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Communication form modulates sentence interpretation: (A)typicality inferences from descriptions vs. direct speech

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Abstract

This study provides the first evidence that sentence interpretation/inferences that comprehenders draw about situation typicality are moderated by the effects of communication form and sentence polarity. We examined the interpretations of **affirmative** and **negative** sentences describing real-world situations of varying typicality. We manipulated whether a sentence is presented as a *description* with an omniscient narrator (e.g., *The house has a bathroom.*) vs. as *direct speech* with the speaker-addressee relationship identified (e.g., *"The house has a bathroom," Emma told her partner.*). By comparing sentence interpretation across situations varying in (i) typicality (e.g., house has bathroom/garage/ballroom), (ii) communicative form (description *vs.* direct speech), and (iii) sentence polarity (affirmative *vs.* negative), we find that presenting information as direct speech encourages pragmatic inferences beyond world knowledge. We also find that negation *per se* does not trigger theoretically predicted pragmatic inferences, but with a specific communicative act like direct speech it does.

Keywords: pragmatics; world knowledge; informativity; negation; communication form

Introduction

As language users, we monitor all kinds of probabilities, including the typicality of situations (/events) in the world, and the likelihood of these situations (/events) being verbally communicated (i.e., communication likelihood). These two probabilities often negatively correlate with each other: information about typical situations is often shortened or omitted (e.g., low communication likelihood), while information about atypical situations is more likely to be communicated (e.g., high communication likelihood). This is supported by natural production data (e.g., Bergey, Morris, & Yurovsky, 2020) and experimental findings (e.g., Brown & Dell, 1987; Rubio-Fernández, 2016). Language comprehension studies suggest that processing is guided by world knowledge (i.e., effects of typicality) and by communication likelihood (i.e., effects of informativity), although these two seem to contradict each other.

On the one hand, prior work suggests that, especially when no context or communicative setting is provided, sentences describing events and situations that are more *typical* based on world knowledge are easier to process (e.g., Walker, 1975; Kutas & Hillyard, 1980; Matsuki et al., 2011). On the other hand, it has also been shown that in communicative settings where a speaker chooses to express certain information to an addressee (e.g., text messages, phone calls, dialogues), sentences describing *less typical* events are easier to process due to their higher communication likelihood (e.g., Rohde, Futrell, & Lucas, 2021; Rohde & Rubio-Fernandez, 2022). This suggests that in contexts where a sentence clearly has a communicative purpose, high communication likelihood is prioritized over high event/situation typicality. However, how exactly the nature of the communicative context affects language comprehension remains under-investigated. For example, does the presence or absence of a *communicative context* – in the current study, defined as whether a sentence is (i) presented as a *description* (with an omniscient narrator) or (ii) embedded in an *utterance*/ direct speech (with the speaker-addressee relationship identified) – affect how much world knowledge guides sentence interpretation? Consider the examples in (1).

(1) a. The house has a bathroom.
b. "The house has a bathroom," Emma told her partner.
c. The house does**n't** have a **ball**room.

(1a) describes a highly typical part-whole relation between a house and a bathroom. Example (1b) presents the same information but as a specific speaker's utterance to their familiar acquaintance. When we hear the direct speech uttered by Emma in (1b), we are informed of a highly typical situation. Moreover, we make inferences about why Emma chooses to mention it, given that it is a communicative act from a specific speaker to a specific addressee. For ease of exposition, we refer to the communicative act exemplified in (1b) as a *specific communicative act,* to separate it from (1a). Since the high-typicality situation of a house having a bathroom is usually assumed and rarely explicitly communicated, in (1b) we have the option of inferring that (i) Emma is making a redundant utterance and violating expectation for communicative informativeness, or that (ii) Emma expects us to make extra inferences about this seemingly redundant utterance.

