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Processing of *It* and *This* in Written Narrative Discourse

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ABSTRACT

Two experiments explored the hypothesis that anaphors and demonstratives signal different procedural instructions: Whereas the anaphor *it* brings a concrete entity into a reader's focus, the demonstrative *this* directs the focus to a predicate proposition in a discourse representation. The findings from an online eye-tracking reading experiment confirm that preferences for *it* and *this* differ as predicted. Moreover, a sentence-completion experiment revealed converging evidence for this difference, with clear differences in antecedent preferences for *it* and *this*. Overall, findings show that the processing and use of anaphoric expressions is affected by the interaction between the lexical characteristics of referential forms and different types of referent.

Introduction

Anaphora, the use of a word or phrase to refer to previously mentioned discourse entities, is a key phenomenon within the study of language processing. This is especially true for theories dealing with the nature and role of mental representations during discourse comprehension (Garnham, 1997). Natural languages use a range of anaphoric expressions that operate on comprehenders' mental models of discourse, coordinating interlocutors' attention throughout the flow of text (Clark & Bangerter, 2004; Cornish, 1999, 2008).

Several corpus studies have focused on *it* and *this* in relation to mental models of discourse, reference resolution, and discourse-structuring (Cornish, 1999; Diessel, 2006; Gundel, Hedberg, & Zacharski, 1993; Himmelmann, 1996; Lapaire & Rotgé, 1991; Lyons, 1977; McCarthy, 1994; Webber, 1988a, b, 1990). As noted by Cornish (2008), some of these studies propose that such referring expressions give "procedural instructions" (i.e., instructions concerning the localization of referents in memory), which are exploited in constructing, modifying, and accessing the content of mental models of an unfolding discourse within the minds of speaker and addressee—or writer and reader. However, despite these previous studies' findings, there is still much to learn about how deictic expressions such as *this* are processed on a moment-by-moment basis or how the processing of deictic expressions differs from that of pronominal anaphora.

To address these important questions, in this study we use online and offline measures to explore the referential preferences for *it* and *this* and explore the role of referent type (a non-NP/less salient vs. a concrete entity/salient) in the processing referents of *it* and *this*. Before presenting the experiments and results, we introduce the English anaphora system relating to *it* and *this*, along with the study's contextual background.

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Functions of It and This

Different terms have been used to draw a conceptual distinction and highlight the functional differences between the anaphoric pronoun *it* and the deictic pronoun *this*. Whereas *it* is consistently defined as an anaphor (Fillmore, 1997; Levinson, 1983; Lyons, 1977), *this* has been variously categorized as discourse deixis (Webber, 1990), a demonstrative (Gundel et al., 1993), imagination-oriented deixis (Bühler, 1990), a complex anaphor (Consten, Knees, & Schwarz-Friesel, 2007; Lenz, 2007), and an anadeixis (Cornish, 2007). Two main explanations have been proposed for these functional differences. In this article we refer to these accounts as the *type of referring expression account* and *the saliency account*.

Type of referring expression account

According to the *type of referring expression* account, the anaphoric pronoun *it* and the deictic pronoun *this* are different types of referential expressions and tend to refer to different types of referents in written discourse (Byron & Allen, 1998; Ehlich, 1982; Gundel et al., 1993; Himmelmann, 1996; Lapaire & Rotgé, 1991; McCarthy, 1994; Passonneau, 1989; Webber, 1989). According to such accounts, an addresser's use of *this* or *it* can be thought of as a *procedural instruction* to the addressee to focus on different aspects of the discourse: Whereas *this* is used to draw the addressee's attentional focus (Cornish, 2008) to a new object or a new aspect of an existing one, *it* is used to continue attentional focus on an existing or established entity (Ehlich, 1982). In addition, Webber (1990) conducted a small-scale analysis of a written corpus, retrieving 177 samples from books, articles, editorials, and *The Guardian* newspaper that showed differing antecedent[1] preferences for *this* and *it,* with *it* referring to discourse entities in subject or object positions (i.e., a noun phrase [NP] referent preference) and *this* tending to refer to a proposition or event (i.e., a non-NP referent preference) in the previous clause/sentence. Although in (1b) *it* refers to a concrete entity (i.e., The T-shirt given to Wendy for Christmas in [1a]), in (2b) *this* refers to a proposition (i.e., management's action of promoting Fred to second vice president in [2a]):

(1) (1a) Wendy gave Eliot a T-shirt for Christmas. (1b) Unfortunately, *it* has the logo "You ate it, Ralph". (Webber, 1988a, p. 3).

(2) (2a) Management promoted Fred to second vice president. (2b) *This* is wonderful for us. (Webber, 1988b, p. 22).

Intuitively, the process of establishing the reference of *it* in (1b) is relatively simple, and involves maintaining focus on the previously mentioned concrete entity (the *t-shirt*). In contrast, according to Webber (1988), examples such as (2b) require extra interpretive processing. In (1b) *it* refers to the referent denoted by the previous NP "a T-shirt," whereas *this* refers to a propositional referent. To interpret *this*, an addressee has to make an interpretation similar to the following: '*This* – that management promoted him to vice president – is wonderful.' The inserted part is a proposition formed by combining a subject (i.e., *the management*) with a predicate. This reconstructive process, which involves combining a subject and predicate, arguably results in extra processing complexity.

We discuss the processing of *this* and *it* in more detail below, but for present purposes the important point to note is that the addresser's choice of referring expression has been proposed to guide the addressee's discourse structuring and processing of incoming text segments (Ariel, 2001; Cornish, 2008; Gundel et al., 1993, Vonk, Hustinx, & Simons, 1992). Although not within the focus of the current

[1]Gundel, Hedberg, and Zacharski (2004) point to the distinction between *antecedent* and *referent*. *Antecedent* is the linguistic expression (e.g. a NP) on whose reference the interpretation of an anaphoric expression depends. *Referent* is the nonlinguistic entity an expression refers to (e.g., events, proposition or ideas derived from the sentence). We follow this distinction and use the term *referent* when demonstrative *this* refers to a mental representation of a proposition.

study, we should also point out that *it* and *this* can both be used cataphorically and can guide the addressee's attention to the upcoming discourse as well (e.g., Gernsbacher & Jescheniak, 1995; Trnavac & Taboada, 2016). *It* can also be used as a nonanaphor with modal adjectives (e.g., it is possible that . . .), with cognitive verbs (e.g., it is believed that . . .), weather predicates (e.g., it was rainy), or with cleft constructions (e.g., it was John who organized this event). Although these cataphoric and nonanaphoric uses of *it* and *this* are not within the scope of the study, such occurrences, and their processing, are potential areas of future investigation.

