A semantics of face emoji in discourse

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Abstract: This paper presents an analysis of face emoji (disc-shaped pictograms with stylized facial expressions) that accompany written text (such as the sentence *I'm hungry*). We propose that there is a use of face emoji in which they comment on a proposition *p* provided by the accompanying text, as opposed to making an entirely independent contribution. Focusing on positively valenced and negatively valenced emoji (which we gloss as *happy* and *unhappy*, respectively), we argue that the emoji comment on how *p* bears on a contextually provided discourse value *V* of the author. Discourse values embody what an author desires, aspires to, wishes for, or hopes for. Our analysis derives a range of non-trivial generalizations, including (i) ordering restrictions with regards to the placement of emoji and text, (ii) cases of apparent mixed emotions, and (iii) cases where the lexical content of the accompanying text influences the acceptability of a face emoji.

1 Introducing Emoji

In today's world, emoji play a central role in digital communication. To explore this recently-emerged communicative phenomenon and to shed light on its relation to language, we use tools from formal semantics and pragmatics to investigate the use and interpretation of sentence-final face emoji (ex.1) such as 😀 and 😚 which express affective attitudes.[5] We view face emoji as part of multi-modal discourse that, intuitively, 'comment on' the text that they accompany. In this paper, we take a systematic look at the nature of the relation between emoji and text, and show that it is more constrained, in semantically interesting ways, than one might initially expect.

(1) My cousin found a $100 bill in her sock 😄

Present-day emoji—keyboard-based depictions of facial expressions and other things—evolved from the emoticons of the 1980s and 1990s which used existing characters to convey facial expressions, like :-) or :(. The creation of the first modern emoji (small pixel-based images, instead of faces built from pre-existing characters) is attributed to Shigetaka Kurita in 1999. Apple added an emoji keyboard to iOS in 2011, Android did so in 2013.[6] Since their inception, emoji use has risen

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[5] In this paper we use the Apple emoji font. However, insofar as emoji on other platforms (e.g. Google, Android) are interpreted as expressing the same kinds of affective attitudes, the discussion here will generalize across platforms.
[6] https://emojitimeline.com/, https://www.wired.com/story/guide-emoji/

meteorically: by some estimates, in 2020, over 10 billion emoji were sent every day. Thus, despite being a very recent phenomenon, emoji are extremely prevalent. Their popularity suggests that they help to fulfill important communicative needs.

In recent years, emoji use has been investigated from a variety of perspectives (see e.g. Bai et al 2019 for a recent overview). In linguistic terms, Gawne & McCulloch (2019) and Pasternak & Tieu (2021) argue for a link between emoji and gestures, and Maier (2020) proposes to analyze emoji and facial expressions as expressives. In other recent work, Gerke & Storoshenko (2018) and Cohn et al (2019) explore how emoji combine with other emoji to create pictorial sequences. Weissman & Tanner (2018) and Weissman (2019) compare contexts where emoji are congruent or incongruent with the accompanying text, in addition to investigating irony effects associated with the winking face emoji. Much of the prior work on emoji uses experimental methods or corpus analysis. Our work builds on these prior studies but uses a different approach: In pursuing a formal semantics approach, we seek to provide an explicit and predictive formal account of the relation between emoji and text.

Our focus here is on face emoji -- the stylized cartoon faces that express different affective states (e.g. 😀, 😟). Face emoji tend to be used much more frequently than other kinds of non-face emoji (see e.g. emojitracker.com, which provides real-time information about the most frequent emoji used on Twitter). Their popularity presumably stems from their resemblance to human facial expressions,[7] and our desire to compensate for the absence of facial expressions, tone of voice and body language in digital communication. In the present work, we remain agnostic about the precise nature of the mapping between emoji and their meaning. The emoji-meaning mapping might be completely stipulative and lexical, or the result of an iconic rule (see Grosz, Kaiser and Pierini to appear for discussion), or emoji might first depict faces that themselves express emotion, or the truth might be some complex hybrid of all of these. Although the details of the mapping are an important issue, they are not central for the aims of the present work: Rather than investigating how different emoji express different affective states, our interest in this paper is the way that emoji contribute to discourse.

As we note in Section 5, we acknowledge there are intriguing parallels between emoji and linguistic expressions of affect. Indeed, we suggest below that emoji share similarities with the class of expressions that Rett (to appear a) calls emotive markers (e.g. *alas*). A related topic, and one that we leave for future work, is the relation between emoji and Potts' (2005, 2007) class of expressives (e.g. curse words, epithets, slurs, and honorifics). In the present work, we mostly look at emoji on their own terms, *sui generis*.

1.1 Project Scope

We investigate the use and interpretation of clearly positively or negatively valenced face emoji (e.g. 😀, 😟), and leave emoji with less clear valence (e.g. 🥶, 🤧, 🤑) for future work. In what follows, we

[7] Independent of emoji, there exists a large literature on facial expressions, e.g. Tomkins & McCarter 1964, Ekman, Friesen & Ellsworth 1972, Russell & Fernández-Dols 1997, Keltner & Cordaro 2017, inter alia. Furthermore, see also Weiss et al. 2020 for recent neuroimaging work on different responses elicited by emoji and actual human faces in a study on decision-making.

focus on '😀 ' as a good representative of the broader class of positive emoji (😄 ,🙂 ,😄 ,😊): According to Emojipedia, this emoji can be taken to convey "general pleasure".[8] Similarly, we investigate '😟 ' as a representative of negative emoji (☹️ ,😖 ,😢 ,😞). According to Emojipedia, this emoji can "convey a variety of moderately sad or tense emotions".[9] We explore single emoji in sentence-final position, in contexts where, roughly, the emoji seem to *comment on* the accompanying text.

This question of what it means for an emoji to 'comment on' the text is the core issue that we tackle in the present paper. Intuitively, it is clear that emoji are linked in some way to the text that they occur with. What is the nature of this relation? Consider the examples in (2). (These examples, like the others in this paper, should be construed as text messages or social media posts.) Here, the intuition is that the emoji comments directly on a specific individual (2a,b) or proposition (2c). In (2a), the emoji is naturally interpreted as expressing the author's affective attitude regarding the specific individual denoted by 'that guy' (or perhaps on what 'that guy' did), and in (2b), the individual denoted by 'that fried chicken sandwich.' In (2c), the sad face comments on the proposition 'Alex hates violent movies.'' (In this paper, we use the term 'author' as we are dealing with the written modality; this term parallels the expression 'speaker.')

(2) a. Did you see that guy? 😍
b. That fried chicken sandwich they make 😌
c. If a movie is violent, Alex hates it 😟

In cases like these, because the emoji offers a comment on the text, the interpretation of the emoji is partially dependent on the interpretation of the text. We use the term **dependence** to refer to these kinds of uses where the interactions between emoji and text are direct/semantic (ex.2), as we discuss at more length in Section 2.

However, it seems that not all emoji uses exhibit this kind of dependence. Consider the examples in (3-4). In (3), the emoji seems to be providing information about the author's feelings/attitude towards the recipient of the message,[10] rather than commenting on an individual or proposition expressed (or presupposed) by the text. Similarly, in (4), the emoji seems to comment on the current situation, rather than any particular linguistically-realized component. We use the term **independence** to refer to these kinds of interactions where the relation between emoji and text is indirect, and based on general (Gricean) pragmatic reasoning.

(3) How did the interview go? 🤗
(4) How are you coping? 😞

We explore the notions of dependence and independence in more depth in Section 2.1. For now, suffice it to say that the potentially independent cases as in (3-4) are not the main focus of this

[8] https://emojipedia.org/grinning-face/
[9] https://emojipedia.org/worried-face/
[10] See Maier (2020) for an analysis of the facial expression *smile* in uses where it expresses an emotive attitude towards the interlocutor.

paper: our aim is to better understand the nature of the emoji-text relation when the emoji comments on the text in a direct way.

It's worth noting here at the outset that affective information expressed by face emoji is (by default) **author-oriented** (see Rett (to appear b) on miratives and Harris & Potts 2009 on expressives, i.a.). As illustrated in (5), there is a strong preference to construe the emoji as reflecting the affective state of the author of the message, even though the sentences contain several other candidate attitude-holders. (For experimental data on the default author-orientation of emoji, as well as information about when emoji can shift away from the author, see Kaiser & Grosz to appear).

(5) a. Kate said Sue called Ann 😀 ⇒ the author is happy
b. Kate said Sue called Ann 😟 ⇒ the author is sad

As will become clear in Sections 3 and 4, the author-oriented nature of emoji is captured in our analysis by our proposal that the denotations of emoji hold between a person (the author), a target proposition, and the current discourse values of the *author*.

In the kinds of configurations that we investigate in the present work, the information that emoji contribute about affective attitudes is typically *not-at-issue* (see Potts 2015, Beaver et al 2017), so not available for explicit denial. For example, C's response to A in (6a) is infelicitous, because that response is trying to deny the information conveyed by the emoji (that the author is happy), which is not-at-issue.

(6) a. A: I just woke up 😀
B: That's wonderful! / C: # No. You're grumpy AF.

We acknowledge that metalinguistic/'presentational' use of emoji, as in (6b), can seemingly promote the information contributed by the emoji to at-issue status (see also Ebert & Ebert 2014 on gesture). An attested (Twitter) example of this kind of at-issue-use is given in (6c). However, in the present paper, we do not investigate these kinds of uses.

