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The emotional impact of verbal irony: Eye-tracking evidence for a two-stage process

Ruth Filik [a,*], Emily Brightman [a], Chloe Gathercole [a], Hartmut Leuthold [b]

[a] School of Psychology, University of Nottingham, UK
[b] Department of Psychology, University of Tübingen, Germany

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ABSTRACT

In this paper we investigate the socio-emotional functions of verbal irony. Specifically, we use eye-tracking while reading to assess moment-to-moment processing of a character's emotional response to ironic versus literal criticism. In Experiment 1, participants read stories describing a character being upset following criticism from another character. Results showed that participants initially more easily integrated a hurt response following *ironic* criticism; but later found it easier to integrate a hurt response following *literal* criticism. In Experiment 2, characters were instead described as having an amused response, which participants ultimately integrated more easily following ironic criticism. From this we propose a two-stage process of emotional responding to irony: While readers may initially expect a character to be more hurt by ironic than literal criticism, they ultimately rationalize ironic criticism as being less hurtful, and more amusing.

Introduction

Irony is a form of indirect language, used when the speaker or writer expresses one thing, but implies another (usually the opposite, e.g., Grice, 1975). A classic example would be uttering "What lovely weather!", when the conditions outside are somewhat disappointing. Sarcasm is a specific form of irony, which is used when the target of the comment is a person, with the intent to criticize (Kreuz & Glucksberg, 1989; Leggitt & Gibbs, 2000; Wilson, 2013). An example would be if you had just done something stupid, and your friend laughs and says, "That was clever!". Thus, it is clear that sarcasm is a form of ironic language that is strongly related to emotion (see also Shamay-Tsoory, Tomer, & Aharon-Peretz, 2005), and is likely to serve complex communicative functions that would not be achieved by speaking directly (e.g., Brown & Levinson, 1987; Colston, 1997; Dews & Winner, 1995; Leech, 1983). For instance, your friend might not only intend to criticize your behavior but also to induce a certain emotional response to his or her sarcastic comment (e.g., amusement). Experience shows, however, that as a recipient of sarcasm, one's emotional response might be quite different from what was intended by the speaker, highlighting the need to examine the socio-emotional functions of sarcasm from these different perspectives. To date, insights into the emotional impact of ironic language have been principally gained from questionnaire studies, thus, not much is known about the time course and underlying processing mechanisms. Here, we address these issues by analyzing participants' eye movements while they are reading, in order to examine their moment-to-moment expectations regarding the emotional impact of ironic versus literal criticism as described from the perspective of both the recipient and the speaker.

In tackling these questions, we take advantage of insights gained from text comprehension research, in

* Corresponding author at: School of Psychology, The University of Nottingham, University Park, Nottingham NG7 2RD, UK. Fax: +44 (0)115 951 5324.
E-mail address: ruth.filik@nottingham.ac.uk (R. Filik).

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which it is generally assumed that readers construct a coherent mental representation of the people, objects, and events being described in the text, that is, a so-called situation model (e.g., Kintsch, 1988; Van Dijk & Kintsch, 1983). Situation models are held to encode various text dimensions such as time, space, causation, motivation, as well as information about the intentions and emotions of story characters (e.g., Zwaan & Radvansky, 1998). Crucially, this allows readers to generate inferences (e.g., McKoon & Ratcliff, 1992) and to thus anticipate the likely behavior or emotional responses of the characters that are being described. Early evidence to suggest that readers do in fact keep track of a character's likely emotional state comes from self-paced reading studies (e.g., de Vega, León, & Diáz, 1996; Gernsbacher, Goldsmith, & Robertson, 1992; Gernsbacher, Hallada, & Robertson, 1998), showing that reading times were longer for sentences that contained emotion words that were inconsistent rather than consistent with the emotional state implied by the context (e.g., someone enjoying the perfect end-of-year party feeling sad vs. happy, respectively). More recent neuroscientific studies support these findings (e.g., Ferstl, Rinck, & von Cramon, 2005) and furthermore, have demonstrated that readers can rapidly detect when characters do not show the anticipated emotional response to a situation (e.g., Leuthold, Filik, Murphy, & Mackenzie, 2012).

In relation to perspective effects, the nature of the situation model that is constructed may depend on the perspective adopted by the reader (cf. Zwaan & Rapp, 2006). For instance, it has been shown that the items recalled in a memory test can depend on whether participants read a story from the perspective of a potential homebuyer versus that of a burglar (Anderson & Pichert, 1978; Pichert & Anderson, 1977). Similarly, using a text-change detection paradigm, Bohan, Filik, MacArthur, and McClusky (2009) showed that changes to perspective-relevant words were more frequently detected than those that were perspective-irrelevant. Thus, findings from these separate strands of research on emotion, and on perspective, suggest that readers build a situation model that allows them to anticipate the likely emotional responses of story characters, and that the nature of the model depends on the perspective that is taken. However, it is unclear at present whether the perspective adopted by the reader also influences which and to what degree specific emotional responses are anticipated.

In relation to the current study, it seems likely that expectations regarding the emotional impact of criticism may be quite different depending on whether one takes the perspective of the victim of the comment, or of the protagonist. For example, Bowes and Katz (2011) found that although ironic and literal criticism were both judged as being relatively impolite, they were judged as more so when viewed from the victim's than from the protagonist's perspective. Perhaps underlying this difference is the observation that intent (e.g., intending to hurt) is central to the protagonist perspective, and emotional impact (e.g., feeling hurt) is central to the victim perspective (Toplak & Katz, 2000).

