Distinguishing Fact from Opinion: Effects of Linguistic Packaging

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Abstract

During language comprehension, what guides how we distinguish between objective facts and subjective opinions? Our three experiments investigate whether people's ability to detect subjective content – which we indicated by means of opinion-conveying adjectives (e.g. *amazing, frustrating*) – is modulated by the adjective's structural position. Our results indicate that altering the linguistic structure of a sentence influences our perception of how subjective it is: Even when the basic information being conveyed is held constant, packaging this information in different ways elicits different levels of perceived subjectivity. When a subjective adjective occurs in a structural position associated with new information, the text is rated as more subjective compared to a text that conveys the same basic information but has the same adjective in a position associated with already-known information. This suggests that the difference between fact and opinion, or at least our ability to recognize opinion-based information, can be distorted by linguistic packaging.

Keywords: subjectivity; language comprehension; adjectives; information structure; psycholinguistics

Introduction

People are continuously faced with a large amount of information from many channels (e.g. television news, social media, news websites and newspapers), often in short 'sound bites' with limited context, often intermixed with people's subjective opinions and reactions. A fundamental step to make sense of such information is distinguishing objective, factual information from subjective opinions.

However, a recent study found that people struggle with this fundamental step (Mitchell et al. 2018). Our work aims to shed light on why people struggle with the seemingly easy task of distinguishing facts and opinions. We investigate whether a statement being perceived as fact or opinion is modulated by its *linguistic packaging*. Can the same words, put together in a different way but conveying the same basic information, influence the extent to which a text is perceived as fact-like or opinion-like?

Language provides multiple 'packaging options' for expressing the same basic information (e.g. Chafe 1976, Lambrecht 1996), and different packaging options are known to influence depth of processing and recall (e.g. Hornby, 1974; Sturt, et al. 2004). For example, the three variants in (1) all convey the same two pieces of information: Piece (a): The orchestra is amazing (someone's opinion) and Piece (b): The orchestra includes five violinists who have won prizes (a fact). (1a-c) vary only in terms of how these two pieces are packaged:

(1a) The *amazing* orchestra included five prize-winning violinists. [**prenominal modifier**]
(1b) The orchestra, *which was amazing,* included five prize-winning violinists. [**appositive relative clause (RC)**]
(1c) The orchestra *was amazing*. It included five prize-winning violinists. [**predicative**]

In (1a), the subjective adjective 'amazing' occurs before the noun 'orchestra,' as a prenominal modifier. In (1b), the adjective occurs in an appositive relative clause (RC), a type of RC which typically conveys supplemental information that is not part of the main news (e.g. Loock 2007, Potts 2005, see also Dillon et al. 2017). In (1c), the adjective occurs in predicative position with a copular verb.

Our work explores whether people's ability to recognize that sentences like (1a,b,c,) contain subjective information (the opinion that the orchestra is amazing) is modulated by these different kinds of linguistic packaging. Is people's ability to detect opinions indicated by subjective adjectives (e.g. *amazing*) lessened when the adjective is presented as background information or already-mentioned information? Conversely, is people's ability to recognize opinions heightened when the adjective is packaged as part of the 'main assertion' or as new information?

Conveying opinions with subjective adjectives

We explore potential effects of linguistic packaging with two classes of subjective adjectives: what we call 'complex' subjective adjectives (e.g. *terrible, amazing,* Experiment 1) and 'simple' subjective adjectives (e.g. *long, heavy*, Experiment 2). Objective adjectives (e.g. *plastic, triangular*) are used as controls (Experiment 3).

Subjective adjectives convey opinions, rather than objective facts about the world. There is a large and growing semantics literature on subjective adjectives (e.g. Lasersohn 2005, Kennedy 2013, Sassoon 2013, Pearson 2013, McNally & Stojanovic 2017, and many others).