(6) b. A: I just woke up like this: 😀
B: That's wonderful! // C: No. You're grumpy AF.

(6) c. You know when you see something that makes you think of someone and go to send it but you don't speak anymore so you're just like 😀 😟

1.2 Methodology – Assessing Infelicity

We use the hash mark (#) to indicate that a text and emoji combination is infelicitous, as illustrated in (7b). Absence of # indicates a felicitous combination.

(7) a. I was really looking forward to today's picnic and now it's raining! 😟
(7) b. # I was really looking forward to today's picnic and now it's raining! 😀

Importantly, use of # does *not* mean that the example can never be judged felicitous. For example, there are cases where (7b) is perfectly fine, provided we apply some *mental gymnastics*: for example, perhaps the emoji is to be interpreted ironically, or perhaps the author is a person who, for whatever reason, loves picnicking in the rain. Indeed, cases where an emoji seems unexpected based on default world knowledge can trigger extra inferences as shown in (8). Here the comprehender tries to 'repair' a potentially odd text-emoji pairing by making an inference about the preferences of the author that could explain their use of the happy emoji. The inference that the author likes picnicking in the rain is possible but unexpected, based on world knowledge. In these kinds of special contexts, (7b) is not infelicitous.

(8) I was really looking forward to today's picnic and now it's raining! 😀
⇒ *The author likes picnicking in the rain*

The idea that certain examples feel 'incoherent' and require extra reasoning that is more effortful than normal already has a precedent in existing linguistic work. For example, (9b) feels incoherent, especially in comparison to (9a), but readers can engage in additional inference to try to make sense of (9b) (see e.g. Jurafsky & Martin 2020 for discussion).[11]

(9) a. Jane took a train from Paris to Istanbul. She had to attend a conference. (Jurafsky & Martin 2020)
(9) b. # John took a train from Paris to Istanbul. He likes spinach. (Hobbs 1979)

In the present paper our focus is on readings that are accessible *without* excessive repair strategies or mental gymnastics. In what follows, we use # for text-emoji pairings that trigger an inferential search or reasoning process, requiring extra assumptions that go beyond the most 'vanilla' world knowledge base or what is already common knowledge. (See Section 4.2 for more detailed discussion about default axioms that we propose are at play.)

We use these judgements of felicity and infelicity as our basic source of data. In the present work, our goal is to supply a simple theory of discourse, along with a semantic analysis of the happy and unhappy emojis themselves that help predict these judgements.

In what follows, we provide semantic representations of the meaning contributed by emoji, rather than attempting to provide naturalistic 'linguistic paraphrases' of emoji meaning. Although we observe that in some cases, there may seem to be a loose equivalence between emoji (😟) and natural language expressions (*it's upsetting me*), as in (10),[12] many digital natives feel emoji cannot,

[11] To give one more example where extra inferencing of this type is needed, *Michael* is preferentially a male name in English, but the main character of the fictional *Star Trek: Discovery* is a woman called *Michael*. When judging (i) 'out of the blue', a reader unfamiliar with this TV series may assign a hash mark to (i).
i. Michael pulled herself up onto her elbow.
See https://books.google.com/books?id=kWVnDwAAQBAJ
[12] A version of the paraphrase *it's upsetting me* was suggested by Masha Esipova (p.c.).

in fact, be satisfactorily paraphrased in words -- i.e., they are ineffable (see also Potts 2005, 2007, Blakemore 2011 for similar claims regarding linguistic expressives).[13]

(10) I'm so hungry 😟
⇝ I'm so hungry, it's upsetting me!

1.3 The Analysis in a Nutshell

In this section we briefly preview key aspects of the analysis of text-emoji messages that we present in this paper. We assume that emoji are part of multi-modal discourse and interact with text. In particular, they contribute information about participants' affective attitudes towards propositions that are expressed by linguistic components of the discourse. We propose that emoji comment on a target proposition, but only do so in light of the way that proposition bears on a salient value, priority, or goal held by the author of the message. We refer to the author's salient value -- a possible state of affairs that the author desires, aspires to, wishes for, or hopes for -- as a **discourse value.**

In short, we propose that there are the three key interpretive forces at work in the discourse contribution of a text-emoji message: (i) the linguistic content of the text (the target proposition), (ii) the affective content of the emoji, and (iii) a discourse value held by the author.

In Section 2 we show that the target proposition must be either expressed or presupposed by the emoji-accompanying text -- in other words, the targets of emoji are strictly constrained. However, we argue that there is great contextual variability with respect to the value held by the author. It can be pragmatically influenced by many factors, which allows us to capture complex relations between emoji and text.

A preview of our value-based analysis is given in (11), capturing how an emoji-based evaluation of a target proposition *p* is connected to a contextually salient value *V* of the author *x*. Crucially, we embed this analysis in a discourse dynamics (Section 4) that handles the conversational impact of a combination *S^E* consisting of an assertive discourse segment *S* and an affective face emoji *E*. After S makes its standard discourse contribution (e.g. adding its content to the common ground in example (10)), *E* operates on a target proposition *P*, which is expressed or presupposed by *S*, thereby triggering the search for a discourse value *V*. *E* then conveys that the author has an affective attitude *A* (*happy* or *unhappy*) towards how *P* supports (in the happiness case) or hinders (in the unhappiness case) the attainment of *V*.

(11) *Value-based approach to emoji semantics (preliminary)*
For any author *x*, target *p*, and value *V*:
i. ⟦😀⟧ = λxλpλV . {w | *x* is happy about how *p* bears on *V* at *w* }
ii. ⟦😟⟧ = λxλpλV . {w | *x* is unhappy about how *p* bears on *V* at *w* }

[13] In an Emoji Usage Questionnaire administered to pre-adolescents by Sick et al. (2020), more than half of the 254 participants selected the following motivation for using emoji: "they express something that normally cannot be described in words".

The value-based view is attractive and parsimonious for the theory-independent reason that values have long been shown to play a central role with regards to affect and its expression (see Ortony, Clore & Collins 1988).

2 The Targets of Emoji

2.1 Core Definitions and Hypothesis Space

The aim of Section 2 is to provide initial evidence for an analysis where face emoji can comment on a proposition provided by the accompanying text. To begin with, examples like (12) give rise to the intuition that there is some connection between the face emoji (😟) and the accompanying text (*I'm hungry!*); what is unclear is how this connection is best characterized.

(12) I'm hungry! 😟

To map out the relevant hypothesis space for emoji-text interactions, we compare two possible analyses, which we pre-theoretically dub **independence**,[14] (13), and **dependence**, (14). In these two examples, (13ab) and (14ab) are identical, as these are the object language expression and the contribution of the text, respectively. Here, the author asserts the proposition *the author is hungry*, which is then added to the Common Ground (CG), the set of propositions that are mutually accepted by the interlocutors (i.e. the author and the readers).

The **independence analysis** is illustrated in (13cd): the emoji contributes affective information that does not comment on the accompanying text, (13c). Instead, it simply communicates a general emotive state that holds in the context ('I am upset right now'). This means that any perceived interaction(s) between the emoji and the text are indirect, as shown in (13d), presumably based on standard pragmatic reasoning (see e.g. Grice 1989, 2001).

(13) *independence analysis*
   a. I'm hungry! 😟
   b. "I'm hungry" asserts p = *author is hungry* and adds p to CG
   c. "😟 " conveys *author is upset*
   d. **interaction:** addressee draws the conclusion (based on pragmatic reasoning) that the author's irritation (13c) is connected to the author being hungry (13b)

The **dependence analysis** is illustrated in (14cd). Here, the emoji contributes affective information that comments on the accompanying text, (14c). Under such an analysis, the interactions between the emoji and the text are direct / semantic, (14d).

[14] Note that our notion of *independence* is distinct from what Potts (2007:167-169) calls 'independence' in his discussion of expressive meaning.

(14) *dependence analysis*
   a. I'm hungry! 😟
   b. "I'm hungry" asserts *p* = *author is hungry* and adds *p* to CG
   c. "😟 " comments on "I'm hungry" and conveys *author is upset* ***about*** *being hungry*
   d. **interaction:** ⟦😟⟧ takes a *p* argument (possibly via an anaphoric relation rather than a syntactic relation) and comments on *p* as its subject matter of emotion

Crucially, we will not argue that *all* emoji uses should be analyzed as dependent, but we argue that *at least some* emoji uses require a dependence analysis in the spirit of (14). This is not a trivial claim, as independence is simple and economical, and thus functions as the null hypothesis.

Before moving onto the empirical evidence in Section 2.2, we introduce one more piece of key terminology: for all dependence cases, we use the term **target (of the emoji)** to refer to the proposition that the emoji comments on, such as *p* in (14d). In a linguistic sense (see e.g. Pesetsky 1995:55), this target proposition loosely corresponds to the *object of emotion*, roughly amounting to the cause of the emotion.[15] In what follows, we focus on propositional targets, leaving open whether face emoji can also comment on non-propositional targets.[16]

In section 2.2, we proceed to argue that dependence cases exist, and that we thus require a dependence analysis of emoji-text interaction.

