)	23 (43)	31 (46)	36 (48)	27 (45)	27 (37)	26 (44)	26 (44)	33 (47)
Regression path reading time (ms)	555 (603)	474 (664)	472 (525)	549 (604)	465 (578)	342 (246)	410 (287)	375 (251)
Total reading time (ms)	406 (306)	461 (319)	457 (304)	451 (314)	342 (218)	386 (228)	342 (183)	373 (194)
Post-critical region								
First fixation duration (ms)	249 (121)	241 (114)	249 (133)	248 (115)	231 (89)	243 (108)	220 (84)	248 (110)
First-pass reading time (ms)	518 (336)	515 (385)	547 (408)	535 (395)	451 (275)	477 (304)	461 (293)	469 (318)
First-pass regressions out (%)	60 (49)	63 (49)	60 (49)	61 (49)	50 (50)	60 (49)	44 (50)	57 (50)
Regression path reading time (ms)	1451 (1658)	1664 (1738)	1516 (1729)	1638 (1629)	885 (682)	1178 (1029)	808 (756)	1011 (957)
Total reading time (ms)	772 (453)	799 (527)	774 (566)	781 (543)	609 (371)	640 (399)	584 (342)	627 (395)

Table 5. Model Estimate, Standard Error (SE) and t-value for first pass reading time, regression path and total reading time in each region for Experiment 2, where * $p < .05$, ** $p < .01$, *** $p < .001$.

	First fixation duration			**First-pass reading time**			**First-pass regressions out**			**Regression path reading time**			**Total reading time**		
	Est.	*SE*	*t-value*	*Est.*	*SE*	*t-value*	*Est.*	*SE*	*z-value*	*Est.*	*SE*	*t-value*	*Est.*	*SE*	*t-value*
Pre-critical region															
Context	-0.007	0.009	-0.77	0.024	0.020	1.17	-0.834	0.475	-1.76	0.007	0.018	0.37	0.014	0.017	0.822
Consistency	0.005	0.009	0.56	0.000	0.014	-0.01	0.061	0.344	0.18	-0.006	0.013	-0.46	-0.042	0.012	-3.46 **
Group	-0.008	0.019	-0.45	-0.012	0.027	-0.47	-0.131	0.365	-0.36	-0.023	0.028	-0.84	-0.085	0.030	-2.84 **
Context:Consistency	0.008	0.017	0.47	-0.004	0.028	-0.14	0.023	0.700	0.03	0.020	0.034	0.59	0.031	0.030	1.029
Context:Group	-0.036	0.018	-2.02	-0.011	0.027	-0.40	0.754	0.599	1.26	-0.013	0.024	-0.52	-0.037	0.028	-1.321
Consistency:Group	-0.012	0.017	-0.69	-0.036	0.025	-1.42	0.755	0.597	1.27	0.009	0.028	0.31	-0.018	0.024	-0.74
Context:Consistency:Group	-0.040	0.037	-1.09	-0.014	0.048	-0.29	-1.377	1.147	-1.20	-0.014	0.048	-0.29	-0.051	0.045	-1.13
Critical region															
Context	-0.009	0.009	-0.92	-0.017	0.012	-1.37	0.358	0.181	1.97 *	0.011	0.018	0.64	0.012	0.014	0.88
Consistency	0.001	0.009	0.05	-0.006	0.011	-0.55	-0.248	0.186	-1.33	0.032	0.018	1.79	0.035	0.016	2.15 *
Group	-0.004	0.021	-0.18	-0.015	0.022	-0.68	-0.262	0.244	-1.07	-0.040	0.028	-1.45	-0.054	0.024	-2.29 *
Context:Consistency	0.004	0.019	0.20	0.011	0.031	0.36	0.556	0.355	1.57	-0.077	0.041	-1.91	-0.045	0.038	-1.19
Context:Group	0.003	0.017	0.16	0.035	0.023	1.52	0.462	0.351	1.31	0.019	0.039	0.49	-0.028	0.029	-0.98
Consistency:Group	0.004	0.018	0.23	0.020	0.021	0.96	-0.567	0.336	-1.68	0.018	0.033	0.56	0.023	0.036	0.65
Context:Consistency:Group	0.066	0.034	1.91	0.066	0.046	1.46	-0.693	0.687	-1.01	0.087	0.059	1.48	0.061	0.049	1.25
Post-critical region															
Context	-0.001	0.008	-0.07	0.004	0.017	0.23	-0.166	0.153	-1.08	-0.030	0.018	-1.66	-0.018	0.013	-1.37
Consistency	-0.016	0.009	-1.74	-0.006	0.015	-0.4	-0.369	0.164	-2.24 *	-0.070	0.020	-3.57 **	-0.025	0.014	-1.74
Group	-0.009	0.019	-0.45	-0.045	0.034	-1.31	-0.441	0.346	-1.27	-0.141	0.052	-2.71 **	-0.093	0.037	-2.47 *
Context:Consistency	-0.024	0.019	-1.25	-0.025	0.033	-0.76	-0.012	0.365	-0.03	-0.004	0.043	-0.10	-0.022	0.032	-0.68
Context:Group	-0.010	0.019	-0.51	-0.010	0.027	-0.39	-0.260	0.310	-0.84	-0.076	0.042	-1.80	0.013	0.029	0.45
Consistency:Group	-0.031	0.021	-1.51	-0.033	0.030	-1.13	-0.461	0.339	-1.36	-0.034	0.035	-0.96	-0.011	0.029	-0.67
Context:Consistency:Group	-0.011	0.035	-0.31	0.050	0.057	0.89	-0.593	0.622	-0.95	0.054	0.072	0.75	0.028	0.056	0.5