Now let's consider the negative sentence in (1c). This negates a low-typicality situation (e.g., a house having a *ball*room) and thus describes a high-typicality situation. The

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reasoning sketched out above also applies here, perhaps even more so. It is assumed that houses do not have ballrooms, so explicitly negating this adds little new information. We might wonder, even without a specific communicative act, if the description in a negative polarity suggests that the house under discussion was expected to have a ballroom (e.g., the house possesses features that a typical house does not have). This inference-triggering property of negation can potentially affect sentence interpretation in a similar way as a communicative context does, but this possibility has not been systematically investigated. In light of this, our work aims to examine two forms of communication (description *vs.* utterance) and compare the effects of communication form in two sentence polarities (affirmative *vs.* negative).

In the present work, we explore the effects of communication form by giving people a specific inference task. As an example of the inference task, we ask participants to assess the likelihood that the house is a typical house (e.g., *How likely is it that the house is a typical house?*) (e.g., similar to Degen, Tessler, & Goodman, 2015).

Contrast between Informativity and Typicality

Our experience with the world provides us with knowledge that some events and situations are more *typical* than others. The effect of typicality on language comprehension is well established (see e.g., McRae & Matsuki, 2009 for a review); processing is guided by world knowledge and facilitated by high typicality. For example, comprehenders read texts mentioning typical instrument-actions pairs faster than atypical pairs (e.g., Matsuki et al., 2011: "use the shampoo to wash hair" vs. "use the hose …"), exhibited N400 effects for atypical properties of culturally specific situations but not for typical properties (e.g., Hagoort et al., 2004: "The Dutch trains are yellow" vs. "… sour"), and even rapidly adapted to fictional new worlds (e.g., Nieuwland & Van Berkum, 2006).

However, our experience with language also provides us with statistics about which events and situations are *more likely to be mentioned/communicated verbally*. A small number of recent studies on the effect of informativity (e.g., Rohde et al., 2021) show that the facilitatory effect of typicality can be reduced (or even reversed) under certain circumstances. For example, in referential communication tasks, hearing a color term results in people looking more to objects that do *not* typically have that color (e.g., Rohde & Rubio-Fernandez, 2022: "yellow shirt" vs. "yellow banana"). When communication takes place in form of texting and dialogue, comprehenders are aware of speaker-specific informativity (i.e., whether a speaker prefers to mention high- or low-communication likelihood information) (e.g., Grodner & Sedivy, 2011; Reksnes et al., 2024) and show higher expectations for newsworthy information as the speaker identity becomes more salient (e.g., Reksnes et al., 2024).

Findings regarding both typicality and informativity indicate that the presence of explicit communicative intentions redirects comprehenders to shift from relying on world knowledge to instead favoring content with higher communication likelihood. However, it remains unclear how this shift influences interpretation of the information presented with communicative intentions. For instance, **are sentences interpreted the same way** when presented as part of a specific communicative act *vs.* when presented as a string of words with an omniscient narrator? The interpretative processes may differ, given prior work indicating that the relative weight given to informativity vs. typicality differs in these two contexts.

Kravtchenko and Demberg's (2022) study is one of the few to approach this issue. Their findings reveal that highly typical events, when communicated in dialogue form, can trigger *atypicality inferences*. Specifically, when a speaker in a dialogue describes someone engaging in highly typical behaviors (e.g., *pay the cashier*) associated with certain events (e.g., *grocery shopping*), participants inferred that the person engages in those behaviors *less* habitually. Pragmatic inferences of this kind are typically triggered by the irrational use of language often associated with 'stating the obvious' (e.g., Sedivy, 2003; Degen et al., 2015).

But what about higher-informativity sentences describing events/situations with lower levels of typicality, e.g., "The house has a garage/ballroom" or "The house doesn't have a bathroom/garage"? Here, we are not dealing with 'stating the obvious.' Will these seemingly rational uses of language be interpreted 'as they are', without triggering inferences? These questions have rarely been discussed in prior work.

Thus, our work goes beyond existing research by investigating a broader spectrum of typicality that ranges from low to high typicality. More importantly, by directly comparing interpretation of sentences presented as descriptions *vs.* as utterances, this study aims to provide a clearer understanding of effects of communicative form.