The results of similar previous studies of emotional responses to ironic versus literal criticism have led to a debate concerning whether ironic language is used to enhance or to mute the positive or negative nature of a message, compared to literal language. For example, Dews and Winner (1995) found in their rating study that ironic criticism (e.g., *That was just terrific*) was judged as less critical than a corresponding literal statement (e.g., *That was just awful*), suggesting that an attack becomes less negative when delivered ironically (see also Dews, Kaplan, & Winner, 1995; Filik et al., 2016; Harris & Pexman, 2003; Jorgensen, 1996; Matthews, Hancock, & Dunham, 2006). From this, Dews and Winner developed the *Tinge Hypothesis*, which states that in the case of ironic criticism, the (negative) ironic meaning is 'tinged' with the (positive) literal meaning of the expression (e.g., of *terrific*), thereby reducing the perceived negativity of the statement.

An alternative view is that irony (in particular, sarcasm) may actually *enhance* the negative emotions felt by the recipient of the criticism (e.g., Blasko & Kazmerski, 2006; Bowes & Katz, 2011; Colston, 1997; Kreuz, Long, & Church, 1991; Leggitt & Gibbs, 2000; Toplak & Katz, 2000). Specifically, it has been argued that the use of irony conveys information relating to the speaker's attitude towards the recipient, being especially appropriate if the speaker wishes to convey a hostile attitude towards the addressee (Lee & Katz, 1998). Thus, in contrast to the tinge hypothesis, this view suggests that being on the receiving end of ironic compared to literal criticism is likely to provoke an enhanced negative emotional response (e.g., be more hurtful).

Most previous studies of emotional responses to criticism have principally involved participants rating how the recipient of such a comment would feel, that is, the task draws attention to the emotional content of the stimuli and allows time for reflection. In the current study, we are interested in how readers process a character's emotional response to criticism 'on-line'. Some recent research has used on-line methodologies, such as eye-tracking while reading, to examine the time course of processes involved in computing the meaning of an ironic utterance (e.g., Au-Yeung, Kaakinen, Liversedge, & Benson, 2015; Filik, Leuthold, Wallington, & Page, 2014; Filik & Moxey, 2010; Kaakinen, Olkoniemi, Kinnari, & Hyönä, 2014; Olkoniemi, Ranta, & Kaakinen, 2016; Turcan & Filik, in press). These studies have principally focused on reporting reading times on the ironic comment itself compared to a non-ironic counterpart, and as a result, much has been learned about the on-line processing of ironic versus literal remarks. What is less clear, and therefore the focus of the current study, is how readers process a character's subsequent emotional response to such remarks. Thus, here we apply such on-line methods to study the time course of the emotional impact of using irony.

Specifically, to allow for a detailed examination of the moment-to-moment inferences regarding a character's emotional response that might be expected following ironic compared to literal criticism, from both the victim's and protagonist's perspective, we will monitor participants' eye movements while they are reading a series of short stories (see Table 1 for example scenarios). In Experiment 1, participants will be presented with scenarios in which one character criticizes another character, either literally or ironically, followed by a target sentence that describes either the recipient's hurt response

Table 1
Example material for Experiment 1 (Critical Word in Bold, Forward Slashes Denote Analysis Regions).

Literal Victim	Charlie was desperately trying to undo the lid of a jar, but was having difficulty with it. Ray said to him, "You're so weak." Charlie felt that this was a/ very $_{\text{pre-critical}}$/ **mean**," $_{\text{critical}}$/ thing to say. $_{\text{post-critical}}$/
Protagonist	Charlie was desperately trying to undo the lid of a jar, but was having difficulty with it. Ray said to him, "You're so weak." Ray had intended for this to be a/ very $_{\text{pre-critical}}$/ **mean**," $_{\text{critical}}$/ thing to say. $_{\text{post-critical}}$/
Ironic Victim	Charlie was desperately trying to undo the lid of a jar, but was having difficulty with it. Ray said to him, "You're so strong." Charlie felt that this was a/ very $_{\text{pre-critical}}$/ **mean**," $_{\text{critical}}$/ thing to say. $_{\text{post-critical}}$/
Protagonist	Charlie was desperately trying to undo the lid of a jar, but was having difficulty with it. Ray said to him, "You're so strong." Ray had intended for this to be a/ very $_{\text{pre-critical}}$/ **mean**," $_{\text{critical}}$/ thing to say. $_{\text{post-critical}}$/

(victim perspective), or the protagonist's intention to hurt (protagonist perspective).

If readers expect the recipient of the comment to be more hurt by ironic than literal criticism (and the protagonist to intend irony to be more hurtful), it should be easier to integrate a hurt response with the previous context in ironic than literal conditions (cf. de Vega et al., 1996; Gernsbacher & Robertson, 1992; Gernsbacher et al., 1992, 1998; Leuthold et al., 2012). That is, encountering the critical word of the target sentence that describes a hurt response should cause less processing difficulty following ironic criticism than literal criticism. Specifically, we would predict shorter reading times on the critical word (e.g., *mean*) in ironic than literal conditions. In contrast, if irony serves to mute the negative nature of the message (following the tinge hypothesis), then we would expect the opposite. Importantly, if criticism is perceived as more negative when viewed from the victim's than from the protagonist's perspective (following Bowes & Katz, 2011), we may also predict a main effect of perspective, with shorter reading times for hurt responses read from the victim's compared to the protagonist's perspective.