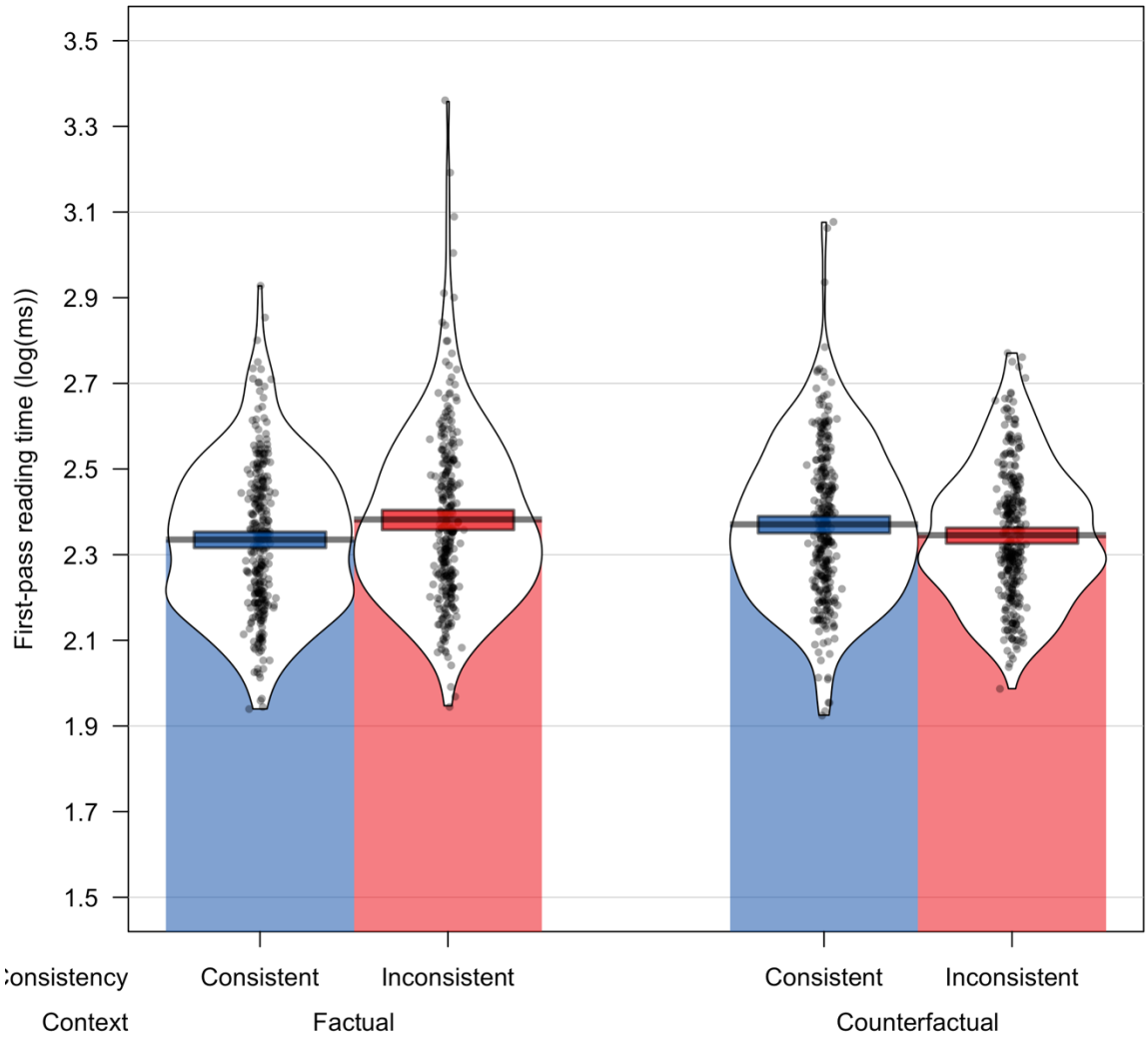

Figure 1. Log-transformed first-pass reading times (ms) on the critical region in Experiment 1, showing raw data points, a horizontal line reflecting the condition mean, a bean showing smoothed density, and a rectangle representing the Bayesian highest density interval.