Asymmetry between Affirmatives and Negatives

Unlike the affirmative polarity, work on the processing of negation has commonly found that negative sentences are easier to process and verify when they describe *atypical* situations and events, i.e., negated typical situations and events such as *The robin is not a bird* (e.g., Wason, 1965; Fischler et al., 1983; Nordmeyer & Frank, 2014; Xiang, Kramer, & Nordmeyer, 2020). This suggests that when a sentence is negated, comprehenders' preference shifts toward low-typicality information (e.g., *house*- no *bathroom*).

For example, Albu, Tsaregorodtseva and Kaup (2023) tested effects of negation using sentence completion. Their sentences were presented out of context, i.e., no information was provided about the communicative context. When asked to select continuations for fragments like (2a), participants tended to choose nouns like *yogurt* for both negative *and* positive sentences, i.e., people preferred completions that make the affirmative events typical and the negative ones atypical. This seems to suggest that people care more about typicality-based world knowledge in affirmative sentences, while informativity is more important for negative sentences. This is corroborated by Albu et al.'s findings for sentences with low informativity-signaling adverbials, like (2b).

(2) a. The child will (not) eat the _____.
b. Obviously, the child will (not) eat the _____.
Four choices: yogurt, shellfish, branch, minivan

When low informativity-signaling adverbials (e.g., *obviously*) were added, participants still tended to complete affirmative sentences with typical words (e.g., *yogurt*) and negative sentences with the other nouns that make negated situations more typical as well (e.g., *shellfish*, *branch*, *minivan*). These findings suggest that affirmative sentences describing typical events (lower in informativity) are preferred due to their alignment with world knowledge. However, negative sentences describing atypical events are preferred presumably due to their high informativity.

Ultimately, prior work suggests that the 'default' preference for sentences to convey typical information is flipped by (i) the presence of negation as well as by (ii) the presence of a specific communicative act: Comprehenders expect negative sentences to describe atypical events. Comprehenders also expect sentences presented as a specific communicative act to describe high-informativity, atypical events (otherwise, why would the speaker bother to mention them?). This similarity raises questions about the interaction between sentence polarity (affirmative vs. negative) and the presence/absence of a communicative context: Does negation affect sentence interpretation in a way similar to how a specific communicative act affects affirmative sentences? Prior work has not systematically investigated how the presence/absence of a specific communicative act influences the processing of affirmative and negated sentences, which is the issue we focus on.

Current Study

As a first look into effects of communicative form on the interpretation of affirmative and negative sentences, we test how sentences are interpreted when presented as (i) direct speech uttered by a specific individual (what we call an **utterance***,* indicated with quotation marks, with speaker identity stated) vs. presented as (ii) a basic descriptive statement (what we call a **description**, without quotation marks, no speaker specified). See (3) for examples.

(3) **Description:**
a. The house has a bathroom / doesn't have a ballroom.

Utterance:
b. "The house has a bathroom / doesn't have a ballroom," Emma told her partner.

We hypothesize that when a sentence is presented as a description (e.g., (3a)), its interpretation is mainly guided by world knowledge, but when presented as an utterance (e.g., (3b)), its interpretation is guided by both world knowledge *and* informativity. Under this view, people expect descriptions to largely reflect typicality of real-world situations, but with utterances, they are more sensitive to utterance informativity (Is this worth mentioning?) which can trigger typicality-related inferences about the main entity (e.g., *house* in (3)) under discussion. We also hypothesize that the negative description in (3a) can trigger typicality-related inferences even when *not* embedded in a specific communicative act.

As a whole, our work goes beyond prior work in testing both affirmative and negative sentences while also manipulating communicative form, and by testing gradiently different levels of real world-knowledge based situation typicality. The two experiments in this paper focus on the typicality of part-whole relationships (e.g., *house-bathroom, classroom-plant, car-freezer*). It is known that comprehenders have robust knowledge of the real-world properties of such relationships and use this during language processing (Chaffin, Herrmann, & Winston, 1988; Sailor & Brooks, 2014). Moving forward, we use the term *situation typicality* to refer to the typicality of a part-whole relation.