2.2 Evidence for *Semantically Encoded* Emoji-Text Interactions

Within the scope of this paper, we take it for granted that some cases of text-emoji independence may exist. A candidate for independence is given in (15); this is a natural message to send discourse-initially if the author knows that the addressee is going through a difficult time. Here, the emoji does not trivially comment on the question "How are you coping?" – instead, it seems to convey that the author empathizes with the addressee on a more general level. (An alternative

[15] In the linguistic literature, the term 'object of emotion' has often been viewed as too broad on the grounds that psych predicates such as *be angry* can interact with more than one entity, as shown in (i), where *be angry* interacts with the preposition phrases *with Bill* and *about the party*. Pesetsky (1995:55) introduces the terms 'subject matter of emotion', which roughly corresponds to the cause of the emotion (*the party*), and 'target of emotion', an entity that is positively or negatively evaluated (*Bill*).
i. Sue is angry with Bill about the party.
(stylistically adapted from Pesetsky 1995:63)
Crucially, our notion of *target (of the emoji)* largely corresponds to the 'subject matter' (which is typically propositional), and not to Pesetsky's 'target of emotion' (typically an individual). That being said, we remain agnostic as to whether emojis can also be used to directly evaluate an individual. Example (ii) seems to be ambiguous between a positive evaluation of the referent of *that guy* (Pesetsky's 'target') as opposed to a positive emotion towards a proposition that involves that referent (Pesetsky's 'subject matter').
ii. Did you see that guy? 😀

[16] Note that our approach is in line with Rett (to appear a) (see Section 5), who argues that emotive markers (e.g. *unfortunately, alas*) attach to propositional constructions. Future developments include an extension of our analysis in terms of polymorphic types, where the semantic type of an emoji depends on its target, which could be a proposition (p = *that the mistake happened*), individual (x = *the mistake*), etc., see Asher (2011, 2014), among many others.

analysis would be that the emoji comments on the expected answer “not well”, but this does not strike us as the most natural interpretation of this particular example.)

(15) a. How are you coping? 😞
b. 😞 ⇝ the current situation makes me sad (i.e., I empathize with you for being in it)
(≠ how you are coping makes me sad)

While we explicitly allow for the existence of independence cases, our aim is to provide compelling evidence for the claim that there exist emoji-target relations that are best accounted for by means of the dependence analysis – in other words, cases that involve a semantically encoded emoji-text interaction. More specifically, we propose that a version of the *Simple Targeting* hypothesis in (16) can be maintained for such semantically encoded emoji-text interactions. (The simple targeting view is closely related to Rett’s, to appear a, proposal for expressives such as *wow* or *alas*. We take these expressives to be the closest counterparts of face emoji in natural language.)

(16) **Simple Targeting**
i. An emoji's target must be a proposition *put into play* by the emoji-accompanying clause.
ii. In the case of multiple clause candidates, pragmatics disambiguates.

In (16i), we use the term *put into play* in a theory-neutral way to capture the observation that an assertoric sentence makes both the asserted proposition and its presuppositions accessible for an emoji. This is shown in example (17), where the emoji comments on the presupposition *I am not there*.

(17) *Context: my friends send me a photo from a party that they are currently at*
a. I wish I were there ☹
b. ☹ ⇝ I am sad *that I am not there*
(≠ I am sad that I wish to be there)

Similarly, a question puts its presuppositions into play quite prominently, so that (18a) has the reading in (18b), where the emoji comments on the presupposition of the question.

(18) a. Who drank my coffee? ☹
b. ☹ ⇝ I am sad *that someone drank my coffee*

To illustrate (16ii), consider the examples in (19) and (20). This is a case where the emoji-accompanying text involves clausal embedding. As shown by the apparently divergent emotions (negative in (19) vs. positive in (20)), an emoji can comment on the entire clause (or matrix clause), as shown in (19), but it can also comment exclusively on the embedded clause, as shown in (20). Here, *E* is a place-holder for the emoji that occurs in the text to be analyzed.

(19) a. nobody told me that today is a holiday 😔
b. *E* comments on *p* = *nobody told me that today is a holiday*

(20) a. nobody told me that today is a holiday 😀
b. *E* comments on *p* = *today is a holiday*

We can now turn to our first two case studies, which corroborate the proposal that we outlined so far. Our first case study (Section 2.2.1) provides evidence that face emoji connect to the immediately preceding sentence; our second case study (Section 2.2.2) further corroborates this point by showing that the face emoji are sensitive to the actual phrasing of the preceding sentence.

2.2.1 Case I: The Hunger

To show that emoji interact with the text that accompanies them, we start by looking at constraints on the positioning/ordering of the emoji with regards to the text. The logic of the argument can be stated as follows: The order of emoji and text should have minimal impact on the interpretation of emoji if the emoji just convey a general emotive state that holds in the context (such as 'I am happy right now' or 'I am unhappy right now', as would be the case under an independence analysis). Yet, we find that relative position/ordering strongly impacts the interpretation of the emoji. Therefore, we conclude that emoji are not interpreted in a way where they express general happiness or unhappiness in the context; instead -- in line with our proposed dependence analysis -- emoji interact with text, and linguistic factors (e.g. surface adjacency to the propositional target) play an important role.

The setup in example (21) can be described as follows. A non-negatively valenced statement ("just ordered some food") is preceded by a negatively valenced one ("I'm really hungry"). Since the author's actual situation (access to food) does not change between the two sentences, a negative emotion ("😟 ") should be licensed throughout if it were to purely reflect the author's overall (holistic) affective state; this is what would be predicted by the independence analysis. By contrast, our test example shows that the critical (21b) is infelicitous, even though the affective state presumably remains the same throughout. The infelicity of (21b) is explained if we assume the simple targeting hypothesis outlined in section 2.2.

(21) a. I'm really hungry 😟 just ordered some food
b. # I'm really hungry, just ordered some food 😟

To see how the asymmetry between (21a) and (21b) provides evidence in favor of simple targeting, we can spell out the consequences of simple targeting in (22) and (23). If the emoji preferentially comments on the immediately preceding clause, then we derive the well-formed inference in (22b) and the contextually inappropriate inference in (23b); this explains the infelicity of (23a) (=(21b)).[17]

[17] A reader may wonder whether (21ab) could be explained in terms of discourse relations, where the emoji is connected to the text by virtue of the discourse relation RESULT (see Lascarides & Asher 1993, Jasinskaja & Karagjosova 2021). Such an approach is spelled out in (i).

i. RESULT(I'm really hungry, 😟)

= The eventuality described by "I'm really hungry" caused the state described by "😟".

(22) **Simple-Targeting-based analysis of (21a)**
  a. I'm really hungry 😟 just ordered some food
  b. *E* comments on *p = the author is really hungry* and conveys that *p* is bad.

(23) **Simple-Targeting-based analysis of (21b)**
  a. # I'm really hungry, just ordered some food 😟
  b. *E* comments on *p = the author just ordered some food* and conveys that *p* is bad.[18]

We can thus conclude that simple targeting explains the infelicity of (21b) and its difference from (21a), which does not follow from an independence analysis where emoji convey a general emotive state (such as 'I am unhappy right now' or 'I am happy right now'). This point is further strengthened by looking at (24a), a variant of (21b) where the positive 😀 has been substituted for the negative 😟. If we switch the two preceding clauses, as in (24b), we observe that the positive emoji becomes infelicitous – another ordering effect that parallels (21b); the acceptable (24c) (without any emoji) shows that the reversed order of sentences is not unacceptable in itself.

(24) a. I'm really hungry, just ordered some food 😀
  b. # just ordered some food, I'm really hungry 😀
  c. just ordered some food, I'm really hungry

2.2.2 Case II: The Game

While we will maintain that simple targeting provides the best explanation of the cases considered thus far, we now proceed to problematize such a simple proposition-based analysis. The core finding of our second case study is that the presentation of equivalent facts (e.g. "a 50% chance of A" vs. "a 50% chance of ¬A") affects the acceptability of a positive (😀) vs. negative (😟) emoji, in ways quite reminiscent of the framing effects first discussed by Tversky & Kahneman (1981) (see Geurts 2013 for a recent semantic analysis; see also Berto & Nolan 2021 on related issues).

To begin with, consider our first observation, in (25) and (26). What these examples show is that emoji appear to not just comment on the proposition conveyed by the preceding text; instead, they are influenced by lexical material contained in the preceding text, such as the choice between the

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While Grosz, Kaiser and Pierini (to appear) propose that discourse relations are, in fact, involved in the interpretation of non-face emoji (🏀, 🎻), we do not pursue such an approach for face emoji, our reasons being the following. On the one hand, while combinations of text and non-face emoji exhibit variation in the discourse relations that connect them, we do not seem to find such variation in how face emoji relate to the preceding text; in other words, all combinations of text and face emoji would require the RESULT discourse relation – an unexpected lack of variation. On the other hand, it is difficult to see how an analysis based on discourse relations would handle examples with questions such as our example (18). That being said, a RESULT-based analysis would not be entirely incompatible with our theory, as it would still entail a form of dependence between the text and the emoji, though that dependence would be different from what we propose. A further investigation of such an approach is beyond the scope of this paper.

[18] As a reminder, (21b) improves if we apply additional reasoning (mental gymnastics), as in (ii).
  ii. Context: I'm on a very tight budget and the thing I really dislike most is to order food.
  I'm really hungry, just ordered some food 😟

predicate *win* and its antonym *lose*. Let us start by highlighting the context. In a contest in which there are no ties, not winning equals losing; therefore, the statements in (25ab) and (26ab) are all truth-conditionally equivalent and describe one and the same set of situations, i.e. one and the same proposition.