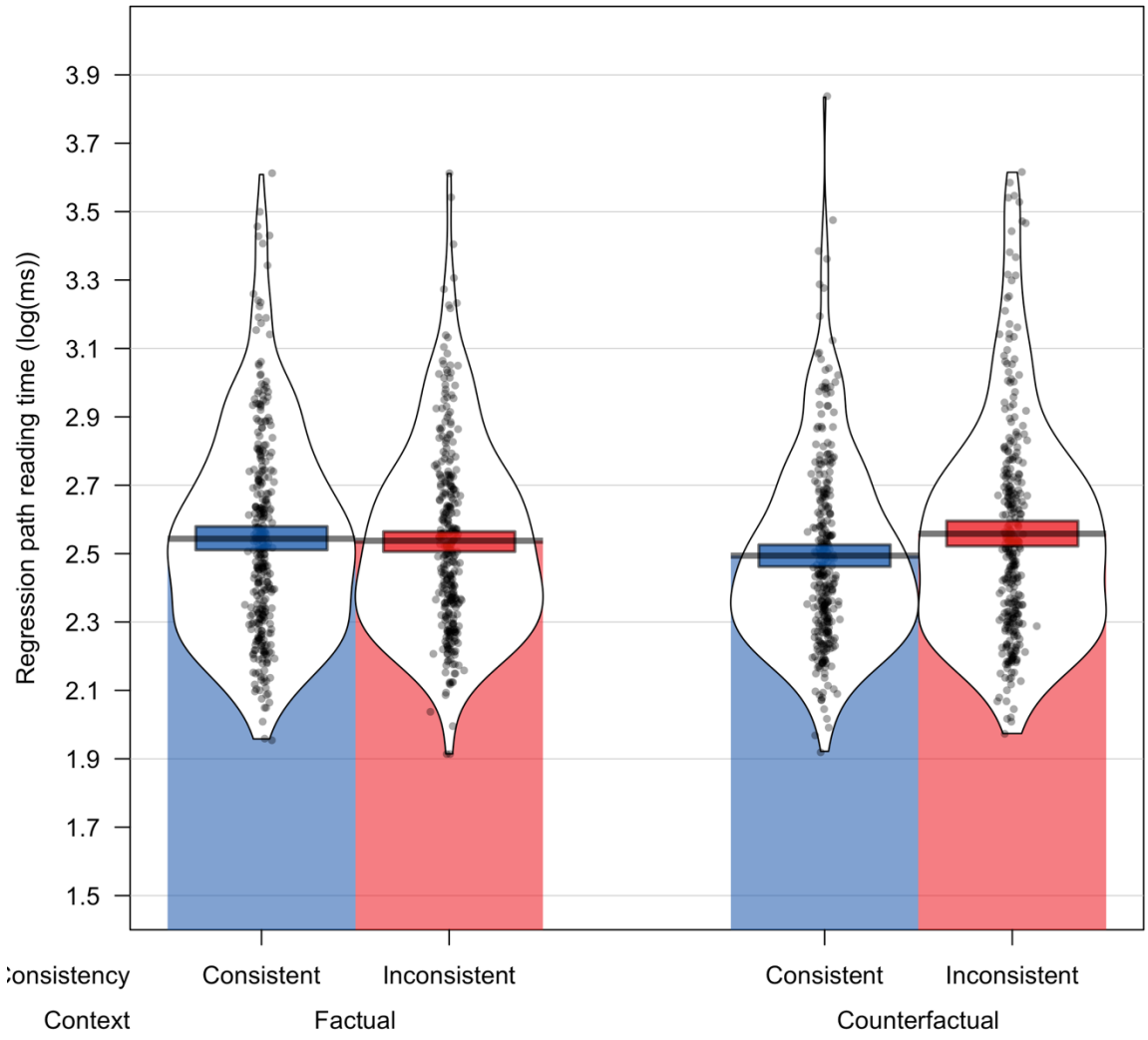

Figure 2. Log-transformed regression path reading times (ms) on the critical region in Experiment 2, showing raw data points, a horizontal line reflecting the condition mean, a bean showing smoothed density, and a rectangle representing the Bayesian highest density interval.

Appendix

Experimental items and comprehension questions used in Experiment 1. Note that for each of the items below, conditions are listed in the order: counterfactual-consistent, counterfactual-inconsistent, factual-consistent, factual-inconsistent.

1
If foreign language courses only taught artistic skills, a student could take a foreign language course to improve his painting and make his parents proud.
If foreign language courses only taught artistic skills, a student could take a foreign language course to improve his French and make his parents proud.
Because foreign language courses only teach language skills, a student can take a foreign language course to improve his French and make is parents proud.
Because foreign language courses only teach language skills, a student can take a foreign language course to improve his painting and make is parents proud.

2
If shoe shops only sold flowers, husbands could go to a shoe shop to buy some roses for their wives.
If shoe shops only sold flowers, husbands could go to a shoe shop to buy some trainers for their wives
Because shoe shops only sell shoes, husbands can go a shoe shop to buy some trainers for their wives.
Because shoe shops only sell shoes, husbands can go a shoe shop to buy some roses for their wives.