Experiments

We manipulated (*i*) situation typicality (a continuous variable, based on a norming study which covers a wide range of situation typicality levels), (*ii*) sentence polarity (affirmative vs. negative, within-subjects), and (*iii*) communication form (description vs. utterance, between-subjects). Experiment 1 examines sentences describing part-whole relationships that are presented as *descriptions*. Experiment 2 uses the same items but presented as *utterances*. Data collection was hosted online on PCIbex (Zehr & Schwarz, 2018) and people participated remotely over the internet (Prolific). Participants were rewarded by their participation ($1.60 - $2 depending on study duration). Each participant only participated in one of the experiments.

Situation Typicality Norming

In a separate norming study, 60 self-reported English native speakers in the US rated the *situation typicality* of 81 part-whole pairs. The pairs consisted of 27 whole entities and three part entities for each whole entity. On each trial, participants saw two words, the whole entity in capitals (e.g., *HOUSE*) and the part entity in lower case (e.g., *bathroom*). Participants gave their ratings on a slider scale (0-100%) to answer questions about *situation typicality*, e.g., how likely they think a bathroom is part of or seen in a house.

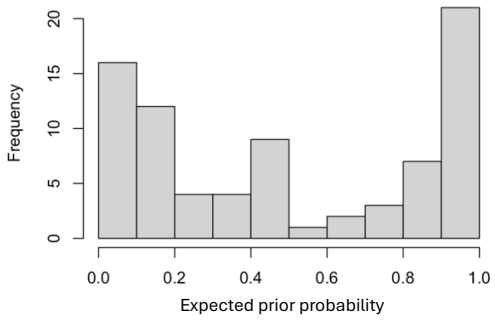

Figure 1. Norming study: Histogram of expected values of each smoothed prior distribution

Only participants who passed nine attention checks were included in the analysis (n = 57). The percentage rating distributions for each pair were smoothed using a nonparametric density estimation method suited for ordinal categorical variables with the np package in R (Hayfield & Racine, 2008), following Degen et al. (2015). This non-parametric smoothing method is applied across all three studies to handle outliers in our relatively small samples, while preserving the ordinal nature of the ratings data.

Figure 1 shows that our stimuli cover a wide range of situation typicality while slightly oversampling the high and low ends. This is ideal for the generalization across levels of situation typicality and the contrast between the two ends.

Experiment 1: Descriptions

Method

Participants 42 adults participated online. Only self-identified adult native speakers of English in the US who passed attention checks mixed in with the experimental items were included in analyses (n = 40).

Design, Materials, Procedure In a rating task, we crossed Situation Typicality of the part-whole pairs (continuous variable) and Sentence Polarity (affirmative vs. negative). Each item consisted of two sentences: one introduces a protagonist and location, and the other is a **description** about the location (whole) containing something (part). The situation typicality of the part-whole relation was varied. Participants rated the typicality of the whole entity, e.g., how likely they think it is that the house is a typical house. We call these *typicality ratings*. See **Table 1** for a sample target. Each participant saw 27 target trials and 8 catch trials. Participants were told to base their ratings on their own experience.

Table 1. Sample target in Experiment 1

Lead-in sentence	Emma visited a friend's house.
Critical Sentence	The house {has/doesn't have} a bathroom.
Question	*How likely do you think it is that the house is a typical house?* (rate on a **0-100% slider**)

Analysis

Typicality Ratings The percentage rating distributions for each item were smoothed in the same way as in the norming study. We calculated the expected means of the smoothed typicality ratings. We then conducted a Pearson correlation analysis of (i) the typicality ratings participants gave for each part-whole pair in Experiment 1 and (ii) the typicality ratings from the norming study. We analyzed affirmative and negative sentences separately. For affirmative sentences, we tested the correlation between typicality ratings (from Experiment 1) and normed situation typicality (from the norming study). For negative sentences, we tested the correlation between typicality ratings (Experiment 1) and the *complements* of the normed situation typicality (i.e., negative situation typicality = 1 – normed situation typicality.