Since the accounts that we are testing here are based on the findings from rating studies, it seems likely that they are intended to explain peoples' ultimate decisions regarding how a character might feel, rather than the ongoing processes that may occur while this decision is reached. Thus, we are unable to make specific predictions regarding the time course of processing on the basis of these accounts (i.e., whether effects may be observable in early or later measures of reading time). However, gathering information on the time course of effects will potentially allow us to further refine these theoretical accounts.

In addition, previous work on the processing of characters' emotional responses in text more generally has typically either used self-paced reading (de Vega et al., 1996; Gernsbacher & Robertson, 1992; Gernsbacher et al., 1992, 1998) or event-related brain potentials (Leuthold et al., 2012). While these studies have demonstrated that effects are observable during reading (but see Gygax, Garnham, & Oakhill, 2004, for discussion), it is again difficult to infer the likely time course of effects based on these studies, since the presentation mode (word-by-word or phrase-by-phrase) does not allow for re-reading, nor a clear distinction between early and late effects on the critical word. However, eye-tracking work on trait expectancies more generally may suggest that when a character's behavior does not meet expectations, this can be observable as early as first-pass regressions out of the critical region (e.g., Filik & Leuthold, 2013), and so it is possible that we may observe effects in early measures too. In sum, to our knowledge, this is the first study using eye-tracking to investigate how readers keep track of a character's anticipated emotional response to a situation. Thus, the current findings may offer novel insights into the time course of processing of characters' emotional responses in text in general, as well as more specifically in relation to their response to different kinds of criticism, and how this is influenced by the perspective that is taken.

Experiment 1

Method

Participants

Twenty-eight native English-speakers from the University of Nottingham community participated (22 females; mean age = 20.6 years). Based on effect size measures (f = .30) from our previous eye-tracking studies of irony comprehension (Filik & Moxey, 2010; Filik et al., 2014), we conducted a power analysis with the program G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) to estimate the sample size needed to achieve a statistical power of $(1 - \beta) = .80$, as recommended by Cohen (1988). With the significance level set to $\alpha = .05$, this analysis showed that at least 24 participants were needed.

Materials and design

Thirty-two experimental items were constructed (see Table 1 for an example). Each item consisted of three sentences. The first was a context sentence (e.g., *Charlie was desperately trying to undo the lid of a jar, but was having difficulty with it.*), which was designed to set-up the subsequent comment to be interpreted as criticism. The criticism could be either delivered literally (e.g., *Ray said to him, "You're so weak."*), or ironically (e.g., *Ray said to him, "You're so strong."*).[1] Since the target of the criticism was always a person, this would mean that the comments

[1] Previous studies using eye-tracking to investigate the on-line processing of irony have typically examined processing of the same comment (e.g., *You're so strong*) presented in contexts that would invite either a literal interpretation (i.e., the character had done something to demonstrate their physical strength) or ironic interpretation (i.e., the character had revealed themselves to be physically weak). This approach is not appropriate in the current study, as it would result in comparing emotional responses to ironic criticism and literal praise. In contrast, we wished to compare the time course of inferences regarding a character's emotional response to ironic criticism and literal criticism to the same contextual event (e.g., *Charlie was desperately trying to undo the lid of a jar, but was having difficulty with it.).* This necessitated the construction of different comments (e.g., *You're so strong* vs. *You're so weak*). Thus, we did not feel that it would be informative to analyze reading times for the remarks themselves, since much is already known about on-line processing of ironic versus literal remarks (cf. Filik et al., 2014), and the lexical differences across conditions in the current study would render any differences in reading time difficult to interpret.

are all examples of sarcastic irony. The target sentence described the emotional response elicited in the recipient of the comment (e.g., *Charlie felt that this was a very mean thing to say.*), or that the protagonist had intended to elicit (e.g., *Ray had intended for this to be a very mean thing to say.*). The emotional response described in the target sentence always related to hurtfulness, using a variety of expressions such as *hurt*, *upset* and *wounded*. The choice of wording used to create the two different perspectives was based on Toplak and Katz's (2000) finding that intent is central to the protagonist perspective, and emotional impact to the victim perspective.

In all scenarios, characters were referred to by name (e.g., *Charlie* and *Ray*) rather than by their relationship with each other (e.g., his friend, or his brother) or by their profession, in order to control for the potential influence of these factors on the expectation for sarcasm (see e.g., Blasko & Kazmerski, 2006). Scenarios were also balanced in terms of gender, to control for gender effects on expectation formation (see e.g., Colston & Lee, 2004; Katz, 2005). Specifically, interlocutor-gender pairings were counterbalanced across the conditions, meaning that each pairing (e.g., male victim-male protagonist, male victim-female protagonist, female victim-male protagonist, female victim-female protagonist) occurred in two out of the eight materials in each condition.

To ensure that the adjective used to convey criticism across the context conditions (e.g., 'excellent' vs. 'dreadful') had equivalent strengths of positive versus negative valence, a pre-test was undertaken in which 20 participants (13 females, mean age = 26.3 years) completed an adjective valence rating scale. Participants rated each adjective on a scale from one (extremely negative) to eight (extremely positive). Mean adjective valence had to fall in the two most extreme valence ratings (between one and two, or seven and eight) to be used in the final scenarios.

Thus the experiment consisted of a 2 *type of criticism* (ironic vs. literal) $\times$ 2 *perspective* (victim vs. protagonist) design. Items were divided into four stimulus lists; each including one version of each item, with equal numbers of items in each of the four conditions. There were also 64 filler items. In order to prevent participants from anticipating an emotional response relating to hurtfulness, 48 of the fillers described two characters interacting, but without irony, and describing a variety of emotions (e.g., happiness, surprise, disgust, fear). An example would be: *Daisy was getting ready to go to bed after spending the evening with her partner watching horror films. Toby said, "Did you hear that noise coming from downstairs?" Toby had intended for Daisy to feel frightened by his comment*. The remaining filler items either described a conversation with no emotional content, or did not contain direct speech.