3
If a hearing aid restored a person's vision, Kelvin could wear a hearing aid to help him see and he would be relieved.
If a hearing aid restored a person's vision, Kelvin could wear a hearing aid to help him hear and he would be relieved.
Because a hearing aid restores a person's hearing, Kelvin can wear a hearing aid to help him hear and he is relieved.
Because a hearing aid restores a person's hearing, Kelvin can wear a hearing aid to help him see and he is relieved.

Where do you wear a hearing aid? Ears < > Eyes

4
If the sun only came out during the night, people could sunbathe on the beach at midnight and wear lots of sunscreen.
If the sun only came out during the night, people could sunbathe on the beach at midday and wear lots of sunscreen.
Because the sun only comes out during the day, people can sunbathe on the beach at midday and wear lots of sunscreen.
Because the sun only comes out during the day, people can sunbathe on the beach at midnight and wear lots of sunscreen.

Where might people sunbathe? On the beach < > In bed

5
If sheep were not herbivores, farmers could leave their flock in the field to eat rabbits and concentrate on other farm work.
If sheep were not herbivores, farmers could leave their flock in the field to eat grass and concentrate on other farm work.
Because sheep are herbivores, farmers can leave their flock in the field to eat grass and concentrate on other farm work.
Because sheep are herbivores, farmers can leave their flock in the field to eat rabbits and concentrate on other farm work.

6
If footballers were not allowed to touch the ball with their feet, footballers could pass the ball by throwing it and run into a clear space.
If footballers were not allowed to touch the ball with their feet, footballers could pass the ball by kicking it and run into a clear space.
Because footballers are only allowed to touch the ball with their feet, footballers can pass the ball by kicking it and run into a clear space.
Because footballers are only allowed to touch the ball with their feet, footballers can pass the ball by throwing it and run into a clear space.

7
If sharks were not man-eaters, parents would consider swimming with sharks as harmless and tell their children.
If sharks were not man-eaters, parents would consider swimming with sharks as dangerous and tell their children.
Because sharks are man-eaters, parents consider swimming with sharks as dangerous and tell their children.
Because sharks are man-eaters, parents consider swimming with sharks as harmless and tell their children.

8
If tooth cavities were caused by eating vegetables, dentists would warn children about the dangers of eating carrots and they would take note.
If tooth cavities were caused by eating vegetables, dentists would warn children about the dangers of eating cakes and they would take note.
Because tooth cavities are caused by eating sugar, dentists can warn children about the dangers of eating cakes and they take note.
Because tooth cavities are caused by eating sugar, dentists can warn children about the dangers of eating carrots and they take note.

Who do you visit if you have a toothache? Mechanic < > Dentist

9
If humans used their feet to write, students could write an essay holding the pen with their toes and get a good grade.
If humans used their feet to write, students could write an essay holding the pen with their fingers and get a good grade.
Because humans use their hands to write, students can write an essay holding a pen with their fingers and get a good grade.
Because humans use their hands to write, students can write an essay holding a pen with their

toes and get a good grade.

10
If tigers were not carnivores, zookeepers could feed the tigers a bucket of turnips for dinner every evening.
If tigers were not carnivores, zookeepers could feed the tigers a bucket of chicken for dinner every evening.
Because tigers are carnivores, zookeepers can feed the tigers a bucket of chicken for dinner every evening.
Because tigers are carnivores, zookeepers can feed the tigers a bucket of turnips for dinner every evening.

11
If all flowers grew out of books, students could pick flowers from the library and give them to their mothers.
If all flowers grew out of books, students could pick flowers from the garden and give them to their mothers.
Because flowers grow out of soil, students can pick flowers from the garden and give them to their mothers.
Because flowers grow out of soil, students can pick flowers from the library and give them to their mothers.

12
If a fridge were designed to heat food, Mum could put chicken in the fridge to keep warm and serve it later.
If a fridge were designed to heat food, Mum could put chicken in the fridge to keep cool and serve it later.
Because a fridge is designed to chill food, Mum can put the chicken in the fridge to keep cool and serve it later.
Because a fridge is designed to chill food, Mum can put the chicken in the fridge to keep warm and serve it later.

13
If our ears had evolved to detect odours, you could put plugs in your ears to stop smelling the things around you.
If our ears had evolved to detect odours, you could put plugs in your ears to stop hearing the things around you.
Because our ears have evolved to detect sounds, you can put plugs in your ears to stop hearing the things around you.
Because our ears have evolved to detect sounds, you can put plugs in your ears to stop smelling the things around you.

What part of your head are your ears on? Front < > Sides

14
If Australia were inhabited by dinosaurs, tourists could go to Australia to see a triceratops and buy special souvenirs.
If Australia were inhabited by dinosaurs, tourists could go to Australia to see a kangaroo and buy special souvenirs.
Because Australia is inhabited by marsupials, tourists can go to Australia to see a kangaroo

and buy special souvenirs.
Because Australia is inhabited by marsupials, tourists can go to Australia to see a triceratops and buy special souvenirs.

15
If caffeine was the only illegal drug in the UK, Ryan could be arrested for possession of coffee and maybe go to prison.
If caffeine was the only illegal drug in the UK, Ryan could be arrested for possession of heroin and maybe go to prison.
Because opiates are illegal drugs in the UK, Ryan could be arrested for possession of heroin and maybe go to prison.
Because opiates are illegal drugs in the UK, Ryan could be arrested for possession of coffee and maybe go to prison.