Predictions When a (affirmative) sentence is presented as a *description*, its interpretation should be primarily guided by world knowledge. For *affirmative sentences*, this predicts a high positive correlation, ideally a perfect positive correlation, between situation typicality (norming study) and the Experiment 1 typicality ratings. For *negative sentences*, if negation alone triggers typicality-related inference, we expect typicality ratings in negative cases to diverge from situation typicality (from norming).

Results

Figures 2 and 3 show that typicality ratings (*y*-axis) are highly correlated with situation typicality (*x*-axis, from norming) for *both* sentence polarities (affirmative: $r_{des}(76) = 0.94$, $p<0.01$ in **Figure 2**; negative: $r_{des}(76) = 0.91$, $p<0.01$ in **Figure 3**).

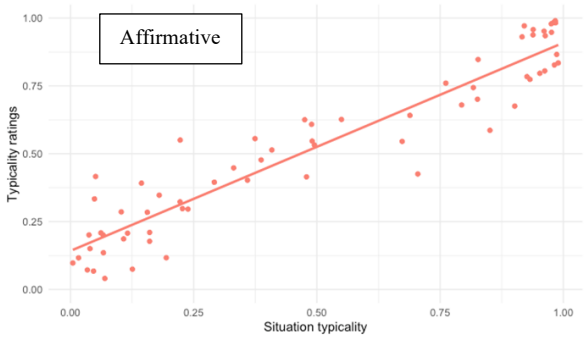

Figure 2. Affirmative **descriptions**: Typicality ratings (Experiment 1) ~ Situation typicality (norming)

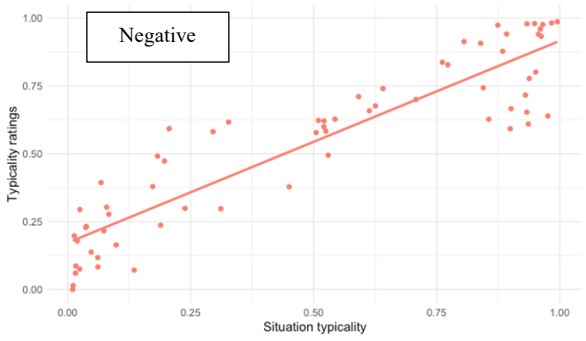

Figure 3. Negative **descriptions**: Typicality ratings (Experiment 1) ~ Situation typicality (norming)

Experiment 1 Discussion

Experiment 1 tested sentences negative and positive sentences presented as descriptions, i.e. not presented as

direct speech by a specific person. The results support our hypothesis for affirmative sentences, namely that interpretations of these sentences, when presented as descriptions, should reflect world knowledge. Negative sentences in the form of descriptions also showed strong evidence of world knowledge-guided interpretations. For instance, comprehenders rated a house as a typical house when it is mentioned as having a *bathroom* or not having a *ballroom*, as a middlingly typical house when it is mentioned as having/not having a *garage*, and as an atypical house when it is mentioned as having a *ballroom* /not having a *bathroom*.

In sum, affirmative and negative sentences pattern alike in Experiment 1. In particular, a typical (negative) situation (e.g., house-no ballroom) does *not* trigger inferences about the house being atypical. Instead, the interpretation of typical (negative) situations still follows from the world knowledge-based typicality. This suggests that, while negation may favor high communication likelihood, it does not fundamentally alter how negative sentences are interpreted, at least in the absence of a specific communicative act.

Now, to test how situation typicality influences the perceived typicality when the sentences are part a specific communicative act, we conducted Experiment 2.

Experiment 2: Direct Speech

Method

Participants 62 adults participated online. Only self-identified adult native speakers of English in the US who passed attention checks mixed in with the experimental items were included in analysis (n = 57).

Design, Materials, Procedure Experiment 2 used the same rating task as Experiment 1, as well as the same items and design (including the same questions). The only difference is that the second sentence of a two-sentence sequence is not a description but rather the protagonist's **utterance** in the form of direct speech about the same part-whole relationship. See **Table 2** for an example.