The subjectivity of *complex* subjective adjectives (e.g. *amazing, beautiful*) can stem from multiple sources. E.g. multiple dimensions can contribute to whether someone judges a particular place as *beautiful* (e.g. landscape, color

of the sky, McNally & Stojanovic 2017), and people differ in terms of which dimensions they view as more important (e.g. Sassoon 2013, McNally & Stojanovic 2017). Also, in some cases the subjectivity of these adjectives is linked to firsthand experience (e.g. Lasersohn 2005, Bylinina 2014, McNally & Stojanovic 2017), which often involves multiple dimensions: I might find a certain novel *boring* because it has too much description and not enough action; you might disagree because the ending was surprising. When assessing our experiences of whether the novel is boring, we can give different weights to different dimensions. In essence, complex subjective adjectives can convey individuals' opinions in a way that does not have a semantically simple or unified source.[1]

In contrast, *simple* subjective adjectives (e.g. *tall, fast*) only make reference to one dimension (e.g. height, speed), and require that a certain threshold along that dimension is met. For example, for a person to count as tall, their height needs to surpass a certain threshold. There is a large body of formal semantic research on this class of adjectives. In the present paper, we refer to them as simple subjective adjectives for ease of exposition, but in semantic terms, our simple subjective adjectives are members of the class of *relative gradable adjectives* which is often analyzed as having degree semantics. The subjectivity of these adjectives stems from the fact that individuals may have different opinions about the threshold/standard for what counts as, say, *tall* in a particular context or for a particular object (e.g. Kennedy 2007, Solt 2015, McNally & Stojanovic 2017). We regard the subjectivity of these adjectives as simpler (relative to complex subjective adjectives) because it is constrained to one dimension.

Intuitively, simple subjective adjectives are less subjective than complex adjectives. Claims about being *boring* or *funny* seem more opinion-based that claims about being *tall* or *fast*. This difference can be derived from Kennedy (2007)'s observation that people tend to interpret linguistic elements according to conventionalized, shared standards whenever possible. The thresholds of simple subjective adjectives (e.g. what counts as tall for a person) are more conventionalized than complex subjective adjectives: E.g. even within the same sociocultural context, people disagree about whether a tv show is amazing. Testing simple and complex subjective adjectives allows us to assess the generality of our findings regarding the effects of linguistic packaging on the perception of subjectivity.

Linguistic packaging

Why might we expect linguistic packaging to modulate perception of subjectivity? Crucially, not all information in a sentence is equally 'newsworthy' (Prince 1981; Vallduví 1992; Birner & Ward 1998). A sentence can contain various kinds of secondary, backgrounded information in addition to its main news (see focus vs. background, e.g. Jackendoff 1972, at-issue vs. not-at-issue meaning, e.g. Potts 2005, Simons, Tonhauser, Beaver & Roberts 2010). We use the terms ***main news*** **and** ***secondary information*** for these two broad classes of information.

It is generally agreed that some linguistic positions are used to convey the 'main news,' while other positions correspond to secondary, backgrounded information. In fact, the packaging choices in ex.(1) differ in terms of whether or not the subjective adjective is presented as main news or as secondary information. Information in predicative position (e.g. *amazing* in 1c) constitutes *main news*, while information inside an appositive relative clause (1b) or as a prenominal modifier of a definite noun (1a) is interpreted as *not* being the main contribution of the sentence (e.g. Potts 2005). The main news conveyed by both (1a) and (1b) is the number of prize-winning violinists. (Here, we focus on definite nouns with 'the' because this makes it possible to compare the different linguistic packaging options in a maximally parallel way.)

In addition to the distinction between main news vs. secondary information, we also consider **whether or not the information is already shared** between (known by both) the speaker and the addressee (e.g. Prince 1981, Birner & Ward 1998). Information that constitutes the main news of an utterance is typically *new* information for the addressee. However, secondary information can be *new or already-known/shared information.* Whether something is presented as new or already-known information maps onto the two packaging options for secondary information: prenominal adjectives vs. adjectives in appositive RCs.