Nevertheless, even though (25ab) are truth-conditionally equivalent, the distribution of the positively valenced emoji 😀 is asymmetric, in that it is acceptable with *win* in (25a) and unacceptable with *lose* in (25b). Moreover, the distribution of the negatively valenced emoji 😟 in (26ab) is its exact mirror image. (Examples (25)-(30) assume that the author and addressee have no strong prior expectations about the chance of winning or losing before the message is sent. We briefly address an example with prior expectations in (31).)

(25) *Context:* we're watching college football; there are no ties; *not winning* equals *losing.*
  a. There's a 50% chance we'll win. 😀
  b. # There's a 50% chance we'll lose. 😀

(26) *Context:* we're watching college football; there are no ties; *not winning* equals *losing.*
  a. # There's a 50% chance we'll win. 😟
  b. There's a 50% chance we'll lose. 😟

These patterns show that the emoji is sensitive to how the facts are presented, in line with well-attested framing effects. Our analysis of these interactions is developed in Section 3.

Even more strikingly, the addition of the exclusive particle *only* reverses the judgments, as shown in (27) an (28). If *only* is added to the acceptable (25a), the resulting (27a) is infelicitous; by contrast, if *only* is added to the infelicitous (25b), the resulting (27b) is acceptable. This is similar to the findings of Ducrot (1974:272-273) for French *seulement* 'only', as applied to English *only* by Winterstein (2011), that *only* reverses "the orientation of its prejacent" (Winterstein 2011:2).

(27) *Context:* we're watching college football; there are no ties; *not winning* equals *losing.*
  a. # There's only a 50% chance we'll win. 😀 (reverses (25a))
  b. There's only a 50% chance we'll lose. 😀 (reverses (25b))

(28) *Context:* we're watching college football; there are no ties; *not winning* equals *losing.*
  a. There's only a 50% chance we'll win. 😟 (reverses (26a))
  b. # There's only a 50% chance we'll lose. 😟 (reverses (26b))

We can state the key insights from this second case study (The Game) as follows: First of all, the asymmetry in truth-conditionally/situationally equivalent emoji-text pairs, (25ab) and (26ab), further corroborates simple targeting in the sense that emoji comment on the text. However, emoji acceptability is affected by linguistic material (*win* vs. *lose*, addition of *only*) in a way not predicted by simple targeting as defined in (16). In Section 3, we proceed to argue that these asymmetries can be explained by adding context-sensitivity to the meaning of emoji.

Importantly, note that the percentages themselves in our examples do not seem to matter. The overall facts remain the same if we tilt the percentages in one direction or the other (i.e. 70%–30% or 90%–10%), as shown in (29) and (30) for two extreme scenarios: 90% winning and 10% winning, respectively. However, as we will see in Section 3, the prior assumptions of a reader (which are not included in these examples) do affect the acceptability of a given emoji.[19]

(29) *Intuitions in a scenario that is favoring a win (90% winning)*
  a. There's a **90%** chance we'll **win**. 😀 / # There's **only** a **90%** chance we'll **win**. 😀
  c. # There's a **90%** chance we'll **win**. 😟 / There's **only** a **90%** chance we'll **win**. 😟

(30) *Intuitions in a scenario that is favoring a loss (10% winning)*
  a. There's a **10%** chance we'll **win**. 😀 / # There's **only** a **10%** chance we'll **win**. 😀
  c. # There's a **10%** chance we'll **win**. 😟 / There's **only** a **10%** chance we'll **win**. 😟

As mentioned above, (25)-(30) are evaluated in a neutral context without strong prior expectations. Crucially, changing the scenario to one where the prior expectation is higher than the stated probability – for instance, 95% – the judgments flip even in the absence of *only*. This is illustrated in (31a), which behaves like (27a) and the *only*-variants of (29a)/(30a), versus (31b), which behaves like (28a) and the *only*-variants of (29c)/(30c). Note that (31ab) seem quite natural with the addition of *actually*, indicating a contrast between what is said and what was expected, see Aijmer (2013:74-126).

(31) *Context*: we're watching college football; there are no ties; *not winning* equals *losing*. Our expectation was that we have a 95% chance of winning. Our friend Mel, a maths genius, does some calculations, and texts the following:
  a. # (**Actually**,) there's a {**10%/50%/90%**} chance we'll **win**. 😀
  b. (**Actually,**) there's a {**10%/50%/90%**} chance we'll **win**. 😟

Intuitively, the facts in The Game seem to be a reflection of different questions that an author is addressing, as shown by (32ab) vs (32cd). Essentially, the author and reader hope that it is possible to win, and, moreover, they also hope that it is likely to win. In the examples that we have seen, the positive emoji tends to occur with affirmations of possibility, (32ab), whereas the negative emoji tends to occur with the denial of likelihood, (32cd). This contrast forms the basis of the analysis we develop in sections 3 and 4. However, our analysis views the observed effects as an epiphenomenon of something more fundamental to the understanding of emoji: the role of **discourse values**, which embody what an author desires, aspires to, wishes for, or hopes for.

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[19] To complete the paradigm in (29) and (30), (i) and (ii) show that the examples with *lose* pattern alike.

i. *Intuitions in a scenario that is favoring a win (90% winning)*
  a. # There's a 10% chance we'll lose. 😀 / There's only a 10% chance we'll lose. 😀
  b. There's a 10% chance we'll lose. 😟 / # There's only a 10% chance we'll lose. 😟

ii. *Intuitions in a scenario that is favoring a loss (10% winning)*
  a. # There's a 90% chance we'll lose. 😀 / There's only a 90% chance we'll lose. 😀
  b. There's a 90% chance we'll lose. 😟 / # There's only a 90% chance we'll lose. 😟

(32) *Introducing the Discourse Context into Emoji Discourse*

a. Q1 = Is it **possible** for us to win? – A1a: (**Yes.**) There's a 50% chance we'll **win**. 😀
b. Q1 = Is it **possible** for us to win? – A1b: (**Yes.**) There's **only** a 50% chance we'll **lose**. 😀
c. Q2 = Are we **likely** to win? – A2a: (**No.**) There's a 50% chance we'll **lose**. 😟
d. Q2 = Are we **likely** to win? – A2b: (**No.**) There's **only** a 50% chance we'll **win**. 😟

Before venturing into the analysis, we can draw intermediate conclusions from our discussion so far. Our first case study (The Hunger) argues that at least some uses of emoji require a 'dependence' approach to emoji, where emoji-text interaction is semantically encoded and emoji target the proposition expressed by the emoji-accompanying clause. Our second case study (The Game) gives rise to the reasonable assumption that the phenomenon is more complicated than communicating affective information about the proposition (set of situations) expressed by the accompanying text. Here, we have seen asymmetry where symmetry was expected. Our core question can thus be posed as follows: What is the role of lexical material (e.g. *win/lose* and the addition of *only*) and the surrounding context in licensing positive / negative evaluation by an emoji?

In Section 3, we propose a more nuanced analysis where emoji target a proposition *p* provided by the accompanying text in a way that is relativized to the values/goals of the author. We propose the notion of discourse values to capture this relation.

3 Emoji, Targets, and Values

3.1 Values and Emotions

So far we have argued that the semantic contribution of emoji to discourse is dependent on the propositions supplied by adjacent text. But we have also seen that this analysis, correct as far as it goes, is too simple, and that emoji are sensitive to elements of context beyond the target proposition. In this section, we propose that emoji express affective attitudes about target propositions only relative to values or goals of the author that are alive in the discourse.

The introduction of contextually determined values to the overall dependence analysis is motivated by the linguistic data, but it also complements decades of research on the psychology of emotions. Cognitive scientists have widely viewed emotions as involving cognitive states of **appraisal,** assessments of the degree of congruence between an agent's values and the facts as they perceive them.[20]

[20] See Lazarus 1991, Ortony, Clore, and Collins 1988, Scarantino and de Sousa 2018. Thanks to [*redacted*] for the suggestion that we could understand emoji meanings as relativized to values, as described in the appraisal theory of emotions.

In their book, *A Cognitive Theory of Emotions*, Ortony, Clore, and Collins (1988, p. 4) introduce the appraisal theory of emotions with the vivid juxtaposition of facts and values that arises in a sports context:

> When one observes the reactions of the players to the outcome of an important game (for example, the final of the World Cup, or the NCAA basketball championship) it is clear that those on the winning team are elated while those on the losing team are devastated. Yet, in a very real sense, both the winners and losers are reacting to the same objective event. It is their construals of the event that are different. The victors construe it as desirable, the losers as undesirable, and it is these construals that drive the emotion system. The emotions are very real and very intense, but they still issue from cognitive interpretations imposed on external reality, rather than directly from reality itself.

We provisionally treat these non-factual "construals" as **values**, possible states of affairs which an agent desires, aspires to, wishes for, or hopes for. The class of values is intentionally broad, encompassing a wide range of tastes, goals, desires, preferences, and normative commitments.[21] To a first approximation, an agent experiences a **positively valenced emotion**, such as happiness, relief, or pride, only when one of their values is **satisfied** by what they believe to be true in the current situation, and a **negatively valenced emotion**, such as sadness, disappointment, or shame, only when a value is **violated**.