Which of these drugs is illegal? Cannabis < > Ibuprofen

16
If books provided information orally when opened, students could get information from books by listening and pass their exams.
If books provided information orally when opened, students could get information from books by reading and pass their exams.
Because books provide information in written form, students can get information from books by reading and pass their exams.
Because books provide information in written form, students can get information from books by listening and pass their exams.

17
If most vehicles ran on fizzy drinks, drivers could fill their car with cola before their journey.
If most vehicles ran on fizzy drinks, drivers could fill their car with petrol before their journey.
Because most vehicles run on oil derivatives, drivers can fill their cars with petrol before their journey.
Because most vehicles run on oil derivatives, drivers can fill their cars with cola before their journey.

Which of these would you put in your car? Milk < > Petrol

18
If the moon were really made of cheese, spacemen could fly to the moon to collect stilton and analyse the specimen.
If the moon were really made of cheese, spacemen could fly to the moon to collect stones and analyse the specimen.
Because the moon is made of rock, spacemen can fly to the moon to collect stones and analyse the specimen.
Because the moon is made of rock, spacemen can fly to the moon to collect stilton and analyse the specimen.

What is the moon? A satellite < > A planet

19

If birds evolved with fins instead of wings, seagulls could teach their young how to swim and steal food from people.
If birds evolved with fins instead of wings, seagulls could teach their young how to fly and steal food from people.
Because birds evolved with wings, seagulls can teach their young how to fly and steal food from people.
Because birds evolved with wings, seagulls can teach their young how to swim and steal food from people.

Where are you more likely to find a seagull? At the beach < > Up a mountain

20
If onions were not a savoury food, people could use fresh onions to make a dessert and serve it to guests.
If onions were not a savoury food, people could use fresh onions to make a casserole and serve it to guests.
Because onions are a savoury food, people can use fresh onions to make a casserole and serve it to guests.
Because onions are a savoury food, people can use fresh onions to make a dessert and serve it to guests.

21
If glass were not brittle, Tom could stamp on a sheet of glass to make it bend if he was angry.
If glass were not brittle, Tom could stamp on a sheet of glass to make it shatter if he was angry.
Because glass is brittle, Tom can stamp on a sheet of glass to make it shatter if he was angry.
Because glass is brittle, Tom can stamp on a sheet of glass to make it bend if he was angry.

What can you use glass for? Clothing < > Windows

22
If vets were only trained to treat mythical animals, vets could learn how to treat injured unicorns and write books to teach others.
If vets were only trained to treat mythical animals, vets could learn how to treat injured puppies and write books to teach others.
Because vets are only trained to treat animals, vets can learn how to treat injured puppies and write books to teach others.
Because vets are only trained to treat animals, vets can learn how to treat injured unicorns and write books to teach others.

Who do vets look after? Animals < > People

23
If houses were built from ice, a house fire would cause the walls to melt and firemen would be called.
If houses were built from ice, a house fire would cause the walls to burn and firemen would be called.
Because houses are built from brick and wood, a house fire can cause the walls to burn and firemen need to be called.

Because houses are built from brick and wood, a house fire can cause the walls to melt and firemen need to be called.

What should you do in a house fire? Sleep < > Evacuate

24
If Jane did not want her hair cut by a professional, she could have her hair cut by a waitress and show it off at parties.
If Jane did not want her hair cut by a professional, she could have her hair cut by a hairdresser and show it off at parties.
Because Jane wants her hair cut by a professional, she can have her hair cut by a hairdresser and show it off at parties.
Because Jane wants her hair cut by a professional, she can have her hair cut by a waitress and show it off at parties.

25
If cats were not carnivores, families could feed their cat a bowl of in carrots and listen to it purr happily.
If cats were not carnivores, families could feed their cat a bowl of in meat and listen to it purr happily.
Because cats are carnivores, families can feed their cat a bowl of in meat and listen to it purr happily.
Because cats are carnivores, families can feed their cat a bowl of in carrots and listen to it purr happily.

How often should you feed a cat? Daily < > Monthly

26
If spiders had wings instead of legs, a tarantula could chase its prey by flying and take it to its nest.
If spiders had wings instead of legs, a tarantula could chase its prey by running and take it to its nest.
Because spiders have lots of legs, a tarantula can chase its prey by running and take it to its nest.
Because spiders have lots of legs, a tarantula can chase its prey by flying and take it to its nest.

What do spiders eat? Chickens < > Insects

27
If nail varnish were for use on the face, Aditi could paint sparkly pink nail varnish onto her in eyelids and look beautiful all night long.
If nail varnish were for use on the face, Aditi could paint sparkly pink nail varnish onto her in nails and look beautiful all night long.
Because nail varnish is for use on the hands, Aditi can paint sparkly pink nail varnish onto her nails and look beautiful all night long.
Because nail varnish is for use on the hands, Aditi can paint sparkly pink nail varnish onto her eyelids and look beautiful all night long.