By using a prenominal adjective with a definite noun (e.g. *the amazing orchestra*), the speaker signals that the information conveyed by the adjective is not only secondary but also something already known and agreed-upon by the speaker and the addressee. Thus, the speaker treats the noun and the information from the adjective as already being in common ground.[2]

In contrast, with appositive relative clauses, the speaker is marking the adjective as conveying extra, supplemental (background) information that may not be previously known by the addressee (e.g. Loock 2007). Although both prenominal modifiers and appositive relative clauses provide secondary, non-'main news' information, they crucially differ in terms of whether this information is presented as new vs. old/known information: Prenominal adjectives with definite nouns convey information that is already shared information, already in common ground, but this is not the case with appositive relative clauses.

In sum, linguistic elements in different structural positions differ in terms of whether they are (a) part of the main news

[1] Our term 'complex subjective adjectives' is largely synonymous with the terms *predicates of personal taste* and *multidimensional adjectives* from formal semantics. However, this distinction is not central for the issues investigated in this paper.

[2] Our design, the critical nouns were in subject position. This choice was made to allow for maximal parallelism across conditions. In information-structural terms, information in subject position tends to be not only known (given/old) information but also topical (e.g. Chafe 1976). This topicality effect may be further strengthening the 'known-information' cue.

vs. secondary information, and (b) new information or already-known information. The existence of these informational differences and their associations with different structural positions brings up the question of whether they influence recognition of subjective content.

Does linguistic packaging guide perception of subjectivity?

We ask two questions: (i) Are subjective adjectives packaged as main news (predicative position) recognized as more subjective than the same adjectives packaged as secondary information (prenominal position or appositive RCs)? (ii) Are subjective adjectives that can be interpreted as new information (predicative position, appositive RCs) recognized as more subjective than the same adjectives presented as already-known information (prenominal position)? These questions relate to **three hypotheses:**

First, according to a *lexically-based hypothesis,* the presence of a subjective adjective, regardless of position, triggers recognition of subjective content. According to this view, subjective adjectives are consistent cues that a sentence contains opinion-based information. This view is motivated by a large body of work arguing that the lexical semantics of subjective adjectives differ in fundamental ways from the semantics of objective adjectives (e.g. Lasersohn 2005, Bylinina 2014). Indeed, there is good reason to expect language users to be sensitive to such lexically-encoded information: Prior work has shown that the human language processing system is highly attuned to lexical properties and makes rapid, efficient use of lexical semantics during real-time processing (e.g. MacDonald, Pearlmutter and Seidenberg 1994 and many others).

However, according to a *structure-based view,* the degree to which subjective adjectives are perceived as conveying subjective content depends on linguistic packaging. There are two (non-mutually-exclusive) sub-hypotheses under this view:

According to the *main-news hypothesis,* subjective adjectives that are presented as being part of main news (predicative constructions) are more easily recognized as subjective than subjective adjectives that are packaged as part of secondary information (appositive RCs, prenominal modifiers).

According to the *new-information hypothesis*, subjective adjectives whose structural position marks them as being information (prenominal modifiers) are less likely to be recognized as conveying an opinion when compared to information that is not clearly marked as being already known (appositive RCs, predicative constructions).

As mentioned above, these two sub-hypotheses are not mutually exclusive. Both newsworthiness and newness could, in principle, play a role in guiding people's perception of subjectivity.

Predictions Investigating the three structures in (1) allows us to test these structure-based hypotheses: If the new/old information dimension modulates perception of subjectivity (new-information hypothesis), we expect adjectives in predicative position and the appositive RCs to be perceived as more subjective than the same adjectives in the prenominal modifier position. In contrast, if the main news/secondary information dimension modulates perception of subjectivity (main news hypothesis), the prediction is for adjectives in predicative position to be perceived as more subjective than those in prenominal modifier position or inside appositive RCs. If both dimensions guide perception of subjectivity, we expect a difference between all three configurations, since the predicative position is associated with newness and 'main-news'-ness, the prenominal position is associated with neither, and information in appositive RCs is associated with newness but not with main news (Table 1).