Materials were displayed in 14 point Courier New font as black text on a white background, on a 17-in. monitor 56 cm from participants' eyes. Individual items were presented across three to four lines of text, with two blank lines between the actual lines of text to aid subsequent fixation analysis. The critical emotion word always appeared towards the middle of a line.

Procedure

Eye movements were recorded via an SR Research Eyelink 1000 eye-tracker, which sampled eye position every millisecond. Before the experiment, the procedure was explained and participants were instructed to read normally. Participants were seated at the eye-tracker, and placed their head on a chin and forehead rest to minimize movements. Participants then completed a calibration procedure before starting the experiment. At the beginning of each trial, a fixation box appeared in the top left quadrant of the screen. Once the participant fixated this box, the box would disappear and the text would be presented, with the beginning of the text appearing at the same location as the fixation box. When the participant finished reading each item, they fixated on a post-it note that was attached to the lower right-hand edge of the monitor, and pressed a key. A comprehension question was displayed following 25% of trials in order to ensure that participants were reading for comprehension. An average correct response rate of 94% indicated that this was the case.

Data analysis

Materials were divided into analysis regions (see Table 1). The *critical region* comprised the target emotion word, the *pre-critical region* was the word preceding the critical region, and the *post-critical region* was the remainder of the target sentence. An automatic procedure pooled short contiguous fixations. Fixations under 80 ms were incorporated into larger adjacent fixations within one character and fixations under 40 ms that were not within three characters of another fixation were deleted, as were fixations over 1200 ms. Prior to analysis, trials where participants failed to read the sentence or there had been track loss were eliminated, accounting for 4.8% of the data.

Four measures of reading behavior are reported. *First-pass reading time* (or *gaze duration*, when the region comprises a single word) sums all fixations in a region until the point of fixation leaves the region either to the left or the right, and provides a measure of early text processing. *First-pass regressions out* is the proportion of trials where readers looked back from the region to an earlier piece of text between the time when the region was first entered from the left to the time when the region was first exited to the right, and is usually taken to indicate that the reader is experiencing difficulty with processing the current region of text. *Regression path* (or *go-past*) *reading time* is the sum of fixations from the time that a region is first entered until a saccade transgresses the right region boundary. This measure includes fixations made to re-inspect earlier portions of text and is usually taken to reflect early processing difficulty along with (at least some) time spent re-inspecting the text in order to recover from such difficulty. *Second-pass reading time* is the total amount of time spent fixating a region after previously having left it through either a leftward or rightward saccade. When reading times were zero for a particular region, the relevant point was excluded from the first-pass and regression path analyses. In pre-critical, critical and post-critical regions this procedure accounted for 29.2%, 17.0%, and 9.5% of the data, respectively. The proportion of trials in

which a particular region was skipped in each condition is reported in Table 1.

Results and discussion

Data for each region were subjected to two 2 *type of criticism* (ironic vs. literal) × 2 *perspective* (victim vs. protagonist) ANOVAs, one treating participants ($F1$) and one treating items ($F2$) as random variables (see Table 2 for descriptive statistics).

Pre-critical region

There was a main effect of perspective in regression path reading time, $F1(1,27) = 18.20$, $p < .001$, $\eta_p^2 = .40$, $F2(1,31) = 5.80$, $p < .05$ $\eta_p^2 = .16$, and first-pass regressions out, $F1(1,27) = 18.34$, $p < .001$, $\eta_p^2 = .41$, $F2(1,31) = 11.42$, $p < .005$, $\eta_p^2 = .27$, with longer reading times and more regressions in victim than protagonist conditions. There were no other significant effects ($Fs < 2.2$, $ps > .14$).

Critical region

There was a main effect of type of criticism in first-pass, $F1(1,27) = 4.34$, $p < .05$, $\eta_p^2 = 0.14$; $F2(1,31) = 3.21$, $p = .08$, $\eta_p^2 = 0.09$, and regression path reading times, $F1(1,27) = 6.36$, $p < .05$, $\eta_p^2 = 0.19$; $F2(1,31) = 6.09$, $p < .05$, $\eta_p^2 = 0.16$, with shorter reading times for the critical emotion word following ironic than literal criticism (see Fig. 1). Thus, immediately on encountering the emotion word, participants experienced less processing difficulty when a character was described as being hurt following ironic than literal criticism. Since participants appeared to find this particular emotional response easier to integrate following ironic criticism, this would suggest that participants had initially anticipated that the character would be more likely to be hurt following ironic than literal criticism. There were no other significant first-pass or regression path effects, and no effects in first-pass regressions out, second-pass reading times (all $Fs < 1$), or word skipping ($Fs < 2.5$, $ps > .12$).

Table 2
Descriptive statistics for Experiment 1.