For now, we will treat values themselves as propositions, albeit propositions that occupy a distinctive role in cognition. We'll provisionally assume that a proposition, or set of propositions, satisfies a value when it entails that value, and violates a value when it entails its negation. These ideas will be refined and enriched as we proceed.

Our contention in this section is that a semantic theory of emoji must countenance values as a parameter of discourse. Just as emotions vary with values, so too do the inferences licensed by the use of emoji. The addition of values to discourse is not a radical departure from linguistic tradition, which has variously recognized the linguistic relevance of extra-linguistic priorities and questions (Roberts 2012, 7), discourse goals (Grosz and Sidner 1986), ordering sources (Kratzer 1981), and telicity (Krifka 1988). We propose that conceptually analogous semantic objects play a role in the interpretation of emoji.

3.2 Values and Emoji in Discourse

The elation of winning teams and disappointment of losing teams highlights the psychological role of values in determining the valence of experienced emotions. The specifically linguistic role of values comes to the fore in cases where values vary even when author, target proposition, and other elements of the discourse context are held fixed. In these cases, contextually selected values, along with target propositions, must be recognized as part of the discourse semantics for emoji.

[21] A more nuanced engagement with specific emotions may require more careful delimitations here.

Consider the following pair.

(33) *Context: We know it's going to rain Saturday. It's mutual knowledge that our friends Jack and Jim are getting married soon, but not when. In addition, we are both happy they are getting married. I text you:*
a. Jack and Jim are getting married Saturday. 😀
b. Jack and Jim are getting married Saturday. 😟

In (33a), we infer that the author conveys their enthusiasm about the wedding, regardless of weather. In (33b), we infer that the author conveys that they are unhappy about the fact that the wedding is on a rainy day, but *not* that they are unhappy in any way about the wedding itself. A theory of emoji should (i) anticipate that (33a) and (33b) are both felicitous given normal assumptions about the author's attitudes towards weddings and weather; and (ii) account for the specific inference in (33b), to the effect that the unhappiness is driven by the rain, and not by the wedding itself.

These facts are not easily explained by a theory in which emoji meanings take only target propositions as arguments (along the lines of simple targeting defined in (16)), a point already anticipated at the conclusion of Section 2.2.2. To capture the acceptability of both (33a) and (33b), simple targeting would require us to accept primitively conflicting emotions about the same proposition, with no account of their apparent inconsistency.[22] And the different inferential potentials of the two discourses would be left entirely to unstructured pragmatic reasoning.

We propose that, when emoji are used, a value held by the current author is made contextually salient; we call this the **discourse value.** How context determines discourse value, and which values it selects in any given case are questions of central importance, ones we address directly in Section 3.4.

For now, the intuitive idea of discourse value is brought out by highlighting three general constraints. (i) First, we assume that, in any context, the discourse value is one held by the author, rather than the addressee or other discourse participant.[23] (ii) Second, the discourse value is broadly relevant to the topic and goals of the present conversation. (iii) Third, it is expected that the discourse value is congruent (in a sense to be explained) with any explicitly stated values in the text of the message as well as with the emoji itself. Thus a reader may often infer the discourse value through a process of accommodation.

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[22] We recognize that genuinely **conflicting emotions** are possible, but we don't think they are the norm. Conflicting emotions arise when an agent has both positively and negatively valenced attitudes about the same proposition relative to the same value. Much more common are **mixed emotions**, where an agent has positively and negatively valenced emotions about the same proposition, but only relative to different values. The author of (33), for example, is experiencing mixed emotions.

[23] In usual circumstances, and under pragmatic pressure, this constraint may be relaxed. Compare Rett (to appear a) on perspective shifting of emotive markers.

The introduction of discourse values offers a more productive frame in which to understand the fact patterns highlighted above. In our analysis of the case in (33), two different discourse values are brought into play by the two discourses. (33a) involves the author's positive valuation of Jack and Jim getting married. This is the value that is satisfied by the target proposition. (33b) involves the positive valuation of Jack and Jim getting married *along with* a positive valuation of the weather being good for the wedding. This is the value that is violated, in context, by the target proposition. So we may understand the variation of target and discourse value in (33) as follows:

(33a) Jack and Jim are getting married Saturday. 😀
target = *J&J are getting married Saturday*
value = *J&J are getting married*

(33b) Jack and Jim are getting married Saturday. 😟
target = *J&J are getting married Saturday*
value = *J&J are getting married on a sunny day*

Semantically, we now view the affective attitudes which are the denotations of emoji as holding between the author, a target proposition, and a discourse value. Following the appraisal theory of emotions, we view the denotation of 😀 as a positively valenced emotion which requires that the target proposition satisfy the discourse value, and the denotation of 😟 as a negatively valenced emotion requiring that the target proposition violate the discourse value.

To begin to formalize this proposal, we render the positive emotion as *happy*, understood as a relation between an individual *x*, a proposition *p*, and a value *V*; the corresponding negative emotion is *unhappy*; and *val* is the relation between an individual *x* and the value *V*, when *V* is a value held by *x*.

(34) **Denotations for emoji with values (version 1)**

- ⟦😀⟧ = λ*x*λ*p*λ*V* . {w | *happy*(*x*,*p*,*V*) at *w* }
  where *happy*(*x*,*p*,*V*) at *w* only if
  a. *val*(*x*, *V*) at *w*;
  b. *p* entails *V*.
- ⟦😟⟧ = λ*x*λ*p*λ*V* . {w | *unhappy*(*x*,*p*,*V*) at *w* }
  where *unhappy*(*x*,*p*,*V*) at *w* only if
  a. *val*(*x*, *V*) at *w*;
  b. *p* entails ∼*V*.

Thus, with their use of 😀, the author of (33a) expresses their happiness that the target proposition (*J&J getting married Saturday*) satisfies (i.e. entails) the selected value (*J&J getting married*). With 😟, the author of (33b) expresses their sadness that the target proposition (*J&J getting married Saturday*) violates the selected value (*J&J getting married on a sunny day*) (by entailing its negation). Of course, this violation relies on the contextual background knowledge that it will rain on Saturday; we'll address the role of context in calculating affective appraisal shortly.

We may partly derive the intended value of (33b) with the help of some generic assumptions about the author's values: (i) they approve of Jack and Jim's marriage; and (ii) they prefer weddings on sunny days. Given (i), an affective contradiction would arise if we assumed that 😟 expressed unhappiness about the proposition *J&J are getting married* relative to the value *J&J are getting married*. This leads to the search for an alternative appraisal, and the assumption that the value in question must be the conjunctive value *J&J are getting married on a sunny day.*

In other cases, the values of the author are not known to the discourse participants or derivable from generic assumptions. Then, as we'll see in Section 3.4, the emoji itself can become a central source of information about the discourse value.

3.3 Satisfying Discourse Values in Context

In the preceding discussion we assumed a role for context in mediating the satisfaction of values by targets. We now turn to clarify this relationship, starting with the following case:

(35) *Context: The author and Carlotta are the finalists competing for a scholarship, which exactly one of them will receive. The author and Carlotta are close friends.*
   a. Carlotta got the scholarship 😀
   b. Carlotta got the scholarship 😟

Here we infer that the author of (35a) is happy *for Carlotta* that Carlotta won the scholarship, while the author of (35b) is unhappy *for themselves* that Carlotta won the scholarship. Thus the case once again involves alternation between two, competing values. We set aside for now the question of what determines the relative prominence of different values that authors can have. This is a pragmatic issue that, in general, lies outside the domain of language.

The analysis of (35a) is straightforward. The author values Carlotta winning, and she won; the use of 😀 expresses the happy consilience of value and fact. (35b) is less direct: the author values their own winning, but the fact that Carlotta won implies, in context, that this value is frustrated. The use of 😟 expresses unhappiness at the contextually implied violation of this value.

(35a) Carlotta got the scholarship 😀
   target = *Carlotta wins*
   value = *Carlotta wins*

(35b) Carlotta got the scholarship 😟
   target = *Carlotta wins*
   value = *Author wins*

What we have to capture now is the idea that a target may satisfy a value or not, *relative* to the context. We initially modeled value satisfaction as entailment in (35); to accommodate context, a

natural thought is to make use of contextual entailment: *p* satisfies *v* relative to the common ground iff *p* + the common ground entails *v* (where "+" is monotonic).[24] Supposing the common ground includes the conditional proposition *Carlotta wins* → *~Author wins*, then *Carlotta* + the common ground entails *~Author wins*. Since this violates the selected value, the use of "😟 " is licensed.

Yet this simple model of contextual satisfaction must be expanded. Recall the order effects observed in the discussion of the hunger case (24ab) from Section 2.2.1:

(36) a. I'm really hungry. just ordered some food. 😀
b. # just ordered some food. I'm really hungry 😀

In (36a), the happiness expressed is felicitous because it comments on the normal way that ordering food leads to the sating of hunger, the value presumably evoked by the discourse. (36b) is infelicitous because it is strange to indicate that one is happy about being hungry; certainly it does not lead to satiation. But (36a) and (36b) share the same common ground, so should satisfy the same values, if satisfaction is defined as contextual entailment. The problem, evidently, is that whether a value is satisfied or not is not a matter of how the whole common ground bears on that value, but to the specific contribution of the target.