Table 1: Informational properties of linguistic packaging.

Linguistic structure	*presented as main news or secondary info*	*presented as new or known info?*
prenominal modifier	secondary info	known
appositive RC	secondary info	(can be) new
predicative	main news	new

Psychological foundations Our predictions have their roots in a large body of prior psychological research showing that the human language processing system privileges new information and 'main news' information over old/known information and backgrounded information, in terms of how much attention is allocated to it: Backgrounded, known information is not processed as deeply, not attended to as much, and not recalled as accurately as information that conveys the main news (e.g. Hornby 1974, Sanford & Sturt 2002, Sturt et al. 2004, and many others). Relatedly, other work has found that the main news is remembered better (e.g., Birch & Garnsey, 1995; see also Dillon et al. 2017). In other words, prior work convincingly shows there to be a close relation between information packaging and allocation of attention. Our experiments assess whether these effects influence people's ratings of perceived subjectivity.

Experiment 1: Complex subjective adjectives

Experiment 1 investigated people's subjectivity ratings of complex subjective adjectives in different positions to test for effects of structural position on the perception of subjectivity. Although linguistic packaging options are known to influence depth of processing and recall (as mentioned above), to the best of our knowledge the effects of different information-packaging options on our ability to recognize subjective, opinion-based information have not previously been systematically investigated.

Method

Participants Thirty-six native English speakers (recruited from Amazon Mechanical Turk) were included in the analysis. We only included those who reported being born

in the U.S. and speaking English as their first language, and made no more than two errors on unambiguous practice items. One more person was excluded because their responses on practice trials indicated they had reversed the scale. In all experiments reported, exclusion criteria were prespecified before data analyses on targets were conducted.

Materials and design The study consisted of 20 targets and 36 fillers. In the targets, we manipulated the presence and location of the subjective adjective. The baseline condition contained no adjective (ex.1d); in the prenominal modifier condition the adjective modifies the noun (1a); in the relative clause condition the adjective occurs inside an appositive relative clause (1b); and in the predicative condition the adjective occurs in the predicative frame "X was Y" (1c). The critical noun is preceded by the definite article *the*. Crucially, all three adjective-containing conditions convey the same propositional information (orchestra=amazing; orchestra=included five prize-winning violinists). They only differ in the linguistic packaging.

(1d) The orchestra included five prize-winning violinists. [**baseline**]

Each target used a different adjective. We used a mix of positive and negative adjectives, e.g. *amazing, interesting, impressive, frustrating, tragic, unpleasant*. Items were presented to participants using a Latin-Square design. In targets, the semantic relation between the adjective and the rest of the text was controlled such that the objective information provided grounds/ evidence for use of the subjective adjective (e.g. the information that the orchestra included five prize-winning violinists provides the evidence for describing it as amazing). (Further studies not reported here show that the same results obtain even when *no* evidence/grounds is provided for the subjective adjective.)

Procedure Participants completed the study via the web and were instructed to treat the texts as coming from newspapers or news websites, and to imagine that the sentences could come from any section such as News, Opinion, Sports, Arts and so on. Participants provided a subjectivity rating for each sentence on a 6-point scale (1=fact, 6=opinion). Crucially, they were instructed to rate a sentence as 'opinion' if it contained any opinion-based/subjective information. (All sentences contained factual information.) People were told that if they "feel strongly that the sentence or sequence of sentences conveys an opinion (in other words, contains subjective information)", they should rate it as 6, whereas if they "feel strongly that the sentence or sequence of sentences does not convey an opinion (only contains objective, factual information)", they should rate it as 1. Participants were encouraged to use 2,3,4,5 as needed.