Few studies have compared cognitive processes involving deictic expressions with those involving other types of referring expressions (but see Brown-Schmidt, Byron, & Tanenhaus, 2005; Carreiras, Garnham, & Oakhill, 1993; Fossard, Garnham, & Cowles, 2012; Kaiser & Trueswell, 2008). In one such study, using the visual-world paradigm, Brown-Schmidt et al. (2005) showed that addressees prefer different antecedents for *it* and the demonstrative *that*. Participants preferred the use of *it* when referring to theme arguments or highly focused entities in the preceding utterance (e.g., *cup*), and preferred *that* when referring to "complex or composite entities" (e.g., a *cup on the saucer*). Another study using the visual-world paradigm (Kaiser & Trueswell, 2008) examined referential preferences in Finnish, focusing on the demonstrative *tämä* (a proximal demonstrative pronoun that targets human referents) and the anaphor *hän* (a third-person gender-neutral pronoun). Kaiser and Trueswell (2008) demonstrated these two referential expressions elicit asymmetrical antecedent preferences. *Hän* was preferred when referring to a high-salient main character in the subject position, whereas *tämä* was preferred when signifying post-verbal and low-salient subordinate characters. The authors interpreted their results in terms of the form-specific multiple constraints approach, in which referential expressions show different degrees of sensitivity to different factors (e.g., salience and/or word order).

A self-paced reading study reported by Fossard et al. (2012) investigated the effect of salience on referential choices for *that NP* and the personal pronoun *s/he*. Two types of referential expressions resulted in different referent preferences. Whereas *that NP* refers to less salient referents (e.g., the subordinate character in the discourse), when referring to highly focused entities, *s/he* was used (e.g., the main character in discourse).

In sum, although corpus studies support the hypotheses that *this* and *it* signal different discourse-structuring procedural instructions to readers and listeners, such hypotheses have not been tested with online and offline measures. There has been some psycholinguistic research on English demonstratives, but these studies have typically examined the demonstrative *that* (or *that NP*) rather than *this*. In addition, these studies have typically shown that different referential expressions are used in association with different discourse features (i.e., focused entity vs. composite entities) (Brown-Schmidt et al., 2005; Fossard et al., 2012).

In this investigation, we follow Webber (1990; 1988) in hypothesizing that *this* and *it* have different referent preferences: Although *it* tends to refer to concrete entities, *this* tends to refer to predicates/propositions in the preceding context. Thus, *this* and *it* lead to different discourse processes. It should be noted that our hypotheses regarding the processing of *this* and *it*, and the referent types an addresser would prefer for *this* and *it*, are based on existing corpus-based evidence, which does not provide for moment-by-moment cognitive processes of *this* and *it*.

Salience account

An utterance tends to be "about" something in particular, and whatever an utterance is "about" is elevated in salience above other entities within the discourse (Hurewitz, 1998). Such "aboutness" depends on an addresser's intention and goals in the discourse intentional structure and the addressee's attentional state (Grosz & Sinder, 1986). According to Ariel's (1996) Accessibility Marking Scale and Gundel et al.'s (1993) Givenness Hierarchy, if the addresser assumes that an addressee can easily access the referent in his/her memory, then the addresser uses more reduced anaphoric expressions (*it* in our case). On the other hand, if the addresser believes the intended referent is not focused but is "activated/familiar" (Gundel et al., 1993) in the previous discourse, then a less reduced expression, such as a deictic

(*this* in our case), will tend to be used. If the addresser assumes that the intended referent has "referential cognitive status" (in which the addressee must retrieve an existing representation of the speaker's intended referent or construct a new representation by the time the sentence is processed), then prenominal *this* is chosen. The choice of prenominal or pronominal *this* signals the different cognitive accessibility of their referents (information about the location of referent in memory and attentional state).

It is important to note that within a given utterance there may be multiple entities under discussion. In such cases, all entities could be argued to be salient, but what is needed in anaphora resolution is some way of determining *relative* salience (Roberts, 1998). Among the theories that explain a referent's saliency/accessibility are Centering Theory (CT) and what we call here the alternative approach to CT. In most versions of CT, saliency or activation can be determined by the grammatical roles that express the antecedent entities (Grosz, et al., 1994; Grosz & Sidner, 1986; Hajičová, Kubofi, & Kubofi, 1992; Kameyama, 1986; Strube & Hahn, 1999). In addition, according to CT, discourse coherence is established by the *backward-looking center* (*Cb*) (e.g., anaphora referring to the center) and *forward-looking center(s)* (*Cf/Cfs*) (e.g., an entity (or entities) in the previous utterance that can be interpreted as the antecedent of an anaphora). Certain entities (i.e., *Cfs*) mentioned in an utterance are more central/salient than others, which imposes constraints on a writer's/speaker's use of different types of anaphoric expressions (Grosz et al., 1983; Gundel et al., 1993).

Most forms of centering theory rank entities from most to least salient as potential anaphoric antecedents, based on syntactic features. For instance, Grosz et al. (1994) rank certain entities based on the entities' grammatical roles in the previous utterance: Subjects > Objects > Others. Brennan, Friedman, and Pollard (1987) specify "other" categories in CT and propose the following ranking of referent saliency: Subject > Direct Object > Indirect Object > Complements > Adjuncts, with entities in the subject/object positions identified as more salient than complements or adjuncts. For example, according to CT, in (3a) there are two (*Cfs*): the "Emperor" and the "castle," either of which can be an antecedent for an anaphoric expression. In the subject position, the Emperor is more salient than the castle, which is in the object position. However, in (3b) *it* refers to the castle and signals a smooth-shift, because the addresser shifts the center smoothly from the Emperor in the subject position to the castle in the object position.