We followed the same procedure as in Experiment 1, except that now, participants were instructed to give their ratings based on what the protagonist communicated about places. This ensures participants are still rating the typicality of the same propositional content as in Experiment 1.

Table 2. Sample critical sentence in Experiment 2

Critical Sentence	"The house {has/doesn't have} a bathroom," Emma told her partner.

Analysis

Typicality Ratings Typicality ratings are analyzed with Pearson correlation and *lm* (linear model). We report three analyses. *First*, we assess the correlation between situation typicality (norming) and typicality ratings (Experiments 2) when the critical sentence is presented as an utterance. To test this, we conducted a Pearson correlation between (i) the Experiment 2 ratings and the (ii) situation typicality ratings (from norming), as we did in Experiment 1. *Second*, we tested whether the influence of communication form (descriptions, Experiment 1 vs. utterances, Experiment 2) differs across levels of situation typicality. We analyzed the interaction between situation typicality norms and communication form separately for both sentence polarities using *lm*. *Third*, to compare Experiment 1 (descriptions) and Experiment 2 (utterances) directly, we analyzed the three-way interaction between communication form, polarity and situation typicality (from norming) using *lm*.

Predictions According to our hypothesis, when an affirmative sentence is presented as direct speech (an utterance), its interpretation should be guided by world knowledge *and* informativity. For example, people might make atypicality inferences about a low-informativity utterance describing a highly typicality situation. This should be true in both sentence polarities, perhaps more so for negative sentences: since negation favors high communication likelihood, the difference in typicality ratings between communication forms should be more pronounced for negative sentences negating low situation-typicality.

Results

Compared to descriptions (Experiment 1, solid line), in the utterances condition (Experiment 2, dashed line), the typicality ratings (*y*-axis, **Figures 4-5**) are less strongly correlated with situation typicality (*x*-axis, **Figures 4-5**) in both affirmative ($r_{utt}(76)= 0.84$, $p<0.01$ vs. $r_{des}(76)= 0.94$, **Figure 4**) and negative sentences ($r_{utt}(76)= 0.75$, $p<0.01$ vs. $r_{des}(76)= 0.91$, **Figure 5**).

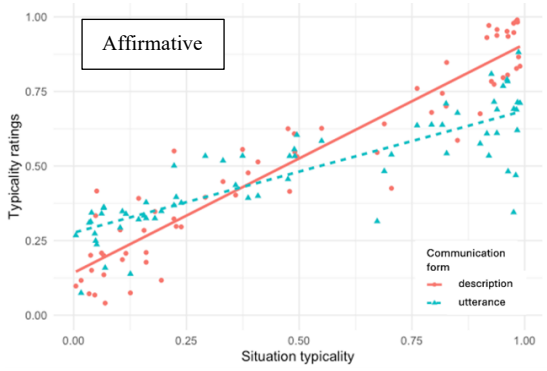

Figure 4. Comparison of Experiments 1 and 2: Affirmative utterances: Typicality ratings ~ Situation typicality (norming) * Communication form

In other words, the dashed line is less steep than the solid line. This follows from our predictions for both sentence polarities: (*i*) the form of direct speech shifts sentence interpretation from relying primarily on world knowledge (as

encoded in situation typicality) to also considering informativity, and (*ii*) the effects of communication form appear to be stronger in negative sentences.

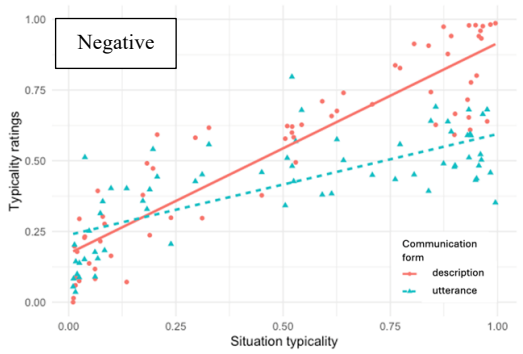

Figure 5. Comparison of Experiments 1 and 2: Negative utterances: Typicality ratings ~ Situation typicality (norming) * Communication form