We propose to zero-in on the contextual contribution of the target proposition, as opposed to the remainder of information already encoded in the context. The idea is to preserve the requirement that the target proposition contextually entail the discourse value, but combine it with the requirement that the previous state of the context *without* the target proposition *not* contextually entail the value. Thus the emoji can be seen as commenting on what is specifically *added* to the context by the target proposition.[25]

To model this proposal, we'll describe the addition of a target proposition *p* to a common ground *C* as *C+p*, and the common ground as it would be without the addition of *p*, as *C-p*. Certain technical issues arise in the definition of the relevant notion of propositional subtraction, which we postpone to Section 4. For now, we can state the analysis in the abstract as follows:

[24] See Section 4 for a discussion of the relevant definitions of common ground, as well as addition and subtraction from the common ground.
[25] Although we do not focus on emotions of surprise, or correlate expressions of mirativity (Rett to appear b), a parallel analysis would be called for. A surprised face comments on a target proposition as it contrasts with the expectations of the context prior to the addition of that proposition.

(37) **Denotations for emoji with values (version 2)**

- ⟦😀⟧$_C$ = λ*x*λ*p*λ*V* . {w | *happy*(*x*,*p*,*V*) at *w*,*C* }
  where *happy*(*x*,*p*,*V*) at *w*,*C* only if
  a. *val(x, V)* at *w*;
  b. *C+p* entails *V*;
  c. *C-p* does not entail *V.*
- ⟦😟⟧ = λ*x*λ*p*λ*V* . {w | *unhappy*(*x*,*p*,*V*) at *w*,*C* }
  where *unhappy*(*x*,*p*,*V*) at *w*,*C* only if
  a. *val(x, V)* at *w*;
  b. *C+p* entails ∼*V*;
  c. *C-p* does not entail ∼*V.*

Returning to the infelicitous use of 😀 in (36b), here *C+p* (where *p*=*Author is hungry*) may entail future satiation, but only because the order for food is already in the common ground; so condition (b) from the definition is met.[26] The problem is that *C-p* entails the very same future satiation, so condition (c) is not met. Nothing of relevance to the discourse value is *added* by *p*, hence the conditions for the expression of the happy emotion are not met.

3.4 Determining Discourse Value

We take values to be a part of the language-independent psychology of human agents. Which values are in-principle available in a given discourse is constrained in part by the current message author, by the personalities of the conversational participants, by the kinds of values that are acceptable for the purposes of conversation, and by common knowledge. The difficult question for our purposes is which particular discourse value is contextually selected in a given conversation. A predictive account of discourse value is well beyond the scope of this paper; for now, we merely wish to recognize the primary influences on value selection.

The first and foremost constraint on discourse value is that, under normal discourse conditions, it must be a value held by the current author, and not the addressee or another discourse participant. This is implicit in the claim from Section 1 that emoji are author-oriented, that is, that the emotions they express are always attributed to the author (compare Rett to appear a). If the emotions in question are the author's, they must arise from the satisfaction or violation of values which are also the author's.

Given this general constraint, perhaps the easiest way for an author to make a privately held value into a discourse value is to state it explicitly. It's hard to know *a priori* whether the gift of a cactus will be appreciated. But if your friend reports back from their second date with (38a), they explicitly state their values, and then express an affective state which reflects the congruence of these values with the facts. On the other hand, (38b) is confusing at best, in light of the explicitly

[26] We are glossing over the distinction between satisfying the value of being satiated in the future, and the value of being satiated now. We unravel this conflation in Section 3.5.

stated value.[27] In (38c), the value satisfied is intuitively still the author's, demonstrating that, even when the values of other agents are explicitly mentioned, it is only the author's values which are relevant to the determination of discourse value.

(38) a. I love cactuses and she gave me a cactus. 😀
b. # I love cactuses and she gave me a cactus. 😟
c. I gave lisa a cactus because she loves cactuses 😀

In other cases, the discourse value is not known to the audience prior to interpretation of the emoji, but the use of the emoji against a background of charitable interpretation allows readers to work backward to the intended value. As a result, the emoji itself can be highly informative about the author's values. If your friend texts you with (39a), and you assume that their values and emotions are coherent, you may infer that the operative discourse value is one that positively assesses gifts of cacti; the reverse is true for (39b). The interpretive reasoning at work here is one of accommodation; since the content contributed by emoji is itself not-at-issue, we understand it to be a form of smooth presupposition accommodation.

(39) a. She gave me a cactus. 😀
b. She gave me a cactus. 😟

Often the discourse value is closely connected with the purpose of the discourse itself. If the aim of the discourse is to resolve a QUD (see e.g. Roberts 2012), one often finds that the discourse value is associated with one answer to the QUD. The author in the scholarship case, for example, presumably made their textual contribution primarily with the aim of informing the recipient about the status of the author's scholarship. It was only contextual circumstance that made them mention Carlotta, and they would have mentioned someone else if someone else had won. The QUD was not: who won? But: did the author win? And so we can see the QUD in this case was directed at the same issue raised by the value itself. Indeed, often a QUD is made salient because of how it bears on a value.

Besides global reasoning, local linguistic phenomena also strongly influence the choice of discourse value. For example, positive and negatively valenced lexical items can signal correspondingly valenced values. The uses of "stress" and "joy" below trigger the values *minimizing stress*, and *maximizing joy* respectively.

(40) a. The stress was overwhelming. 😟 (adapted from Weissman 2019:479)
b. The joy was overwhelming. 😀

Choice of lexical item and sentence constructions can also influence which values are raised to prominence. Consider again the scholarship example from (35ab) reproduced as (41ab) below. In (41ab) we considered target propositions expressed in terms of Carlotta; now we consider them expressed with the-first person pronoun "I." Recall that only one person can win the scholarship,

[27] Compare Kratzer (1981) on modal bases: "according the laws," "according to the time table," etc.

so Carlotta wins if and only if the author does not. Logically speaking, the propositions referring to Carlotta are equivalent to the propositions referring to the author. Yet we find an asymmetry in judgement.

(41) *Context: The author and Carlotta are the finalists competing for a scholarship, which exactly one of them will receive. The author and Carlotta are close friends.*
   a. Carlotta got the scholarship 😀
   b. Carlotta got the scholarship 😟
   c. I got the scholarship 😀
   d. ?# I got the scholarship 😟

(41c) is of course easy to parse: I am happy because my winning the scholarship satisfies my goal of winning. But (41d) presents a puzzle. It is clearly deviant to assume that I am sad that I won the scholarship. The problem is that the alternate reading, which instead evokes the author's valuation of *Carlotta* winning is not immediately available; this unavailability stands in contrast with (41b), where the corresponding cross-matched value is available. (It is noteworthy that (41d) is significantly more natural if you are texting Carlotta directly--- further evidence for the influence of conversational context on the availability of discourse value.)

We suspect this asymmetry is explained by the close connections between the self-oriented text of the target proposition and the self-oriented value it evokes. In (41a), the target text discusses Carlotta, so naturally highlights the author's values having to do with Carlotta. Meanwhile, the author's values *about themselves* are never far from consideration, so easily accessible in (41b), even though the text concerns Carlotta.[28] In (41d), by contrast, there is no mention of Carlotta, and the text is self-oriented, so only the author's values that concern the author themselves are immediately available.[29] In general, we hypothesize, the author's values about the author are always easily available as discourse value, but the author's values about other people must be explicitly signaled.

Although a detailed theory of discourse value lies beyond the scope of the current work, we have seen that the problem of determining discourse value is tractable. Discourse values must be compatible with (i) the values held by the author, (ii) the values explicitly espoused by the author; (iii) the emoji they invoke; (iv) background knowledge about the context. Interpreting affective discourse with emoji is partly a matter of finding the values that appropriately satisfy these constraints.

Ultimately, an analysis of discourse value that focuses only on one source of determination will be empirically insufficient. By introducing a flexible contextual parameter we hope to capture the variability found in the data, while making room for a richer pragmatic analysis in the future.

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[28] The ubiquity of self-oriented values is consonant with the discovery of self-serving biases in social psychology. See, e.g. Shepperd, Malone and Sweeny (2008).

[29] These effects can be overcome through explicit signaling, as the following is perfectly acceptable: "Carlotta really deserved it, but I got the scholarship 😟."

3.5 Satisfying and Promoting Discourse Values

So far we have been treating values as simple propositions which are satisfied or not by a given matter of fact. In reality, however, values are often hierarchically organized, with proximal or instrumental values leading on to ultimate ones. This is particularly vivid for the case of goals. For example, in the context of a race, my ultimate goal is winning the race, but I have a series of incremental proximal goals in virtue of my strategy for winning: passing a certain competitor by the mid-point, cresting the hill without burning out, and so on. We can expect that meeting a proximal goal will also evoke a positively valenced emotion, as it foreshadows my ultimate success.

To regiment this idea, we shall say that, in a context, certain propositions stand in relations of **promotion** to one another. We'll assume that promotion is transitive, reflexive, and asymmetric. A paradigmatic relation of promotion holds between a final goal, and the proximal goals that must be met as part of a strategy to achieve the final goal. More broadly, for one proposition to promote another is for the first proposition to enable, cause, make likely, or "open the door" to the latter.[30] As a heuristic, if you value A, and B promotes A, then, all else equal, you will attempt to bring about B as a means to bringing about A. Conversely, if you value A, but B promotes ∼A, then, all else equal, you will attempt to avoid B as a means to avoiding A. To promote A, B need not entail, or be entailed by A, but it must be part of a natural course of events which leads to A, and it must be logically compatible with A.