Region	Measure (ms)	Victim Ironic		Victim Literal		Protagonist Ironic		Protagonist Literal	
		M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Pre-critical	First-pass	197	7.6	196	6.9	200	7.8	193	6.8
	Regs out (%)	12.4	2.8	9.3	3.5	3.6	1.4	3.6	1.3
	Reg path	250	14.6	230	13.3	208	9.4	209	10.6
	Second pass	24	5.1	25	7.1	20	4.5	25	5.4
	Skipping (%)	26.3	3.9	30.0	3.7	32.8	3.3	29.7	4.2
Critical	First-pass	219	7.3	229	8.6	213	7.2	229	9.2
	Regs out (%)	7.2	2.0	9.5	2.6	8.0	2.0	9.2	2.2
	Reg path	252	13.9	298	25.0	242	11.8	277	16.3
	Second-pass	28.2	7.0	30.7	5.5	28.7	6.2	33.7	6.4
	Skipping (%)	11.6	2.4	19.4	3.1	20.0	3.1	19.5	3.0
Post-critical	First-pass	392	30.8	321	20.9	330	18.7	329	20.5
	Regs out (%)	22	3.6	22	3.6	25	4.0	24	3.5
	Reg path	579	46.6	454	33.0	530	44.7	492	39.4
	Second-pass	32.2	7.7	34.1	9.2	38.1	11.3	38.0	10.0
	Skipping (%)	10.9	2.7	12.2	3.2	7.0	2.1	12.2	3.5

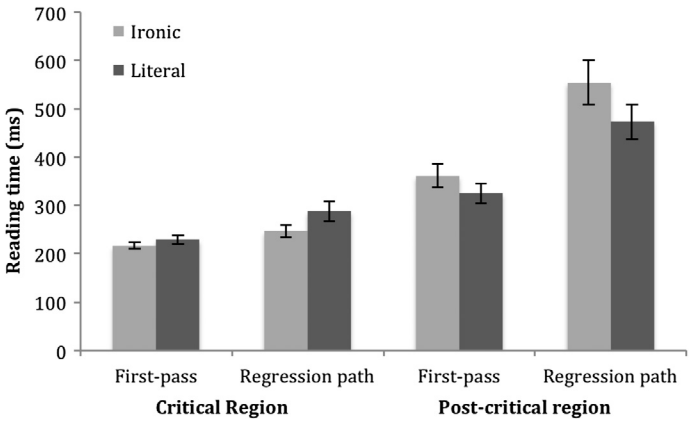

Fig. 1. Main effects of type of criticism in first-pass and regression path reading times on the critical and post-critical regions in Experiment 1. Error bars represent ± 1 *SEM*.

Post-critical region

In first-pass reading times, the main effects of perspective, $F1(1,27) = 2.80$, $p = .11$, $\eta_p^2 = 0.09$; $F2(1,31) = 4.82$, $p < .05$, $\eta_p^2 = 0.13$, and type of criticism, $F1(1,27) = 4.25$, $p < .05$, $\eta_p^2 = 0.14$; $F2(1,31) = 2.87$, $p = .10$, $\eta_p^2 = 0.08$, did not reach significance by both participants and items. However, there was a significant interaction, $F1(1,27) = 6.30$, $p < .05$, $\eta_p^2 = 0.19$; $F2(1,31) = 4.87$, $p < .05$, $\eta_p^2 = 0.14$. Analysis of simple main effects showed that for materials describing the victim perspective, reading times were longer following ironic than literal criticism, $F1(1,27) = 7.57$, $p < .05$, $\eta_p^2 = 0.22$; $F2(1,31) = 6.18$, $p < .05$, $\eta_p^2 = 0.17$. For materials that described the protagonist perspective, there was no difference (Fs < 1). In addition, for ironic materials, reading times were longer for scenarios read from the victim's than the protagonist's perspective, $F1(1,27) = 5.86$, $p < .05$, $\eta_p^2 = 0.18$; $F2(1,31) = 9.56$, $p < .01$, $\eta_p^2 = 0.24$, suggesting that readers had more difficulty integrating a hurt response when taking the perspective of the victim. This would go against Bowes and Katz' assertion that criticism is perceived as more negative when viewed from the victim's than from the protagonist's perspective, at least for *ironic* criticism. For literal materials, there was no difference (Fs < 1).

First-pass regressions out and second-pass reading times showed no significant effects (Fs < 1), and there were no differences across conditions in terms of word skipping (Fs < 1.7, ps > .20). Regression path reading times showed a main effect of type of criticism, $F1(1,27) = 8.38$, $p < .01$, $\eta_p^2 = 0.24$; $F2(1,31) = 4.34$, $p < .05$, $\eta_p^2 = 0.12$, with shorter reading times following literal than ironic criticism; no other regression path effects were significant (Fs < 2.3, ps > .14). This is the opposite pattern of effects to that observed in the critical region, and would suggest that, while readers initially expected a character to be more hurt by ironic than literal criticism, when they reach the end of the sentence, they instead find it easier to integrate a hurt response following literal than ironic criticism (see Fig. 1).

Thus, it seems that as text comprehension progresses, a reader's expectations regarding emotional reaction and intention following ironic criticism changes. Initially, the reader may rapidly interpret the emotion word, believing that it makes sense for victims to be upset and for the protagonist's intentions to be upsetting through ironic criticism (see Colston, 1997). However, by the time they reach the end of the target sentence, readers may have considered the positive functions of irony, such as increased humor (Roberts & Kreutz, 1994). We further investigated this proposal in Experiment 2.

Experiment 2

In Experiment 2 we examine whether or not participants expect the recipient of an ironic criticism to be amused, compared to when receiving literal criticism (e.g., Boylan & Katz, 2013; Dews et al., 1995; Dress, Kreuz, Link, & Caucci, 2008; Gibbs, 2000; Glenwright & Agbayewa, 2012; Lampert & Ervin-Tripp, 2006; Leggitt & Gibbs, 2000; Matthews et al., 2006; Pexman & Olineck, 2002; Roberts & Kreutz, 1994). To this end, we adopted the same approach as in Experiment 1, but substituted a hurt reaction for one of amusement.