Data analysis We used linear mixed effects regression (lme4, Bates et al. 2015) and lmerTest (Kuznetsova et al. 2017) in R (R Core Team 2013) to analyze the data. Because Experiment 1 does not have a factorial design and we are not testing for interactions, the baseline condition was first set as the reference level and compared to each of the other conditions using dummy coding. To conduct the remaining three comparisons, the reference level was changed to the modifier condition and then to the predicative condition. Because six comparisons were conducted, we treat p-values equal or below 0.0083 as significant (Bonferroni correction). In these and other analyses reported here, we used the maximal random effects structure that was justified by the design and supported by the data. We report the outcomes for raw scores; analyses with z-scores yielded largely the same basic pattern.

Results

As shown in Figure 1, the baseline condition is rated as significantly less subjective (i.e. more objective) than the other three conditions (t's>1, p's<.0001). The modifier condition – while rated more subjective than the baseline – is rated significantly less subjective than both the predicative and the relative clause conditions. (t's>4, p's<.0001) The predicative condition is numerically rated the most subjective, but it does not differ reliably from the relative clause condition.

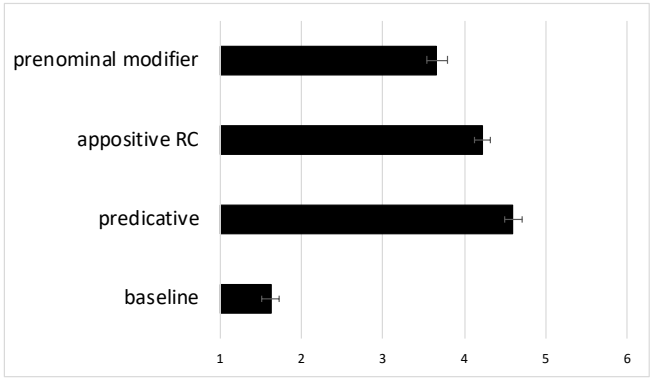

Figure 1. Complex subjective adjectives. The fact/opinion ratings for the four conditions in Experiment 1. (1 = fact, 6 = opinion). Error bars: +/-1 SE

Discussion

Experiment 1 investigated whether linguistic packaging, i.e. subjective adjectives in different structural positions, has an effect on how people perceive subjective information. The results of Experiment 1 show clear effects of linguistic packaging, and support the new-information hypothesis more strongly than the main-new hypothesis: When the subjective adjective is a prenominal modifier, the text is rated less subjective (more objective) than when the same adjective is in predicative position or inside an appositive RC. The predicative and appositive RC conditions do not differ reliably. Crucially, we find a clear contrast between the prenominal modifier and appositive relative clause conditions. This difference is not predicted by the main-news hypothesis.

Overall, the results of Experiment 1 show that people's subjectivity ratings are modulated by linguistic packaging: We can take the same basic information and structure it differently, in order to raise or lower the likelihood that participants will judge a text as 'opinion' or 'fact.'

Experiment 2: Simple subjective adjectives

The results of Experiment 1 show that subjectivity ratings are modulated by the linguistic position of complex subjective adjectives. Experiment 2 tests the generalizability of this result by investigating whether it also applies to a simpler class of subjective adjectives: unidimensional relative adjectives e.g. *tall, heavy* and *fast*. If our findings regarding the effects of linguistic packaging on the perception of subjectivity extend to this class of adjectives, the predictions are the same as for Experiment 1. Furthermore, the subjectivity ratings for the class of simple subjective adjectives are predicted to be lower overall than the ratings for complex subjective adjectives, in light of Kennedy' (2007)'s observations that people prefer to use conventionalized thresholds when possible.

Method

Participants Participant recruitment and exclusion criteria were the same as in Experiment 1, with the addition of four catch trials/attention checks. Participants who made more than one error on catch trials were excluded. Thirty-two participants were included in the final analysis.