(3) (3a) The Emperor built a *castle. Cf*: [Emperor, castle]

(3b) *It* was a fearsome fortress and won the Emperor great fame. *Cb*: [*it*, castle] *Cf*: [fortress, Emperor]

Thus, the standard version of centering theory deals mainly with NP constituents, which refer to entities, and whose saliency is defined in terms of the syntactic features of these constituents. However, some studies also involve a richer range of features and a richer range of possible targets of reference (Grosz et al., 1994; Kameyama, 1986; Passonneau, 1993; Rambow, 1993; Strube & Hahn, 1999). Specifically, in a theory of Japanese reference resolution, Kameyama (1986) includes features related to a verb's subject or object identity. In the current article the claims of these studies are collectively referred to as the *alternative centering account*.

The main assumption behind the alternative account is that in addition to syntactic saliency, other information such as the ontological status of a referent plays an important role in the selection of referential expressions. To the authors' best knowledge, non-NP constituents such as verb phrases or clauses have not been incorporated into *Cf* templates or ranked with *Cf* sets (see Cornish, 1999, p. 181). However, Maes (1997) demonstrated that different Dutch referential expressions were preferred for different types of NP referents (i.e., NP referents that express affairs or activities [e.g., states, events, situations] versus NP referents to concrete entities [e.g., animals, physical objects] in subject or object position). In a series of sentence completion experiments, Maes (1997) manipulated the type of Dutch referential expressions (*het*: *it*/*the*) versus (*dat*: *this/that*), as well as the ontological status of referents (concrete referents vs. nominalized verb referents), and the referent's transition stage (continuation/subject position vs. shift/object position). For instance, although in (5a) and (5c) participants used *het*

(*it/the*) to refer to the concrete entity "the electronic eye in the carburetor" in subject/object position, in (5b) and (5d) they used *dat* (*this/that*) to refer to the nominalized verb such as "the increase in pressure in the cylinder" in preference to concrete referents.

(5a) **The electronic eye in the carburetor** causes the increase in pressure in the cylinder. . . . has the form of a computer chip.

(5b) **The increase in pressure in the cylinder** is registered by the electronic eye in the carburetor. . . . is necessary to provide the engine with enough pressure.

(5c) The increase in pressure in the cylinder is registered by **the electronic eye in the carburetor.** . . . has the form of a computer chip.

(5d) The electronic eye in the carburetor causes **the increase in pressure in the cylinder.** . . . is necessary to provide the engine with enough pressure (Maes, 1997, p. 225).

Maes claims that the concrete entity in (5a) and (5c) can be more naturally conceptualized, classified, and expressed as a member of its ontological class than the nominalized verb referent in (5b) and (5d), which requires more cognitive effort to access. Accordingly, the deictic *Dat* was chosen instead of the pronominal *het* in (5b) and (5d). The findings from the study suggest that the choice of referential expressions reflects the degree of cognitive effort that an addressee needs to pay to maintain the referent of *dat* and *het.* The deictic referential form is preferred when extra cognitive effort is needed. However, Maes did not investigate reference involving non-NP antecedents.

To sum up, it has been claimed that the level of referent accessibility in an addressee's working memory can affect the choice of referential expression (Ariel, 1996; Gundel et al., 1993). As discussed above, for CT, syntactic categories (e.g., subject/object) determine the choice of referential expressions. On the other hand, for the alternative approach to CT, other linguistic features, such as whether the antecedent is a concrete entity or the referent of a nominalized verb, can play a role in the use and processing of referential expressions

Current study

In the current study we extend Maes' (1997) work in which concrete and nominalized verb referents were in subject and object positions. Our intent is to test the preferences that govern the identified referents of *it* and *this* and whether in English different referential expressions are preferred as referents for different types of antecedents (i.e., a non-NP proposition vs. concrete entity/NP). In addition, we use eye-tracking to examine whether this information is used on-line in the reference resolution process. We assume that, in English, a concrete entity/NP (i.e., referring to an entity/entities in object position) is more likely to be accessible to an anaphor than a non-NP proposition. (To see this, refer to the examples [6a, 6b, and 6c] below.).

In (6a) the concrete entities "Charlotte" and "a book" are entities that might be topics in the upcoming discourse, whereas in (6b), *it* is simply resolved by referring to the referent denoted by the previous concrete NP "a book":

(6a) Charlotte wrote a book. (6b) *It* was a difficult read but the sales were spectacular. (6c) *This* was a difficult job but the sales were spectacular.

In the case of *this* in (6c), a reader must first process the conceptual entities (Charlotte, a book) and then combine the subject "Charlotte" with its predicate to resolve the reference: *This*—that Charlotte wrote a book—was a difficult job. In other words, the reader has to reconstruct a subject–predicate configuration. As a result of such complex configuration/relational propositional referents in language processing, the reader can interpret *this* as referring to Charlotte's process of writing a book.

In language production, if both the *type of referring expression* and *alternative centering* accounts are correct, then a writer's choice between *it* and *this* would not be arbitrary (Cornish, 2008; Di Eugenio,

1996; Kameyama, 1986; Maes, 1997; Webber, 1988a/b). As a result, addressers would tend to use *it* to refer to a concrete entity and *this* to refer to a non-NP entity. Thus, addressers' choices of anaphoric expressions would be informative about the discourse's information structure. Moreover, addressees/readers will tend to interpret *it* and *this* in line with these preferences.

Experiment 1

The experiment used a 2 × 2 within-subject experiment. The design included two levels of referring expression (*it* and *this*) and two levels of referent types (NP and proposition/predicate). We manipulated the postanaphora information, which provides a test of the anaphors' identified referent. A similar postanaphoric disambiguation manipulation to identify the selected anaphor referent has been used in previous studies (e.g., Garrod, Freudenthal, & Boyle, 1994; Gordon & Scearce, 1995). We disambiguated the antecedents of *it* and *this* by using referential expressions after them. Referential expressions such as *job* or *book* were used as disambiguators (e.g., ***it/this*** *was a difficult* ***job/read***—referring to either *Charlotte* ***wrote a book*** or ***a book***.). The disambiguating NP referred either to the proposition expressed by the previous sentence (e.g., *This/it* was a difficult job—referring to Charlotte's process of writing a book) or to the concrete entity in object position in the previous sentence (e.g., *This/it* was a difficult read—referring to a book). The conditions of the experimental stimuli are illustrated in the following examples:

Conditions 1 and 2: *It/this* referring to the proposition:

Charlotte wrote a book. *It/This* was a difficult job but the sales were spectacular.