When a series of outcomes are connected together in a chain of promotion, we'll refer to the intermediate elements as **mediating outcomes**, and the last element as the **final outcome.** When the final outcome is something that is valued, like a goal, then the mediating outcomes will promote this value.[31] But promotion isn't always a relation between positively valued outcomes. Spraining your ankle promotes losing the race, in which case the mediating outcome of spraining your ankle promotes the final outcome of losing, which negates what you value.

In reasoning about the affective states expressed by emoji, we now want to shift our focus from whether the discourse value is *satisfied* by the target proposition (that is, entailed by it, per (37)) to whether the discourse value is *promoted* by the target proposition. In particular, we propose that an author will express a happy state when the addition of the target proposition to the common ground *further* promotes the discourse value, relative to the earlier state of the discourse. Intuitively, the addition of the target proposition, moves the author closer to their discourse value.

To implement this idea, we assume that appropriate contexts determine chains of promotion between relevant propositions. The target p of an emoji contextually entails a mediating outcome O, which is (typically) an intermediate point in a chain of promotion. This mediating outcome will in

[30] Note that relations of promotion, so construed, are neither necessary nor sufficient for the promoted proposition to be true. Not necessary, because more than one strategy can result in the same goal, and each promotes it. Not sufficient because promotion is no guarantee of a given outcome.

[31] The segregation of values into final and intermediate stages is probably best thought of as a provisional assumption for the explanatory purposes at hand. Whether there are some truly final values is a foundational question for normative ethics and psychology.

turn promote a final outcome *O'*. If the final outcome entails *V*, the discourse value, then a positively valenced emoji is licensed. If the final outcome entails ~*V*, the negation of the discourse value, then a negatively valenced emoji is licensed. This idea leads to the following revised denotation for positive and negatively valenced emoji:

(42) **Denotations for emoji with values (version 3)**

- $[\![😀]\!]_C = \lambda x \lambda p \lambda V$. {w | *happy*(*x,p,V*) at *w,C* }
  where *happy*(*x,p,V*) at *w,C* only if
  there is a mediating outcome *O* and final outcome *O'* such that:
  a. *val(x,V)* at *w*;
  b. *C+p* entails *O*;
  c. *C-p* does not entail *O*;
  d. *O* promotes *O'*:
  e. *O'* entails *V*.
- $[\![😔]\!] = \lambda x \lambda p \lambda V$. {w | *unhappy*(*x,p,V*) at *w,C* }
  where *unhappy*(*x,p,V*) at *w,C* only if
  there is a mediating outcome *O* and final outcome *O'* such that:
  a. *val(x, V)* at *w*;
  b. *C+p* entails *O*;
  c. *C-p* does not entail *O*;
  d. *O* promotes *O'*:
  e. *O'* entails ~*V*.

Here, the denotation of 😀 requires for satisfaction there be some mediating outcome *O* and final outcome *O'* such that: (a) the author values *V*; (b) *O* is contextually entailed by the addition of the target *p* to the context; (c) *O* is not contextually entailed by the previous context; (d) *O* promotes the final outcome *O'*; and (e) the final outcome entails the discourse value *V*. Since promotion is reflexive, there will be cases where these distinctions collapse, and *O=O'=V*.

Where relations of promotion play no role, as in straightforward cases of value satisfaction, then the mediating outcome *O* and the final outcome *O'* are identical.[32] The mediating outcome diverges from the final outcome when chains of promotion intervene. When context plays no substantive role, then the target *p* and the mediating outcome *O* are identical; in that case, where *p=O*, the definition requires that the target itself promote the final outcome.[33] In Section 3.3, we focused on cases where context, but not promotion played a role; in what follows we focus on cases where promotion, but not context, play the central role. (Of course, both context and promotion can also assume a central role at the same time.)

To illustrate, we find that the machinery of promotion allows for a more satisfactory analysis of one of our first cases, The Hunger. Consider the original case again:

[32] In this case, the current definition (v3) is equivalent to the last (v2).
[33] In the very simplest kind of case, where the target itself expresses the discourse value, then *p = O = O' = V*. E.g. "I am happy 😀"

(43) a. I'm really hungry. just ordered some food. 😀
b. I'm really hungry. 😟 just ordered some food.

In our initial analysis of (43a) we said that the author was happy about ordering food because ordering food suggested the eventual satisfaction of the value of satiation. The problem with this gloss is that, intuitively, we are happy about the prospective *consequence* of eating food, but the explicit target of the emoji concerns the *antecedent* act of ordering food. We can resolve this tension in a natural way by assuming that satiation of hunger is both the final outcome (*O'*) and the discourse value (*V*), and ordering food is the mediating outcome (*O*) that *promotes* that value. The happy emoji comments on the fact that the target proposition (*p*) promotes the speaker's discourse value (*V*).

(43a) I'm really hungry. just ordered some food. 😀
target: *Author just ordered some food.* (*p*)
mediating outcome: *Author just ordered some food.* (*O*)
final outcome: *Author is satiated.* (*O'*)
discourse value: *Author is satiated*. (*V*)

In (43b), the proposition *I am hungry* (*p*) contextually entails the mediating outcome *I am not satiated* (*O*). Since promotion is reflexive, the mediating outcome promotes the final outcome *I am not satiated* (*O'*), which corresponds to the negation of the discourse value (*V*), thus licensing the use of "😟 ".

(43b) I'm really hungry. 😟 just ordered some food.
target: *Author is really hungry.* (*p*)
mediating outcome: ~(*Author is satiated*). (*O*)
final outcome: ~(*Author is satiated*). (*O'*)
discourse value: *Author is satiated*. (*V*)

As the last example suggests, the structure of promotion comes into play whenever we encounter the satisfaction of proximal goals on the way to an ultimate goal. Consider a sequence of possible text messages I might send to you while hiking:

(44) *Context: reports from the hike.*
a. I'm a quarter-way to the top 😀
b. I'm halfway to the top 😀
c. I'm three-quarters of the way to the top 😀
d. I made it to the top 😀

There is something annoyingly cheerful about all these reports, but they are linguistically unassailable. We could understand each independently, as expressing the satisfaction of a series of contingently related goals. But this approach seems to miss a common explanatory factor. Instead,

in our analysis, the happy emoji in each case reflects the relationship of promotion between target proposition (*p*) and the discourse value (*V*) and final outcome (*O'*) of making it to the top. Only, a different mediating outcome is invoked in each case. In (44a) for example, the target proposition *p* = the mediating outcome *O* = the proposition *I'm a quarter-way to the top*, which promotes the final outcome *O'* = the discourse value *V* = the proposition *I made it to the top*. In (44b), the same discourse value is promoted, but now the mediating outcome (*O*) is *I'm halfway to the top*. And so on.

The formal structure of intermediate and final outcomes allows us to model not just forward movement along a strategy that results in success, but any situation in which there are scalar magnitudes— that is, cases where more (or less) is better, for a range of magnitudes on a scale. Indeed, this conception of intrinsically scalar values is the key to our analysis of The Game, introduced in the last section. Our explanations of the judgements in this case are admittedly conjectural, but they help make sense of some of its more peculiar features in a reasonably principled manner. Recall the initial set of observations:[34]

(45) *Context: we're watching college football; there are no ties; not winning is the same as losing.*
- a. There's a 50% chance we'll win 😀 /#😟
- b. There's a 50% chance we'll lose #😀 /😟
- c. There's only a 50% chance we'll win #😀 /😟
- d. There's only a 50% chance we'll lose 😀 /#😟

Although the text portions of (45a) and (45b) express equivalent propositions, the difference in lexical items selected to express these propositions clearly influences the felicity of the ensuing emoji. We assume this affective difference is the result in part of a difference in value. But this cannot be the whole story, since normally our values with respect to winning and losing are themselves equivalent. Some further asymmetry is at work here.

The intuition we wish to pursue is that (45a) expresses a positive emotion about the way that any chance of winning *leads on* to the possibility of winning, while (45b) expresses a negative emotion about the way that any chance of losing *leads on* to the possibility of losing. It is relations of promotion which link the reported 50% chances to the ultimate prospects of winning or losing. Analogically: (45a) is like filling the glass half way, and (45b) is like emptying the glass half way; the glass is half-full/half-empty in both cases, but each action is part of a process with a different

[34] As discussed in Section 2, relevant changes to the context will shift the judgements at work here. In a context where it is commonly known that the author is expected to report 60% chance of winning, the judgements involved in (45a) will be reversed. Our treatment of such cases follows our understanding of the significance of "only" outlined below.

natural end-point.[35]

To implement this idea, we assume that, all things equal, talk about the chance of winning as in (45a), has two characteristic effects. (i) First, it induces a context in which a series of mediating outcomes concerning the lower bound on chances of winning are linked by promotion. We might call this an **at-least series** for chances of winning, illustrated below; "≫" indicates the promotion relation. Though the propositions in the at-least series are not waypoints in a strategy for winning, each is a relevant pre-condition for the next.