If it is the case that readers initially expect the character to be hurt by ironic criticism, but later rationalize it as amusing, then we might expect to observe shorter reading times for an amused response following ironic than literal criticism, particularly in later measures of reading time. In terms of the perspective manipulation, results from the rating study conducted by Bowes and Katz (2011) suggested that only the protagonist is expected to regard ironic comments as more amusing than literal comments. Thus, we might expect an interaction between type of criticism and perspective indicating shorter reading times following ironic than literal criticism in the protagonist conditions only.

Method

Participants

Twenty-eight native English-speakers from the University of Nottingham community (23 females; mean age = 19.3 years), who did not take part in Experiment 1, participated.

Materials and design

Thirty-two experimental items, similar to those used in Experiment 1, were constructed. However, in these materials, the target sentence's critical emotion word indicated that an 'amused' rather than a 'hurt' response was elicited in the recipient of the comment (e.g., *Charlie thought this was a very amusing thing to say.*) or intended by the protagonist (e.g., *Ray had intended for this to be a very amusing thing to say.*).

Procedure

The procedure was the same as in Experiment 1. Again, a question was displayed following 25% of trials in order to ensure that participants were reading for comprehension. An average correct response rate of 95% indicated that this was the case.

Data analysis

Materials were divided into the same analysis regions as in Experiment 1, the same data pre-processing procedures were adopted, and the same measures of reading behavior are reported. Prior to analysis, trials where participants failed to read the sentence or there had been track loss were eliminated, accounting for 3.1% of the data. When reading times were zero for a particular region, the relevant point was excluded from the first-pass and regression path analyses. In pre-critical, critical and post-critical regions this procedure accounted for 23.4%, 20.7%, and 9.4% of the data, respectively.

Results and discussion

Data for each region were subjected to two 2 *type of criticism* (ironic vs. literal) × 2 *perspective* (victim vs. protagonist) ANOVAs, one treating participants ($F1$) and one treating items ($F2$) as random variables (see Table 3 for descriptive statistics).

Table 3
Descriptive statistics for Experiment 2.

Region	Measure (ms)	Victim Ironic		Victim Literal		Protagonist Ironic		Protagonist Literal	
		M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Pre-critical	First-pass	200	8.4	188	7.0	198	7.5	197	7.2
	Regs out (%)	12.6	2.4	10.6	2.4	4.5	1.3	2.0	1.2
	Reg path	247	11.2	232	14.3	224	13.9	209	9.4
	Second-pass	28.9	5.2	24.1	6.3	17.5	5.4	19.5	5.4
	Skipping (%)	21.6	3.8	23.6	4.1	25.6	4.2	24.0	3.8
Critical	First-pass	216	9.4	218	7.9	214	8.1	219	10.0
	Regs out (%)	7.8	1.8	8.7	2.1	8.0	2.4	6.4	1.7
	Reg path	251	12.3	260	18.2	260	14.2	250	15.9
	Second-pass	20.6	5.4	38.5	7.8	18.5	4.5	20.8	6.4
	Skipping (%)	19.7	3.7	16.1	2.5	24.6	4.0	23.3	3.5
Post-critical	First-pass	395	37.5	362	24.8	384	29.5	371	37.9
	Regs out (%)	22.1	4.4	30.4	4.6	13.5	2.5	21.7	4.3
	Reg path	564	59.2	604	63.8	455	35.9	555	63.7
	Second-pass	27.1	7.9	48.6	12.9	13.1	4.8	24.0	6.1
	Skipping (%)	12.3	3.6	8.9	2.6	8.4	2.6	9.2	2.0

Pre-critical region

There was a main effect of perspective in regression path reading time, $F1(1,27) = 4.86$, $p < .05$, $\eta_p^2 = .15$, $F2(1,31) = 2.55$, $p = .12$, $\eta_p^2 = .08$, first-pass regressions out, $F1(1,27) = 11.81$, $p < .005$, $\eta_p^2 = .30$, $F2(1,31) = 8.33$, $p < .01$, $\eta_p^2 = .21$, and second pass reading times, $F1(1,27) = 4.90$, $p < .05$, $\eta_p^2 = .15$, $F2(1,31) = 2.94$, $p < .10$, $\eta_p^2 = .09$, with longer reading times and more regressions in victim than protagonist conditions. There were no other significant effects ($Fs < 2.8$, $ps > .10$).

Critical region

There were no effects in first-pass, regressions out, or regression path reading times (all $Fs < 1$). Second-pass reading times showed a main effect of perspective that was significant by participants but not by items, $F1(1,27) = 5.13$, $p < .05$, $\eta_p^2 = 0.16$; $F2(1,31) = 3.02$, $p = .09$, $\eta_p^2 = 0.09$. There was no significant effect of type of criticism, $F1(1,27) = 1.90$, $p = .18$, $\eta_p^2 = 0.07$; $F2(1,31) = 3.30$, $p = .08$, $\eta_p^2 = 0.10$, and no interaction, ($Fs < 1.7$, $ps > .20$). Word skipping showed a main effect of perspective, $F1(1,27) = 5.16$, $p < .05$, $\eta_p^2 = 0.16$; $F2(1,31) = 5.18$, $\eta_p^2 = 0.14$, $p < .05$, with a higher proportion of skipping in protagonist than victim conditions, but no other significant effects ($Fs < 1$).