Conditions 3 and 4: *It/this* referring to the NP:

Charlotte wrote a book. *It/This* was a difficult read but the sales were spectacular.

We assume that if readers exhibit a preference for *it* when referring to entities, and for *this* when referring to propositions, then—other things being equal—processing difficulty should be greater and reading times longer when a proposition is referred to with *it*, than when referred to with *this*. Conversely, other things being equal, reading times should be longer when a NP referent is referred to with *this* than with *it*. Overall, this pattern should result in an interaction between the two experimental factors of referring expression type (*it* vs. *this*) and referent type (reference to a NP vs. a proposition). This interaction should initially be found at the point where the reader first encounters the disambiguating information, which will be reflected in regression path time at the disambiguating region. If readers refixate the context sentence after disambiguation, then the interaction may also be found in the context region in second-pass reading time and total time, as both of these measures include refixations that are made after the reader has progressed beyond the analysis region.

Given the experimental design, the crucial prediction is the interaction between referring expression type and referent type, and it is important to note that, depending on the analysis region, the main effects will not always be straightforwardly interpretable. For example, the main effect of referring expression type is not interpretable in the anaphor region in any theoretically interesting way, because the two anaphors (*this* and *it*) differ in length and frequency (e.g., in the 90 million word written portion of the British National Corpus, *it* occurs 835,205 times, whereas *this* occurs half as often, 404,753 times).

Methods

Participants. Forty paid native English-speakers aged 21 to 24 from the University of Edinburgh participated. All were unaware of the purpose of the study.

Apparatus. We used an Eyelink 1000 eye-tracker (SR Research Ltd,. Ottawa, Canada) in tower-mounted mode, with a chin rest to stabilize each participant's head. After *it* and *this*, to test what is preferred as referents of *it* and *this*, we used disambiguating NPs (i.e., a job/read) throughout the stimuli.

Materials. Adjectives were used immediately before the disambiguating noun (i.e., expensive, splendid, and wonderful). The number of characters in the adjectives ranged from 7 to 9. We were careful to select the disambiguating nouns from commonly used words to avoid introducing extraneous processing difficulties. To avoid extraneous differences in fixation times due to length, the lengths of the disambiguating nouns between conditions were kept as similar as possible. The average noun length in each antecedent condition was 6.2 characters and the length differences between the conditions were not significant ($t = .530$, $p > .05$).

There were 40 experimental items,[2] each in the four experimental conditions illustrated above; thus, the experimental manipulations were within-item. In all four constructed files each sentence appeared in only one condition and each condition appeared an equal number of times. Ten participants were assigned to each constructed file. There were 60 fillers and eight practice items, which were similar in length to the experimental sentences. The following is an example of one of the fillers:

Alice packed her belongings with the help of her best friend. Once she had wrapped everything, she put the packages into her small car.

The texts were presented on one or two written lines. The number of characters in each line was between 75 and 90. *It* and *this* always appeared towards the middle of the line.

Procedures. We presented 108 texts in Times New Roman 18-point font, in a fixed random order, and with no two experimental items appearing adjacent to each other. The experiment began with eight fillers to familiarize participants with the experimental procedure. Only the right eye was tracked, but viewing was binocular. Items appeared on a 19-inch monitor approximately 80 cm from the participants' eyes. Before each item, the participant fixated on a black square, which allowed the experimenter to check the calibration of the participant's eyes. After reading each item, the participant pressed the X-button on the controller to see the corresponding comprehension question and then pressed the left button for the option on the left and the right button for the option on the right. The comprehension questions never probed the referents of *it/this*.

Results

The texts were divided into five regions, defined in Table 1. Fixations of less than 80 ms or more than 1,200 ms were excluded from the analysis. All participants scored at least 90% correct in their answers to the comprehension questions.

We report results for regression path times (the sum of all fixations from the first entry into the region from the left, until the first fixation to a later region), second-pass reading times (i.e., the sum of all fixation durations after the first exit of the region either to right or left), and total reading times (i.e., the sum of all fixations in the region, reflecting overall processing). Regression path time was our measure of early processing, as this reflects the fixation behavior that immediately follows the reader's initial inspection of a given region. First-pass reading times were also analyzed, but this measure failed to show significant effects.[3] In the analysis, we removed zeros from regression path times, and such trials were treated as missing data. On the other hand, for second-pass reading time we did not remove zeros or trials where a region was not refixated contributed a value of 0 ms, as these zero values are

[2]Please visit the following website for the full set of stimuli used in Experiment 1: http://stimuliexperiments.weebly.com/

[3]In our laboratory, we typically find that regression path time is a more reliable indicator of discourse-level effects than first-pass reading time.

Table 1. Analysis regions in experiment 1.

Region	Sample Stimulus
1: Context antecedent	Charlotte wrote a book.
2: Anaphor	It/This was
3: Disambiguation	a difficult job/read.
4: Conjunction	but the
5: Final	sales were spectacular.

Critical regions are 1–3.

meaningful (a region did not require a second pass). For total reading time, regions that received no fixations at all in any given trial were treated as missing data and removed from total reading time. All analyses were conducted using linear mixed effects regression (Baayen, 2008; Baayen, Davidson, & Bates, 2008; Jaeger, 2008) and the lme4 R package (R Core Team, 2015). An additional package (plyr) was used to compute *p* values.

For each region and measure, a linear mixed effects regression model was constructed, incorporating all fixed effects and their interactions in a single step. Factor labels were transformed into numerical values and centered before analysis to have a mean of 0 and a range of 1. The results provide coefficients, standard errors, and *t* values for each fixed effect and interaction.

All analyses reported below incorporated crossed random intercepts for participants and items. Random slope parameters (levels of anaphor) (e.g., *it* and *this*), two levels of ontology (e.g., *NP* and *proposition*), and the interaction in the slopes (anaphor × referent type +1|subject) were included in the maximal model for both participants and items. The maximal model always converged and therefore was used throughout.