28

If margarine contained soap, Mum could use a tub of Flora in her in washing and feel pleased with the results.
If margarine contained soap, Mum could use a tub of Flora in her in baking and feel pleased with the results.
Because margarine contains oil, Mum can use a tub of Flora in her baking and feel pleased with the results.
Because margarine contains oil, Mum can use a tub of Flora in her washing and feel pleased with the results.

What colour is margarine? Yellow < > Blue

29
If schools only taught wizarding skills, pupils could go to school to learn magic and get homework.
If schools only taught wizarding skills, pupils could go to school to learn maths and get homework.
Because schools teach academic skills, pupils can go to school to learn maths and get homework.
Because schools teach academic skills, pupils can go to school to learn magic and get homework.

What is the main purpose of schools? Cookery < > Education

30
If flu symptoms needed surgery to be alleviated, doctors would cure a headache with an operation and expect a quick recovery.
If flu symptoms needed surgery to be alleviated, doctors would cure a headache with an aspirin and expect a quick recovery.
Because flu symptoms need medication to be alleviated, doctors can cure a headache with an aspirin and expect a quick recovery.
Because flu symptoms need medication to be alleviated, doctors can cure a headache with an operation and expect a quick recovery.

Which of these is a symptom of the flu? Aches < > A rash

31
If a ferry were a flying vessel, a ferry could travel across the Atlantic Ocean in the air and reach America.
If a ferry were a flying vessel, a ferry could travel across the Atlantic Ocean in the sea and reach America.
Because a ferry is a sailing vessel, a ferry can travel across the Atlantic Ocean in the sea and reach America.
Because a ferry is a sailing vessel, a ferry can travel across the Atlantic Ocean in the air and reach America.

32
If Greenland had really hot winters, we could go to Greenland in November to sunbathe and escape work for a week.
If Greenland had really hot winters, we could go to Greenland in November to sledge and escape work for a week.

Because Greenland has really cold winters, we can go to Greenland in November to sledge and escape work for a week.
Because Greenland has really cold winters, we can go to Greenland in November to sunbathe and escape work for a week.

Experimental items and comprehension questions used in Experiment 2. Note that for each of the items below, conditions are listed in the order: counterfactual-consistent, counterfactual-inconsistent, factual-consistent, factual-inconsistent.

1
If Harry Potter lost all his magic powers, he would use a broom to sweep around Hogwarts.
If Harry Potter lost all his magic powers, he would use a broom to fly around Hogwarts.
Because Harry Potter has magic powers, he uses a broom to fly around Hogwarts.
Because Harry Potter has magic powers, he uses a broom to sweep around Hogwarts.

2
If Cinderella's fairy Godmother had never appeared, she would have used the pumpkin to make a soup the night of the ball.
If Cinderella's fairy Godmother had never appeared, she would have used the pumpkin to make a carriage the night of the ball.
Because Cinderella's fairy Godmother appeared to her, she used the pumpkin to make a carriage the night of the ball.
Because Cinderella's fairy Godmother appeared to her, she used the pumpkin to make a soup the night of the ball.

Who did Cinderella live with? Stepmother < > Stepfather

3
If Jack's beans had not been magical, his beanstalk would have grown to 3 feet high and he'd feel very proud.
If Jack's beans had not been magical, his beanstalk would have grown to 3 miles high and he'd feel very proud.
Because Jack's beans were magical, his beanstalk had grown to 3 miles high and he'd felt very proud.
Because Jack's beans were magical, his beanstalk had grown to 3 feet high and he'd felt very proud.

What did Jack find at the top of his beanstalk? A giant < > Dinosaurs

4
If Pinocchio was a real boy, his body would have been made of flesh and he'd live with Geppetto.
If Pinocchio was a real boy, his body would have been made of wood and he'd live with Geppetto.
Because Pinocchio was a puppet, his body had been made of wood and he lived with Geppetto.
Because Pinocchio was a puppet, his body had been made of flesh and he lived with Geppetto.

5
If the third Little Pig's house had been made of feathers and not bricks, the wolf would have blown it down when he huffed and puffed.
If the third Little Pig's house had been made of feathers and not bricks, the wolf would have given up when he huffed and puffed.
Because the third Little Pig's house had been made of bricks and not feathers, the wolf had given up when he huffed and puffed.
Because the third Little Pig's house had been made of bricks and not feathers, the wolf had blown it down when he huffed and puffed.

What animal wanted to eat the little pigs? Wolf < > Tiger

6
If Minions did not get along with each other, Minions would always work alone in the lab.
If Minions did not get along with each other, Minions would always work together in the lab.
Because Minions get along with each other, Minions always work together in the lab.
Because Minions get along with each other, Minions always work alone in the lab.

Who do the Minions work for? Gru < > Putin

7
If the Incredible Hulk lost his extreme strength, lifting up a car would be impossible when he was angry.
If the Incredible Hulk lost his extreme strength, lifting up a car would be effortless when he was angry.
Because the Incredible Hulk is extremely strong, lifting up a car is effortless when he is angry.
Because the Incredible Hulk is extremely strong, lifting up a car is impossible when he is angry.