Post-critical region

First-pass reading times showed no effect of perspective ($Fs < 1$), no significant effect of type of criticism, $F1(1,27) = 3.20$, $p = .09$, $\eta_p^2 = 0.11$; $F2(1,31) = 3.27$, $p = .08$, $\eta_p^2 = 0.10$, and no interaction ($Fs < 1$). There was a main effect of perspective in first-pass regressions out, $F1(1,27) = 8.39$, $p < .01$, $\eta_p^2 = 0.24$; $F2(1,31) = 7.87$, $p < .01$, $\eta_p^2 = 0.20$, regression path reading times, $F1(1,27) = 5.43$, $p < .05$, $\eta_p^2 = 0.17$; $F2(1,31) = 2.59$, $p = .12$, $\eta_p^2 = 0.08$, and second pass reading times, $F1(1,27) = 5.14$, $p < .05$, $\eta_p^2 = 0.16$; $F2(1,31) = 7.67$, $p < .01$, $\eta_p^2 = 0.20$, with fewer regressions and shorter reading times in the protagonist than the victim condition. This would suggest that readers had found it easier to integrate an amused response to criticism when taking the perspective of the protagonist than the perspective of the victim.

Importantly, there was also a main effect of type of criticism in first-pass regressions out, $F1(1,27) = 7.17$, $p < .05$, $\eta_p^2 = 0.21$; $F2(1,31) = 10.78$, $p < .01$, $\eta_p^2 = 0.26$, regression path reading times, $F1(1,27) = 4.14$, $p = .05$, $\eta_p^2 = 0.13$; $F2(1,31) = 6.09$, $p < .05$, $\eta_p^2 = 0.16$, and approaching significance in second-pass reading times, $F1(1,27) = 3.47$, $p = .07$, $\eta_p^2 = 0.11$; $F2(1,31) = 4.03$, $p = .05$, $\eta_p^2 = 0.12$, showing fewer regressions and shorter reading times following ironic than literal criticism. There were no interactions in any of the measures ($Fs < 1$), nor any effects in word skipping ($Fs < 1.8$, $ps > .19$). It appears that readers had indeed experienced less difficulty in integrating an amused response following ironic than literal criticism, suggesting that although people may initially expect ironic criticism to be more hurtful than literal criticism (as indicated by the results of Experiment 1), it may later be rationalized as less hurtful and instead as being amusing (from both the perspective of the victim and the protagonist).

General discussion

Verbal irony can be a useful communicative tool to enrich messages with additional meaning, such as emotional connotations that may be lacking from more direct forms of speech. As noted earlier, previous studies of the emotional impact of verbal irony have typically used offline rating tasks, and have largely neglected the possible influence of different perspectives (i.e., victim vs. protagonist). In comparison, the present study affords novel insights into readers' expectations of how a character might behave in response to ironic versus literal criticism, how these expectations may change over time, and how they are influenced by the perspective that is taken.

The first key finding relates to the time course of readers' expectations for how a character might emotionally respond to criticism. Results from early reading time measures in Experiment 1 indicate that on encountering the

critical emotion word, readers initially found it easier to integrate a hurt response following ironic than literal criticism, but on reaching the end of the scenario, ultimately found it easier to integrate a hurt response following literal than ironic criticism. This would suggest that immediately on encountering the critical emotion word, readers expect a character to be more hurt by ironic than literal criticism. In relation to theory, this finding is in line with the proposal of Colston (1997, see also Bowes & Katz, 2011). In contrast to this, findings for later reading time measures are more in line with the tinge hypothesis (Dews & Winner, 1995), in that ultimately, readers expect a character to be *less* hurt by criticism that is delivered ironically rather than literally. This also accords with the results from Experiment 2, for which later reading time measures indicated that ultimately, participants found it easier to process an amused response to ironic criticism than to literal criticism.

On the basis of these findings, we propose a new two-stage account. Following this proposal, readers initially respond to the negative aspects of ironic criticism, which may result from the sharp contrast between the superficial positive message (i.e., what may have been expected or desirable in the situation) and the intended negative message (i.e., the reality). The representation of this contrast has been argued to be necessary to interpret the irony (e.g., Giora, 1995). Subsequently, upon reaching the end of the target sentence, readers have had more time to consider the speaker's motivation for using ironic language. Following this, they ultimately rationalize ironic criticism as being less hurtful, and more amusing, when viewed from the perspective of both the victim and the protagonist. This is important, as it may serve the real life function of allowing the delivery of criticism that ultimately has less of a negative impact on the relationship between speaker and addressee (e.g., Dews et al., 1995).

It is important to note that the proposed account is specifically designed to explain the time course of processing emotional responses to irony, and is thus distinct from other two-stage accounts, which instead apply to how ironic comments are processed and understood in relation to context (e.g., Giora, 1997, 2003; Grice, 1975; see e.g., Gibbs & Colston, 2012, for an overview). Specifically, these accounts would argue that, in some cases at least, the literal meaning of an ironic comment is accessed or constructed first, after which the comment is reinterpreted as being ironic once a mismatch with context is detected. In the current experiments, we assume that by the time the reader encounters the described emotional response, they have already successfully interpreted the prior comment as being intended literally, or ironically (following Filik & Moxey, 2010, who also investigated readers' representation of meaning in the sentence following the ironic comment). Under other circumstances, the time course of an emotional response is likely to be related to the time course of comprehension, thus, further research is needed to investigate the interplay between comprehension and emotional processes.