Regression path time. There were no effects of referring expressions and referent types on regression path times for the context and anaphora regions (Figure 1), $t < 2$. In regression path times, for the disambiguation region, the predicted interaction of the two variables (referring expression and referent type) was significant ($\beta = -92.52$, $SE = 34.33$, $t = -2.695$, $p < .05$) (Figure 1). References to the NP with *it* (e.g., the book) led to shorter regression path times (NP M[4] = 561) than did references with *this* (NP $M = 616$, pairwise comparison $t = -2.014$, $p = .045$). References to the proposition (e.g., *writing up a book*) with *this* ($M = 585$) led to numerically shorter regression path times than references to the proposition with *it* ($M = 620$), although this pairwise comparison failed to reach significance ($t = 1.280$, $p > .05$).

Second-pass reading time. In second-pass reading times, for the context region there was a main effect of referent type (Figure 2) ($\beta = 88.40$, $SE = 39.48$, $t = 2.239$, $p < .05$, NP $M = 472$, Proposition $M = 561$). References to the proposition led to longer second-pass reading times than references to the NP. The same region also revealed a significant interaction between the two variables in second-pass reading times ($\beta = -111.49$, $SE = 48.00$, $t = -2.312$, $p < .05$). Second-pass reading times were numerically shorter in NP references with *it* than those with *this* (*it* NP $M = 456$, *this* NP $M = 488$), but the pairwise comparison did not reach significance ($t = .902$, $p > .05$). Fixation times in the condition where *this* referred to the proposition ($M = 521$, $t = 1.997$, $p = .049$) were reliably shorter than those in which *it* referred to the proposition ($M = 600$).

The main effect of referring expression was significant in the second-pass reading times in the anaphor region ($\beta = 71.347$, $SE = 13.546$, $t = 5.267$, $p < .05$, *it* $M = 96$, *this* $M = 167$). Second-pass reading times were longer in the condition with *this* than with *it*. However, as mentioned above, this effect is not interpretable because of the length differences between the two anaphors. In the same region, the interaction of the two variables (referring expression and referent type) was not significant ($\beta = -32.764$, $SE = 18.853$, $t = -1.739$, $p > .05$). In the disambiguation region, neither the main

[4]Means are reported based on data aggregated by participant.

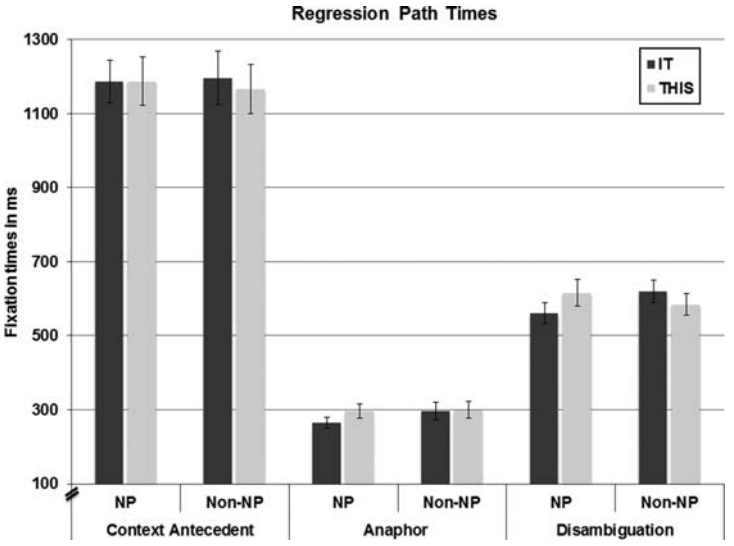

Figure 1. Regression path times (in ms) across regions. Error bars represent the standard errors of the condition means.

effect (anaphor and type of referents) nor the interaction between the two variables were significant in second pass, $t < 2$.

Total reading time. In total reading times, for the context antecedent region, the interaction between the two factors was significant ($\beta = -147.42$, $SE = 68.74$, $t = -2.113$, $p < .05$; Figure 3). Total times were numerically longer when *this* referred to a NP than when *it* did so, with a numerically opposite pattern for the proposition-reference conditions, but neither of these two pairwise comparisons reached significance (*it* NP $M = 1644$, *this* NP $M = 1{,}680$, pairwise comparison between *it* and *this* referring to NP: $t = .587$, $p > .05$; *it* proposition $M = 1{,}800$, *this* proposition $M = 1{,}691$, pairwise comparison between *it* and *this* proposition: $t = 1.545$, $p > 05$).

In the anaphor region, there was a main effect of referring expression for total reading times ($\beta = 105.222$, $SE = 16.050$, $t = 6.556$, $p < .05$). Fixation times were longer when references were made with *this* than when they were made with *it* (*this* $M = 369$, *it* $M = 221$). Again, this effect is not interpretable because of length differences. In the same region, the interaction between two variables

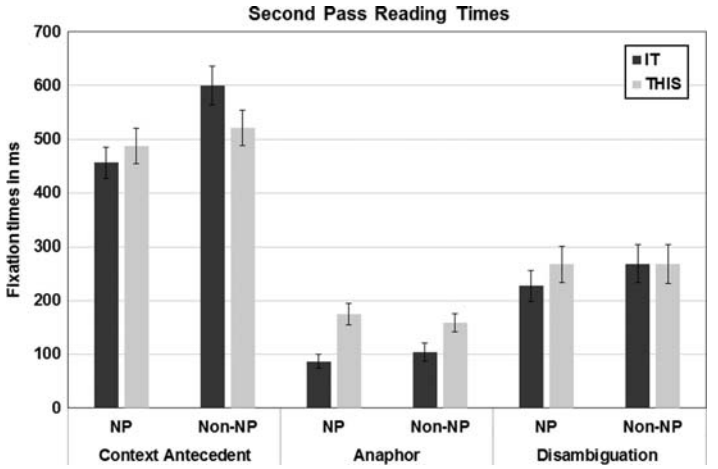

Figure 2. Second-pass reading times (in ms) across regions. Error bars represent the standard errors of the condition means.