What colour does the Incredible Hulk turn when he is angry? Green < > Blue

8
If Fred Flintstone lived in the modern age, he would drive a car powered by petrol to get places.
If Fred Flintstone lived in the modern age, he would drive a car powered by his feet to get places.
Because Fred Flintstone lives in prehistoric times, he drives a car powered by his feet to get places.
Because Fred Flintstone lives in prehistoric times, he drives a car powered by petrol to get places.

What is the name of Fred Flintstone’s best friend? Barney Rubble < > Bart Simpson

9
If Aladdin had not found the magical lamp in the cave, marrying Princess Jasmine would have been very hard for him.
If Aladdin had not found the magical lamp in the cave, marrying Princess Jasmine would have been very easy for him.

Because Aladdin had found the magical lamp in the cave, marrying Princess Jasmine was very easy for him.
Because Aladdin had found the magical lamp in the cave, marrying Princess Jasmine was very hard for him.

Who helped Aladdin? Genie < > Fairy Godmother

10
If Ariel was a human girl and not a mermaid, she would have legs and beautiful long hair.
If Ariel was a human girl and not a mermaid, she would have a tail and beautiful long hair.
Because Ariel is a mermaid and not a human girl, she has a tail and beautiful long hair.
Because Ariel is a mermaid and not a human girl, she has legs and beautiful long hair.

Mermaids are half human. What is the other half? Fish < > Horse

11
If the Grinch loved Christmas, the Grinch would look forward to giving presents every year.
If the Grinch loved Christmas, the Grinch would look forward to stealing presents every year.
Because the Grinch hates Christmas, the Grinch looks forward to stealing presents every year.
Because the Grinch hates Christmas, the Grinch looks forward to giving presents every year.

12
If Mary Poppins was like any other nanny, she would use her umbrella to shelter on the way home.
If Mary Poppins was like any other nanny, she would use her umbrella to fly on the way home.
Because Mary Poppins is a magical nanny, she uses her umbrella to fly on the way home.
Because Mary Poppins is a magical nanny, she uses her umbrella to shelter on the way home.

13
If Robin Hood abided by the law, the Sheriff of Nottingham would have had the utmost respect towards him.
If Robin Hood abided by the law, the Sheriff of Nottingham would have had the utmost hatred towards him.
Because Robin Hood was an outlaw, the Sheriff of Nottingham had the utmost hatred towards him.
Because Robin Hood was an outlaw, the Sheriff of Nottingham had the utmost respect towards him.

Who did Robin Hood steal from? The poor < > The rich

14
If Superman was hard of hearing, knowing when people were in trouble miles away would have been very difficult for him.
If Superman was hard of hearing, knowing when people were in trouble miles away would have been very easy for him.
Because Superman has super hearing powers, knowing when people are in trouble miles away is very easy for him.

Because Superman has super hearing powers, knowing when people are in trouble miles away is very difficult for him.

What is the name of Superman's alter ego? Dwayne Dibly < > Clark Kent

15
If Tinkerbell was the size of a human girl, she would measure around five feet in height.
If Tinkerbell was the size of a human girl, she would measure around five inches in height.
Because Tinkerbell was a fairy, she measured around five inches in height.
Because Tinkerbell was a fairy, she measured around five feet in height.

What colour is Tinkerbell's dress? Red < > Green

16
If Cupid's arrows were tipped with poison, the people he struck would fall down dead where they stood.
If Cupid's arrows were tipped with poison, the people he struck would fall in love where they stood.
Because Cupid's arrows are magical and tipped with gold, the people he strikes fall in love where they stand.
Because Cupid's arrows are magical and tipped with gold, the people he strikes fall down dead where they stand.

17
If Hagrid didn't have any giants blood in him, his height would be about six feet when he stood up.
If Hagrid didn't have any giants blood in him, his height would be about nine feet when he stood up.
Because Hagrid has giants blood in him, his height is about nine feet when he stands up.
Because Hagrid has giants blood in him, his height is about six feet when he stands up.

18
If Mickey was an ordinary mouse, he would move around on four legs and enjoy cheese.
If Mickey was an ordinary mouse, he would move around on two legs and enjoy cheese.
Because Mickey is a special mouse, he moves around on two legs and enjoys cheese.
Because Mickey is a special mouse, he moves around on four legs and enjoys cheese.

What is the name of Mickey Mouse's girlfriend? Cheryl < > Minnie

19
If Wolverine did not have regenerative abilities, a knife wound would be fatal for him.
If Wolverine did not have regenerative abilities, a knife wound would be safe for him.
Because Wolverine has regenerative abilities, a knife wound is safe for him.
Because Wolverine has regenerative abilities, a knife wound is fatal for him.

Which superhero group was Wolverine part of? The Justice League < > The X-Men

20
If Alice had not fallen asleep and gone to Wonderland, Alice would have had tea with her sister in the afternoon.

If Alice had not fallen asleep and gone to Wonderland, Alice would have had tea with the mad hatter in the afternoon.
Because Alice fell asleep and went to Wonderland, Alice had tea with the mad hatter in the afternoon.
Because Alice fell asleep and went to Wonderland, Alice had tea with her sister in the afternoon.