The assumption of our new two-stage account, that immediate expectations regarding emotional responses are different from those that follow when given more time for reflection, may help to tie together some of the apparent inconsistencies in the literature. Specifically, one recent study by Filik, Hunter, and Leuthold (2015) tapped into rapid reactions to ironic language. In their experiment, they measured the time taken for participants to move a slider towards or away from themselves when responding to a critical word that disambiguated a comment as being literal or ironic criticism or praise. In this paradigm, faster push movements are considered an index of an avoidance response to a negative stimulus (e.g., criticism) and faster pull movements are interpreted as approach responses to a positive stimulus (e.g., praise). They found that such action-sentence compatibility effects were present for ironic language, but not for literal comments. One interpretation of this finding is that when initially encountered, irony leads to larger emotional responses than literal language. In contrast, findings from a number of rating studies (measuring more considered responses) showed the exact opposite, that is, participants rated likely emotional responses as being less extreme following ironic than literal criticism and praise (e.g., Dews & Winner, 1995; Dews et al., 1995; Filik et al., 2016; Pexman & Olineck, 2002). These apparently conflicting findings between studies examining immediate versus more considered responses would fit well with the current suggestion that emotional responses to irony may change over time.

The finding that emotional expectations change over time also has important implications for the examination of readers' representations of emotional states in situation models more generally, and arguably would not have been uncovered without using a methodology (such as eye-tracking) which is sensitive to the moment-to-moment cognitive processes underlying comprehension. By using this methodology, we were able to show that readers can very rapidly detect when a character's emotional response does not match their expectations; as early as first-pass and regression path reading times on the emotion word itself (in Experiment 1).

In addition, much of the work in this area has focused on the extent to which people infer specific emotions while reading (e.g., de Vega et al., 1996; Gernsbacher & Robertson, 1992; Gernsbacher et al., 1992, 1998; Gygax, Oakhill, & Garnham, 2003; Gygax et al., 2004). An important issue that has received relatively less attention is whether readers can represent and keep track of how characters' emotions might change over time (as investigated by de Vega et al., 1996). De Vega et al. found that readers could keep track of a protagonist's changing emotions, based on new information that they were given in the text. A novel finding from the current study is that readers seem to be keeping track of how a character's emotional state may change over time, even in the absence of new information.

The present eye-tracking results also provide new insights into the role of perspective. Experiment 2 revealed a main effect of perspective, with participants experiencing more difficulty processing an amused response to criticism in the victim than in the protagonist condition. This supports Toplak and Katz's (2000) suggestion that when focus

is on the victim, readers may concentrate more on the negative aspect of the critical comment, leading to greater difficulty in processing an amused response. In contrast, when focus is on the perspective of the protagonist, participants may have considered the reasons behind the remark, which consequently could have resulted in the criticism being perceived more positively. This finding, however, does not fully support Bowes and Katz's (2011) suggestion that only the protagonist is expected to find ironic criticism more amusing than literal criticism, since our data suggest that readers also expected the victim of an ironic criticism to be more amused than the victim of a literal criticism.

Perspective effects in Experiment 1 showed some evidence of greater difficulty integrating a hurt response following the victim's perspective than following the protagonist's perspective (for ironic criticism, at least). This does not support Bowes and Katz's (2011) suggestion that criticism is viewed as more hurtful from the victim's perspective, since this would have predicted less difficulty in processing a hurt response in the victim condition, not more. Together, the current findings in relation to perspective contribute to the growing body of research suggesting that criticism is interpreted differently depending on which perspective it is viewed from, and suggest that perspective effects may differ when measured on-line versus off-line. One factor that may contribute to this latter finding may be that in many of the previous rating studies, participants may have had more freedom in deciding how they think a character might respond.

Of course, the present work should be viewed as a first step towards a more comprehensive understanding of the socio-emotional functions of figurative language, leading to a number of interesting questions that deserve attention in future research. Firstly, naturally it is the case that ironic language may be used to convey and evoke emotions that are more subtle and complex than simply hurtfulness, and amusement. However, since these emotions are those that are most commonly discussed in the literature, we felt that this was a good starting point to investigate the time course of inferences about emotional responses to irony. Secondly, the materials used in this study reflected a particular type of irony, specifically, sarcasm, since this seemed most closely related to affect. Further research is needed to examine expectations for emotional responses to other types of ironic language such as jocularity, hyperbole, and understatement, as well as other types of figurative language more generally. Finally, it would be interesting to examine whether a reader's ability to take different perspectives and to infer the emotional states of characters may be influenced by their empathic abilities (see e.g., Komeda & Kusumi, 2006, for some investigation of this; see also Gernsbacher et al., 1992, for discussion). These observations may be particularly important when focusing, as in the current study, on overhearers' interpretations of likely emotional responses rather than those of the recipient themselves. In addition, empathic abilities may play a more general role in irony comprehension (see e.g., Nicholson, Whalen, & Pexman, 2013; Shamay-Tsoory et al., 2005). Thus, investigating the role of empathy in decoding a character's emotional response to irony is an interesting avenue for future research.

In conclusion, the current study provides new insights into the time course of effects when inferring characters' emotional responses in text. Results would suggest that readers not only rapidly anticipate how a character will respond in a particular situation, but they also keep track of how this may change over time. We examined this process in particular relation to characters' responses to ironic versus literal criticism, for which we suggest a two-stage process. Initially, sarcasm increases the anticipated 'bite' of a critical comment. Subsequently, the described emotional response is integrated with the nature of the criticism, and readers ultimately rationalize ironic comments as being less hurtful, and more amusing, when viewed from the perspective of both the victim and the protagonist. These findings clearly demonstrate that a more comprehensive understanding of the emotional impact of verbal irony entails the investigation of the moment-to moment time course of information processing. Specifically, whereas eye-tracking has already taught us much about cognitive processes involved in text comprehension, here we show that this method can also be applied to reveal the time course of emotion-related influences on language processing.

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