Materials and Design The study consisted of 24 targets and the same 36 fillers as in Experiment 1. In the target items, we again manipulated the presence and location of the adjective, for a total of four conditions. (New items were created because changing the adjectives in the Experiment 1 items did not yield sensical items.) An example is in (2).

(2a) The *wide* bridge connected the villages to each other. [**prenominal modifier**]
(2b) The bridge, *which was wide,* connected the villages to each other. [**appositive relative clause (RC)**]
(2c) The bridge was *wide*. It connected the villages to each other. [**predicative**]
(2d) The bridge connected the villages to each other. [**baseline**]

Procedure The procedure was the same as in Experiment 1.

Results

The results are in Figure 2. We replicate the patterns from Experiment 1: the baseline condition (no adjective) is rated less subjective than each of the adjective-containing conditions (t's>10, p's<.0001), the modifier condition is rated less subjective than the predicative and the appositive relative clause structures (t's>3, p's<.001), but the relative clause and the predicative structures do not differ.

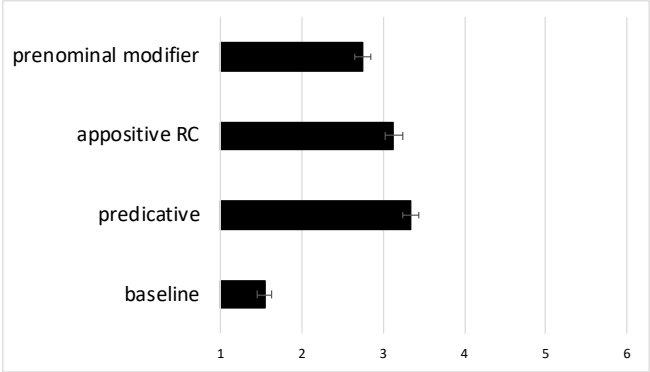

Figure 2. Simple subjective adjectives. The fact/opinion ratings for the four conditions in Experiment 2. (1 = fact, 6 = opinion). Error bars: +/-1 SE

Discussion

The results of Experiment 2 replicate the effects of linguistic packaging with the simpler class of unidimensional relative adjectives. Echoing Experiment 1, the results support the new-information hypothesis, and confirm that even with relatively less subjective adjectives, linguistic packaging affects people's subjectivity ratings. As expected, the class of simple subjective adjectives is rated as being less subjective overall than the class of complex subjective adjectives (tested in Experiment 1).This fits with the hypothesized preference to use conventionalized thresholds with unidimensional adjectives.

Experiment 3: Objective adjectives

The results of Experiments 1 and 2 show that, with both simplex and complex subjective adjectives, the structural position of the adjectives modulates people's subjectivity ratings. The extent to which people can detect that a text contains opinion-based information is influenced by the linguistic packaging of that information. However, the first two studies not yet answer an important open question, namely: Is the increased subjectivity of the adjective-containing conditions (relative to the baseline) specifically due to the adjectives being subjective?

The answer is not as obvious as one might think, given that research in computational linguistics suggests that the presence of *any* kind of adjectives may be linked to increased perception of subjectivity (see e.g. Wiebe 2000). Could it be that the presence of any kind of descriptive information – even if it is largely objective – would show the same kind of linguistic packaging effects we observed in Experiments 1 and 2? If even *objective* adjectives boost subjectivity ratings, this would mean that, rather than telling us about subjectivity, our results would be informing us more generally about the consequences of the presence vs. absence of adjectives.

To assess whether the boost in subjectivity ratings in the adjective-containing conditions (relative to the baseline) is associated specifically with subjectivity, Experiment 3 tested **objective adjectives**. The interpretation of objective adjectives (e.g. *plastic, ceramic, international, electric*) is

independent of a person's subjective opinion. Thus, Experiment 3 tests whether we see the same increase in subjectivity ratings even when the adjectives express objective, non-opinion-based information.