On the one hand, we see the expected decrease in typicality ratings for high situation typicality. This is evidence for atypicality inferences: information about a high-typicality situation triggers the inference that the situation is less typical. On the other hand, the results also yield some unexpected findings. We also observe an increase in typicality ratings for low situation typicality: in the utterance form (Experiment 2), when someone says "The house has a ballroom/ doesn't have a bathroom" to someone else, the house is regarded as *more typical* than in the description form (Experiment 1) that largely reflects world knowledge. We call this novel observation a *typicality inference*, to set it aside from the already-discussed *atypicality inference*.

Our results provide strong evidence for an interaction between communication form and situation typicality (affirmatives: β= - 0.36, p<0.01; negatives: β= -0.39, p<0.01). This interaction also differs between sentence polarities, supported by a three-way interaction (β= -0.75, p<0.01).

Experiment 2 Discussion

Experiment 2 supports our hypothesis regarding the effects of communicative settings: When faced with a specific communicative act, comprehenders not only rely on world knowledge but also reason about *why such utterances were produced*. Exp.2 also provides novel evidence at the interpretive level for the subtlety of polarity asymmetries: Atypicality inferences were stronger in negative sentences than in affirmative sentences.

General Discussion

This study provides the first evidence that sentence interpretation / inferences that comprehenders draw about situation typicality are moderated by the effects of communication form and sentence polarity. The two experiments reported here revealed two key findings: (*i*) Specific communicative acts like direct speech (with the speaker and the addressee identified) encourage not only atypicality inferences, replicating prior work using part-whole relations, but also what we call typicality inferences, and (*ii*) Contrary to what one might expect, negation does not affect interpretation the same way as communicative form.

The 'typicality inferences'—atypical situations are inferred to be less atypical—we observed may seem counterintuitive, considering that atypical situations are newsworthy and informative to communicate. In principle, communicating atypical situations should not violate any communicative principles related to informativeness.

What, then, could be triggering these inferences? One possibility has to do with the Maxim of Manner (Grice 1975). Prior work shows that various aspects of linguistic form are deeply connected to notions such as typicality and predictability. For example, previous work demonstrated that less predictable information is communicated with orthographically and phonologically longer forms (e.g., Aylett & Turk, 2004; Mahowald et al., 2013), and that disfluency (e.g., *um*) and high informativity-signaling lexical cues (e.g., *surprising*) facilitate the processing of less predictable information (e.g., Heller et al., 2015; Rohde et al., 2021). Kravtchenko & Demberg (2022) also shows that with exclamation point and the lexical cue "oh yeah", which tend to emphasize the unusualness of an event, atypicality inferences became stronger. Thus, in very general terms, when information is atypical or unpredictable, this is often reflected in linguistic form.

However, in our studies, typical and atypical information were presented in the same way – in other words, there were no cues provided to flag something as atypical. Putting it differently, we presented atypical information with none of the usual 'warnings' that occur in natural communication. This may have led to comprehenders assuming that atypical situations are more typical than they seem. This in turn may explain why we observed typicality inferences.

To better understand the subtle ways in which people interpret and utilize information across different settings, we plan to conduct a follow-up study that elicits both typicality ratings and participants' explanations of their choices of ratings, following Ryzhova, Mayn & Demberg (2023).

Furthermore, our findings show that negation *per se* does not trigger (strong) typicality-related inferences across the board: rather, this only occurs in sentences that are clearly presented as part of a specific communicative act with an explicit speaker-addressee relationship. More importantly, under negation, utterances communicating most levels of situation typicality seem to behave like utterances communicating high-typicality situations. We observe that negative sentences almost only trigger atypicality inferences when embedded in direct speech, which is a novel finding regarding the subtlety on the pragmatic side of negation. This aligns well with the existing empirical findings of the processing of negation (e.g., Nordmeyer & Frank, 2014; Xiang et al., 2020; Albu et al., 2023) – it favors high communication likelihood which is usually associated with negating highly typical events/situations.

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