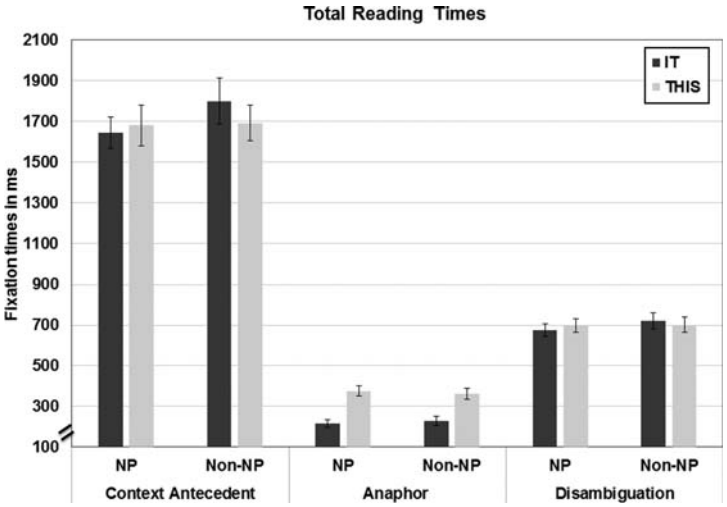

Figure 3. Total pass reading times (in ms) across regions. Error bars represent the standard errors of the condition means.

was not significant: $t = 1.424$, $p > .05$. The disambiguation region for total reading times did not reveal any main effects or any interaction between the variables, $t < 2$.

Discussion

The predicted interaction between referring expression type and referent type was observed in regression path time in the critical region as well as total time and second-pass time in the context region. In all cases the means for the interaction showed the predicted cross-over pattern, with (1) longer reading times when *it* referred to a proposition than when *this* referred to a proposition and (2) the reverse effect when *it* or *this* referred to an entity. Among measures that showed an interaction, there were significant pairwise comparisons for both second pass in the context region and regression path in the critical region. In addition, although we acknowledge that no single measure showed significant contrasts for both simultaneously, the overall effect is consistent with our predictions and with previous work (Brown-Schmidt et al., 2005; Byron & Allen, 1998; Consten et al., 2007; Fossard et al., 2012; Kaiser & Trueswell, 2008; Lenz, 2007; Linde, 1979; McCarthy, 1994; Passonneau, 1989; Webber, 1989).

The first appearance of the predicted interaction was in the regression path measure at the critical disambiguating region, indicating that the effect occurred relatively early, before readers moved on from the disambiguating word to later sentence regions. This suggests readers committed to the preferred referential interpretation soon after their first encounter with the anaphoric expression (i.e., *it* or *this*) rather than waiting for further disambiguating information before making a decision. Further evidence of the interaction was found in the second pass and total time measures in the antecedent region, implying that disambiguation towards the dispreferred alternative led to increased time spent refixating the antecedent sentence

Our results also demonstrate that references to the proposition led to more time spent refixating the context sentence than references to the NP referent, an effect that was manifested in second-pass reading times. This finding supports our prediction that readers' processing of concrete entity references would be easier than propositional references. This may possibly be because readers first processed atomic/entity referents (Charlotte, a book) and then reconstructed a subject-predicate configuration between entities (that Charlotte wrote a book), subsequently linking this with the content of the target verb phrase (e.g., was a difficult job/read) and recomputing all relational propositional referents into a discourse entity as a referent of *this*. Because of the complex subject–predicate

configuration in the processing of propositional references, extra cognitive effort may be required to identify and maintain the referent, and this may have been the reason for the longer fixations for the propositional reference in second pass for the context region. If so, then our results reflect the complexity in the processing of relational propositional referents compared to concrete entity referents.

Experiment 2

Experiment 1 showed that readers make early referential commitments on the basis of the writer's use of *it* vs. *this*. Experiment 2 tested whether the same preferences would be used in an offline production task. In this experiment participants were given the context sentences of Experiment 1, but with the target sentences left blank after *it* or *this* (see sample stimulus below). The participants were asked to write the rest of the sentence in a way that was consistent with the previous text.

Sample Stimulus:

1- Alice pruned the bonsai tree. *It*/*this* . . .

We predicted that the frequency of referent types would differ as a function of whether the anaphor was *this* or *it* and that participants would write more completions with *it* than with *this* when referring to the referent of a NP and more completions with *this* than with *it* when referring to a proposition.

Methods

Participants. The participants were 16[5] paid British native speakers of English from the University of Edinburgh. Participants were not informed of the purpose of the study.

Materials and procedures. There were 40 experimental and 60 filler stimuli.[6] The experimental stimuli used the context sentences from Experiment 1. There were two types of anaphor (*it* and *this*), and this factor was manipulated within items and subjects. Two versions of each sentence and two files were constructed. In each file, each sentence appeared in only one condition, but each condition appeared an equal number of times. Sentences were presented in a booklet in fixed random order. Each participant was asked to complete the sentences given in the stimuli.

Results

While coding sentence completions, we counted how often *it* or *this* was used to refer to a NP or a proposition. We also coded prenominal uses of (*this* + NP) or cleft uses of *it* as "other" and we excluded all trials coded as "other" from further statistical analysis. Continuation codings, as well as samples for prenominal and pronominal *it* and *this*, are presented in Appendix A. Two research assistants independently transcribed the data and coded the continuations according to the predetermined categories. Any continuations that annotators did not understand were excluded from data analysis. Figure 4 shows the relative proportions of references to NP and non-NP proposition for each anaphor type.

Because the data for this experiment are categorical, the statistical analyses in this section involved logistic mixed effects regression,[7] taking condition (*it* vs. *this*) as the fixed effect and including crossed random intercepts and slopes for subjects and items. In 18% of the cases, the antecedents of *this* and *it* were neither NPs nor propositions (e.g., *this* morning, *this* Friday) or their antecedents were unclear. Because prenominal and pronominal uses of *this* are assumed to signal different cognitive processes

[5]This sample size was determined based on our experience with completion data in previous studies.
[6]Please visit the following website for the full set of stimuli used in Experiment 2: http://stimuliexperiments.weebly.com/
[7]The analyses were computed using the lme4 package in R (see http://lme4.r-forge.r-project.org). The official number of lme4 was 999375-35. R 3.0 for Windows was used.