Who did Alice follow into Wonderland? White puppy < > White rabbit

21
If Rapunzel had very short hair, the prince would have had to visit her by climbing a ladder to the tower.
If Rapunzel had very short hair, the prince would have had to visit her by climbing her hair to the tower.
Because Rapunzel had very long hair, the prince visited her by climbing her hair to the tower.
Because Rapunzel had very long hair, the prince visited her by climbing a ladder to the tower.

22
If Peter Pan grew old, he would live in Dorset and be friends with the other residents.
If Peter Pan grew old, he would live in Neverland and be friends with the other residents.
Because Peter Pan never grew old, he lived in Neverland and was friends with the other residents.
Because Peter Pan never grew old, he lived in Dorset and was friends with the other residents.

23
If Dr Jekyll never turned into Mr Hyde, his friends would say his character was very stable when they spoke about him.
If Dr Jekyll never turned into Mr Hyde, his friends would say his character was very unpredictable when they spoke about him.
Because Dr Jekyll turned into Mr Hyde, his friends said his character was very unpredictable when they spoke about him.
Because Dr Jekyll turned into Mr Hyde, his friends said his character was very stable when they spoke about him.

24
If Batman drove an ordinary car, he could get a Vauxhall to travel around Gotham City.
If Batman drove an ordinary car, he could get a Batmobile to travel around Gotham City.
Because Batman drives a special car, he has a Batmobile to travel around Gotham City.
Because Batman drives a special car, he has a Vauxhall to travel around Gotham City.

Where did Batman live? Metropolis < > Gotham City

25
If Cinderella had not lost her glass slipper, finding her would have been impossible for the Prince.
If Cinderella had not lost her glass slipper, finding her would have been easy for the Prince.
Because Cinderella had lost her glass slipper, finding her had been easy for the Prince.

Because Cinderella had lost her glass slipper, finding her would have been impossible for the Prince.

26
If Spiderman lost his ability to stick to surfaces, he would climb tall buildings with a rope and surprise his enemies.
If Spiderman lost his ability to stick to surfaces, he would climb tall buildings with his fingers and surprise his enemies.
Because Spiderman has an ability to stick to surfaces, he can climb tall buildings with his fingers and surprise his enemies.
Because Spiderman has an ability to stick to surfaces, he can climb tall buildings with a rope and surprise his enemies.

27
If the wardrobe in the Professor's house did not lead to Narnia, when she looked inside Susan would have seen warm clothes and shown Peter.
If the wardrobe in the Professor's house did not lead to Narnia, when she looked inside Susan would have seen mythical animals and shown Peter.
Because the wardrobe in the Professor's house lead to Narnia, when she looked inside Susan had seen mythical animals and shown Peter.
Because the wardrobe in the Professor's house lead to Narnia, when she looked inside Susan had seen warm clothes and shown Peter.

28
If Dr Who was a medical doctor and not a Time Lord, he would use the Tardis to make phone calls when he needed.
If Dr Who was a medical doctor and not a Time Lord, he would use the Tardis to time travel when he needed.
Because Dr Who is a Time Lord and not a medical doctor, he uses the Tardis to time travel when he needs to.
Because Dr Who is a Time Lord and not a medical doctor, he uses the Tardis to make phone calls when he needs to.

29
If Elsa lost her ability to control snow and ice with her hands, she would give her sister a big cuddle and play all day.
If Elsa lost her ability to control snow and ice with her hands, she would give her sister a big snowman and play all day.
Because Elsa has an ability to control snow and ice with her hands, she can give her sister a big snowman and play all day.
Because Elsa has an ability to control snow and ice with her hands, she can give her sister a big cuddle and play all day.

What is the name of Elsa’s sister in Frozen? Marjorie < > Anna

30
If Edward Cullen had not been transformed into a vampire, he would have lived for 70 years along with his family.
If Edward Cullen had not been transformed into a vampire, he would have lived for centuries along with his family.

Because Edward Cullen was transformed into a vampire, he had lived for centuries along with his family.
Because Edward Cullen was transformed into a vampire, he had lived for 70 years along with his family.

31
If Gandalf the wizard lost his magical powers, he would use his staff as a walking aid and carry it everywhere with him.
If Gandalf the wizard lost his magical powers, he would use his staff as a wand and carry it everywhere with him.
Because Gandalf the wizard has magical powers, he uses his staff as a wand and carries it everywhere with him.
Because Gandalf the wizard has magical powers, he uses his staff as a walking aid and carries it everywhere with him.

32
If Garfield was an ordinary cat, his owner would feed him Whiskas and stroke his fur.
If Garfield was an ordinary cat, his owner would feed him lasagne and stroke his fur.
Because Garfield is not an ordinary cat, his owner feeds him lasagne and strokes his fur.
Because Garfield is not an ordinary cat, his owner feeds him Whiskas and strokes his fur.