Method

Participants Recruitment and exclusion criteria were as in Exp. 2. 32 participants were included in the final analysis.

Materials and Design The targets were the same as Experiment 2, except with objective adjectives. An example is in (3). The fillers were the same as Experiment 2.

(3a) The *wooden* bridge connected the villages to each other. [**prenominal modifier**]
(3b) The bridge, *which was wooden,* connected the villages to each other. [**appositive relative clause (RC)**]
(3c) The bridge was *wooden*. It connected the villages to each other. [**predicative**]
(3d) The bridge connected the villages to each other. [**baseline**]

Procedure The procedure followed Experiments 1 and 2.

Results

The results are shown in Figure 3: All conditions receive low subjectivity ratings. Statistical analyses show that the baseline condition does not differ reliably from the modifier or the relative clause condition (t's<1). We see hints of the baseline condition being rated less subjective than the predicative condition (t=2.76, which remains significant after correcting for multiple comparisons) but the 95% CIs reveal overlap (baseline: mean 1.354, SD 0.709, SE 0.051, 95% CI 0.101, predicative: mean 1.552, SD 0.957, SE 0.069, 95% CI 0.136), suggesting that this is not a strong effect. What about differences between the three adjective-containing conditions? Statistical analyses confirm what can be seen visually in Figure 3: none of the adjective-containing conditions differ reliably from each other.

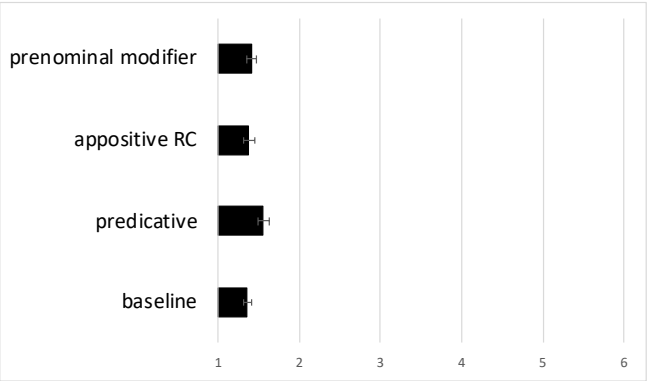

Figure 3. Objective adjectives. The fact/opinion ratings for the four conditions in Experiment 3.
(1 = fact, 6 = opinion). Error bars: +/-1 SE

Discussion

The results of Experiment 3 show that objective adjectives elicit a different pattern of subjectivity ratings than subjective adjectives. We find no evidence for the idea that the presence of *any* adjective triggers an across-the-board increase in subjectivity ratings. When combined with the outcomes of Experiments 1 and 2, the results of Experiment 3 suggest that the effects of adjective position only occur when the adjective is subjective. We find hints of the predicative condition being judged – at least numerically – as more subjective than the baseline, but overlap in the 95% confidence intervals do not allow us to conclude that this difference is very strong.

General discussion

Being able to distinguish fact from opinion is a fundamental part of interpreting the influx of information that people today encounter on a daily basis. However, because texts often contain a mix of factual (objective) and opinion-based (subjective) information, detecting which texts convey subjective information is an important but non-trivial task.

Language offers multiple ways to package information and different packaging options are known to influence depth of processing and recall, but to the best of our knowledge, the effects of different information-packaging options on the human ability to recognize subjective, opinion-based information have not been systematically investigated in prior work. Thus, we used subjective adjectives as a tool to systematically probe for potential effects of linguistic packaging on perception of subjectivity.

Our results show that simply changing the linguistic structure of a sentence influences our perception of its subjectivity: The same basic information, packaged differently in linguistic terms, yields significantly different subjectivity ratings. This has implications not only for our understanding of how humans process subjective information in language, but also for communicative choices made in various contexts. Our results suggest that linguistic packaging choices can be used to blur the distinction between fact and opinion, or at least our ability to perceive opinion-based information as such.

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