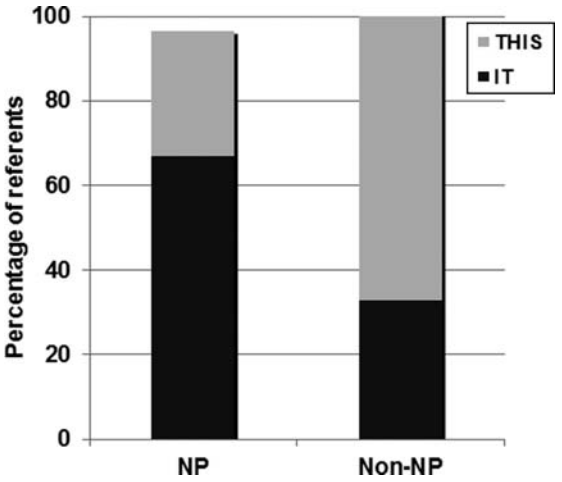

Figure 4. Proportion of NP and non-NP responses for each anaphor type.

(Ariel, 1996; Gundel et al., 1993) and our study focused on pronominal uses of *this*, we excluded all trials coded as "other" from further statistical analysis. The proportion of these trials (coded as *other*) differed between *it* and *this* conditions, though the difference was marginal $Z = 1.720$, $p = .09$. There were more "other" responses in the *this* condition than the *it* condition (see below).

Of the remaining responses, participants had a strong preference for using *it* when referring to a NP and *this* to a proposition (*it*: NP 67% vs. PRO 33%; *this*: NP 30% vs. PRO 70%; Figure 4). These percentages reflect the distribution of NP and non-NP proposition responses within each anaphor type, after the "other" responses have been removed from analysis. In the logistic mixed effects regression, we coded references to the proposition as 0 and references to the NP as 1, including anaphor type as a fixed effect, and random slopes and intercepts for both participants and items. This analysis yielded a highly significant effect of anaphor type ($Z = -8.133$, $p < .001$), confirming that *it* led to reliably more NP references than did *this*. Thus, the likelihood of referring to a proposition was higher with *this* than with *it*.

As can be seen in Figure 5, in 54 % ($n = 25$) of "other" cases, *this + NP* was used to refer to a NP in an object position, whereas in only 4%. ($n = 2$) of cases a prenominal *this* was used when referring to a proposition (e.g., [1] Cassiopeia stabbed at the advancing dragon. *This fatal blow* killed the dragon instantly. [2] Catherine crossed the Atlantic. *This journey* took 20 days). Consequently, NP references were preferred over proposition references when *this* was used prenominally.

In accordance with our predictions, both *it* and *this* are preferred when referring to different types of antecedents. Specifically, *this* was preferred when referring to a proposition, whereas *it* was preferred when referring to a NP in the completion experiment. It appears writers take into consideration the referent's type when choosing to use *it* or *this*.

In addition, the analysis of the "other" category revealed that prenominal *this* references to a NP were preferred over references to a proposition. The NP reference of prenominal *this* is consistent with the Poesio and Modjeska's (2002) corpus findings (which used a collection of museum and pharmaceutical descriptions) demonstrated that prenominal *this* tended to refer to active NPs in discourse, but not to entities in focus.

General discussion

This study had two purposes: to use online and offline measures to explore the referential preferences for *it* and *this* and to explore the role of referent type (a non-NP/less salient vs. a concrete entity/salient) in the processing referents of *it* and *this*. Experiment 1 demonstrated an interaction of referent type with referring expression type, in several eye-tracking measures, such that reading times were shorter

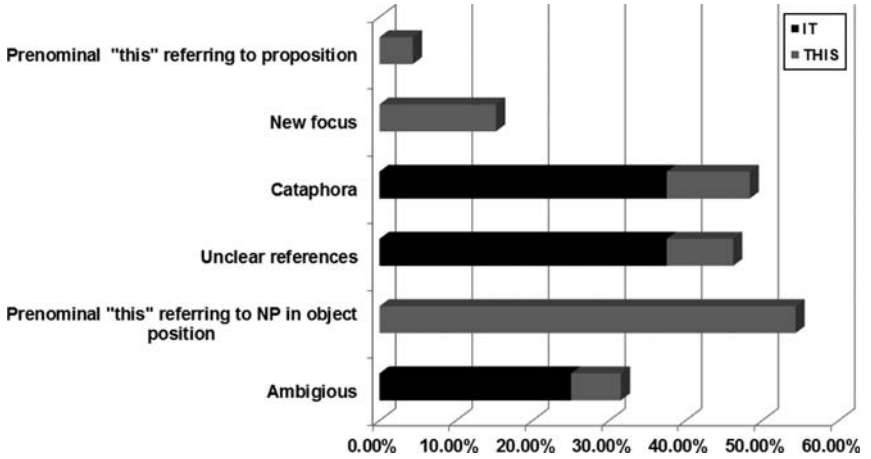

Figure 5. Percentage of referents of it and this in the other category.

when the reference was disambiguated toward a non-NP reference/proposition for *this* and toward an NP for *it*. The effect occurred relatively early in regression path times for the disambiguating region. This demonstrates that readers committed to a referential choice consistent with the preferences for *this* or *it,* soon after encountering the referring expression. In addition, readers spent more time resolving such ambiguities when the disambiguating information required reference to a proposition, relative to when it required reference to an entity. This effect of antecedent, which was manifested in second-pass reading times in the context sentence, is consistent with extra processing effort required to identify and maintain a propositional reference.

Sentence completion results were consistent with those of the reading experiment and confirmed that writers use *it* and *this* to refer to different types of antecedents. NP (i.e., entity) references were more frequent with *it* than with *this*, whereas references to a proposition were more frequent with *this* than with *it*. Both experiments' results were consistent with the *type of referring expression* account, suggesting *this* and *it* were encoded with different procedural instructions to readers/writers (Ariel, 2001; Byron & Allen, 1998; Gundel et al., 1988; 1993; Linde, 1979; McCarthy, 1994; Passonneau, 1989; Webber, 1990).

The sentence completion experiment showed a 37% difference in preference between *this* and *it*. This is a very large effect for this type of data and the statistical analysis showed highly reliable effects. In the eye-tracking experiment, the predicted interaction was reliable in three different measures, but we informally note the effect was relatively subtle for a study with this number of participants and items per condition, based on our experience with eye-tracking data. Clearly, it is not possible to make any kind of direct comparison between two datasets using two different tasks, but we suggest the preference may be stronger given the sentence completion task, relative to online comprehension (see also related discussion in Çokal, Sturt, & Ferreira, 2014). If these differences across tasks are genuine, they might be related to sentence completion and reading differences. In addition, such clear antecedent preferences in the sentence completion experiment may explain why linguistic and corpus studies have found different antecedent preferences for *this* and *it* (Asher, 2001; Byron & Allen, 1998; Consten, et al., 2007; McCarthy, 1994; Passonneau, 1989; Webber, 1989). Alternatively, it may be that the offline method used in Experiment 2 gives more robust results, because it reflects the outcome of processing, rather than the ongoing process of constructing an interpretation.

According to the addressee-centered account (i.e., Ariel, 1996; Grosz & Sidner, 1986; Gundel, et al., 1993), an addresser selects referential expressions regarding an addressee's need for comprehension and avoids ambiguity for the addressee. It is assumed that an addresser uses referential expressions "to

accommodate the hearer's perspective" (Givón, 1992). However, the differences across our tasks and the relatively subtle effect in our eye-tracking experiment indicate that readers' and writers' mental representations for the processing of anaphors may not match as closely as is commonly assumed. This idea relates to Fukumura and Van Gompel's (2012) finding that the addresser's choice of referential expressions and referents is governed by the addresser's own drive to continue the discourse (purpose/intentional states) and his/her own discourse structures rather than by the addressee's mental/discourse state or working memory.

Our results also suggest the references of *this* and *it* to different types of referential objects might be related to complexities in readers' language processing. In the eye-tracking experiment, non-NP references/propositions led to longer fixations than NP references in second pass reading times for the context region. This indicates that processing of propositional antecedents requires extra cognitive effort, possibly because readers must first establish a predicate-like relationship between concrete entities and verb phrases and then reconstruct a subject-predicate configuration. On the other hand, in concrete entity references, readers simply need to identify the referent denoted by the previous NP. Therefore, because of its deictic character, *this* was preferred when referring to a proposition rather than *it*. Here, deicticity/indexicality of *this* signals the need to reconstruct a subject–predicate configuration or a "new" discourse representation about the previous discourse. Thus, via its deicticity/indexicality, *this* can guide addressee's attention to a new representation rather than the referentially continuous one (cf. scale of anaphoricity and deicticity in Cornish, 2007). In addition, reconstruction or reorientation of *this* requires more cognitive effort to maintain its referent compared to the entity/atomic reference of *it*. In short, the less complex a referent (NP referents in our case), the more reduced are anaphoric expressions used to refer to that referent. Meanwhile, an indexically stronger referential expression (*this* in our case) is preferred to refer to complex/relational propositional referents (Ariel. 1990; Givón, 1983; Gundel et al., 1993).

Previous psycholinguistic studies have shown that different types of referential expressions are affected by different factors, which contrasts with traditional views of salience (e.g., Brennan et al., 1987; Grosz et al., 1994; Grosz & Sidner, 1986; Kameyama, 1986; Passonneau, 1993) and with the functional linguistic account (e.g., Halliday & Hasan, 1976; Dik, 1997). According to traditional views of salience, the preferred referents for pronominal anaphoric expressions are those in the subject and object positions rather than other categories (Brennan et al., 1987; Grosz et al., 1994; Grosz & Sidner, 1986; Kameyama, 1986; Passonneau, 1993). However, our results extend the alternative CT account (Maes, 1997) and suggest that a non-NP referent is the preferred antecedent for *this*. Consequently, referent ontology (i.e., whether the referent is an entity or a proposition) plays a role in producing and processing referents of *this* and *it*.

According to traditional functional account (Dik, 1997; Halliday & Hasan, 1976), anaphora resolution is a binary relation between anaphoric expressions and antecedents in which anaphors refer to entities in discourse. Here, our results are consistent with the view that although *it* refers to entities in discourse, the pronominal *this* introduces a new aspect to existing referents and signals interpretation and integration of the given information. As a result, the relation between pronominal *this* and its referent is computed at the level of discourse representation. Therefore, supporting the findings in previous psycholinguistic studies, we suggest that different types of referential expressions presuppose different referent types/complexity in language processing at the point of use, and this difference is manifested immediately after the referential expressions are processed. The referents themselves also differ in the amount of cognitive effort required to resolve such ambiguity. Besides helping to resolve reference, these expressions also serve to structure discourse and guide readers/writers' attentional focus (Cornish, 2008).

Additionally, our sentence completion experiment demonstrated that references to a NP denoting an entity with prenominal *this* + *NP* (e.g., *this* book) were more frequent than those to prenominal *this* + *proposition*. The different antecedent preferences for prenominal *this* + *NP* and pronominal *this* also support the assumption that prenominal and pronominal uses of *this* trigger different cognitive

processes (Ariel, 1996; Gundel et al., 1993). Given that differences between prenominal and pronominal uses of *this* are not within the scope of the current research, there is a need for further research on the distinction between prenominal and pronominal demonstratives.

Overall, our study shows that the processing and use of anaphoric expressions is affected by the interaction between the lexical characteristics of referential forms, different levels of referent types, and, possibly, characteristics of the tasks. In addition, our study points to the need for a further examination of differences between prenominal and pronominal demonstratives in written discourse and how other types of entities (NPs in different grammatical roles) affect the processing and production of anaphors across different experimental tasks and languages.

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Appendix A

Categories for coding antecedents of It and *This*

1. If *it* or *this* referred to the proposition, then its antecedent was coded as the proposition.
   - Daniel climbed Mount Ventoux. *It* didn't take him as long as he expected.
   - Bernadette hurled her computer. *This* caused a few people to stare at her in the office.

2. If *it* or *this* referred to the NP, then its antecedent was coded as the NP.
   - Alice rented an allotment. *It* was a place where she could gather her thoughts.
   - Bernadette hurled her computer. *This* was the second one she had smashed against the wall in her frustration.
3. Other categories:
   - If the antecedents of *it* or *this* were not clear or ungrammatical, if the new discourse focus was introduced, if *this* was used as a pre-nominal (i.e. this book), or if *it* or *this* refers to the entity in the following part of the text, then all these cases were coded as other categories.