Chance(win) ≥ 1% ≫ *Chance(win)* ≥ 2% ≫ ... ≫ *Chance(win)* ≥ 99% ≫ *Chance(win)* = 100%

(ii) Second, talk about the chance of winning sets the discourse value to a particular chance of winning. In this case, it makes the proposition *Chance(win)=100%* the discourse value.

In (45a), the target proposition *Chance(win)=50%* entails a point in the at-least series for chances of winning, the mediating outcome *Chance(win)≥50%*. This proposition in turn promotes the final outcome *Chance(win)=100%*, and this is the same as the discourse value. Since the target entails a promotion of the discourse value, the happy emoji 😀 is felicitous, and the sad emoji 😟 is not. What the author expresses with the 😀 , in essence, is their positive emotion about the way that *Chance(win)=50%* bears on the prospect of winning.

(45a) There's a 50% chance we'll win 😀 /#😟
target: *Chance(win) = 50%* (*p*)
mediating outcome: *Chance(win) ≥ 50%* (*O*)
final outcome: *Chance(win) = 100%* (*O'*)
discourse value: *Chance(win) = 100%* (*V*)

The analysis of (45b) proceeds largely in parallel. All things equal, we conjecture, talk about the chance of losing has two characteristic effects: (i) it induces an at-least series for chances of losing, with *Chance(lose)=0%* at the bottom and *Chance(lose)=100%* at the top; (ii) it sets the discourse value to a particular chance of winning; in this case it makes the proposition *Chance(lose)*=0% the discourse value.[36] The target proposition *Chance(lose) = 50%* entails the mediating outcome *Chance(lose) ≥ 50%* which in turn promotes the final outcome *Chance(lose) = 100%*. Since this outcome in turn entails the negation of the discourse value, only the sad emoji 😟 is felicitous.[37]

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[35] We register the following judgements, while recognizing that they may be less forceful than those associated with the case of the game in the main text:
(i) the glass is half full 😀/#😟
(ii) the glass is half empty 😟/#😀
(iii) the glass is only half full 😟/#😀
(iv) the glass is only half empty 😀/#😟

[36] Note that the discourse value cannot be the weaker proposition ~(*Chance(lose)*=100%), i.e. *Chance(lose)*<100%. Such a value would be satisfied by the target proposition that *Chance*(*lose*)=50%, which would in turn license the happy emoji, contrary to our judgements about the case.

[37] The same conclusion can be reached more directly, without an additional *O'*≠*O*, by noting that *O* entails ~*V*. However this breaks the intuitive symmetry with the *win*-case.

(45b) There's a 50% chance we'll lose #😀 /😟
target: *Chance(lose) = 50%* (*p*)
mediating outcome: *Chance(lose) ≥ 50%* (*O*)
final outcome: *Chance(lose) = 100%* (*O'*)
discourse value: *Chance(lose) = 0%* (*V*)

The foregoing account, though it is not without complication, helps to explain some of the more puzzling aspects of the case. For example, using the idea of promotion along an at-least series explains why the author in (45a) expresses a positive emotion towards the target, despite the fact that the target does not assert that the team is likely to win. The author is happy not about the satisfaction of any value, but about the promotion of the value of 100% winning. Likewise, it explains why the author of (45b) may express negative emotion, though the target does not assert that the team is likely to lose: the reported fact promotes the chances of losing.

This account also explains the surprising fact, observed in Section 2.2.2, example (30a), that the same distribution of emoji applies equally to any stated magnitude of chance for winning no matter how objectively dismal, as in (46) below. Even a 10% chance of winning will entail a point on the at-least series, which in turn promotes the discourse value of 100% chance of winning.

(46) There's a 10% chance we'll win 😀 /#😟

We believe this account of the data is superior to a potential modal subordination explanation (Roberts 1989; Stone 1997,1999). According to such an analysis, talk about the chances of winning introduces a set of possible *win*-worlds into the discourse record, and the emoji takes this set of worlds as its target proposition. The positive emotion reflects the fact that all such worlds satisfy the value of winning. The envisioned dependence would run parallel to the modal subordination that emerges in a modal discourse like (47) below.

(47) Suppose we'd won. We'd be happy.

On its face, however, this analysis seems to be on the wrong track. It makes the expressive effect of the emoji in (45a) and (45b) practically vacuous, reporting only that the author likes winning and dislikes losing. This misses the affective quality of future-oriented optimism (or pessimism) which seems to be reported in these cases.

More prosaically, the modal subordination account also seems to make false predictions for (48) below, where subordination to the most salient possibility would require that the happy emoji is trivially felicitous. By contrast, we believe that the additional text muddies the context in a way that blocks the selection of a clear discourse value and promotion structure.

(48) There's a 50% chance we'll lose and a 50% chance we'll win #😀 /? 😟

Finally, the modal subordination analysis appears to predict that the "only" variants of the case, (45c) and (45d) should pattern just like the original (45a) and (45b); nothing about the use of "only" in the introduction of a possibility leads us to expect that it would block subsequent modal subordination. Yet we see just the opposite patterns of felicity. We now turn to our own gloss of the "only" cases.

As we observed in Section 2, the introduction of "only" into cases involving scalar values has the standard effect of reversing the felicity of the valenced emoji. The mechanics of this phenomenon are subtle, and we don't attempt to give a compositional analysis of "only" or its effect on value here. Still, certain general observations help make sense of the observed data.

Emoji aside, the introduction of "only" into a scalar context has the customary effect of signaling that an actual magnitude is lower than an expected magnitude on a common scale. Perhaps you think that $30,000 is a lot of money to earn in a week; but if your colleague says:

(49) I only made $30,000 this week.

then she clearly conveys that her earning expectations for the week were higher than $30,000. So, as a rough generalization, we assume that the use of "only" in a scalar context like (49) signals that the stated magnitude falls *below* a magnitude that we will call the **prior expectation.**

Prior expectations interact with discourse values in predictable ways. "Only" signals that the actual scalar magnitude falls short of the expected scalar magnitude; whether this is a good or bad thing depends on the kind of scale involved. When the scale in question tends towards a magnitude whose realization is preferred, then meeting expectations is a value, and falling lower than expectations violates this value (entails its negation). Thus I could have followed (49) with a sad emoji. When the scale in question tends towards a magnitude whose realization is dispreferred, then falling lower than expectations is a value, and meeting them violates this value. So, generally speaking, introducing "only" will turn a value-satisfying proposition into a value-flouting proposition, and visa versa.

We can operationalize this idea with the following very rough statement of principle: (i) If a scalar sentence *P* affirms that a magnitude *X* is realized, and the scale for *P* is oriented towards an endpoint that maximizes the author's preferences, then asserting the "only" variant of *P* will normally reset the discourse value *V* to the proposition that a magnitude *greater* than *X* be realized. As a consequence, "only+P" will entail the negation of the discourse value *V*. (ii) If a scalar sentence *P* affirms that a magnitude *X* is realized, and the scale for P is oriented towards an endpoint that minimizes the author's preferences, then asserting the "only" variant of *P* will normally reset the discourse value *V* to the *negation of* the proposition that a magnitude greater than *X* be realized, i.e. to the proposition that a magnitude *equal to or less than X* be realized. As a consequence, "only+*P*" will entail the discourse value *V*, rather than it's negation.

Applying (i) to the context of the game, the introduction of "only" has the effect of shifting the discourse value to an interval of magnitudes that either includes or excludes the magnitude achieved. On the scale of chances of winning, "only" sets the discourse value to the interval *above* the stated chance.

(45c) There's only a 50% chance we'll win 😟 /#😀
target: *Chance(win) = 50%* (*p*)
mediating outcome: *Chance(win) = 50%* (*O*)
final outcome: *Chance(win) = 50%* (*O'*)
discourse value: *Chance(win) > 50%* (*V*)

Applying (ii) to the context of the game, on the scale of chances of losing, "only" sets the discourse value to the interval including and below the stated chance.

(45d) There's only a 50% chance we'll lose 😀 /#😟
target: *Chance(lose) = 50%* (*p*)
mediating outcome: *Chance(lose) = 50%* (*O*)
final outcome: *Chance(lose) = 50%* (*O'*)
discourse value: ∼(*Chance(lose) > 50%*) [⇔ *Chance(lose) ≤ 50%*] (*V*)

The resulting analysis of the "only" cases does not make use of the promotion structure, but this, we believe, is the correct result. The peculiar behavior of the non-"only" cases is explained by the intervening promotion chains. The "only" cases, by contrast, are explained by the interaction of prior expectation and value. Together, the two kinds of conversational forces explain the range of judgements observed for this case.

In sum, we have proposed that emoji are not only sensitive to discourse values, but also to relations of promotion that structure the interaction between these values and the linguistically presented facts. The result, we believe, is analysis of emoji meaning that is both faithful to the data and coherent with a psychologically plausible understanding of the affective states expressed.

4 Formal Analysis

4.1 Proposal Summary

Through the preceding discussion, we have argued that emoji are part of multi-modal discourse. We have focused on simple face emoji in clause-final position, and argued that there are cases where they semantically interact with their accompanying text in a predictable way: by commenting on a target proposition's relation to some value held by the author. The target proposition is highly restricted. According to Simple Targeting (16), the target proposition must be one that is either expressed or presupposed by the emoji-accompanying text. But there is great contextual variability with respect to the operative discourse value. Many factors pragmatically influence the value,

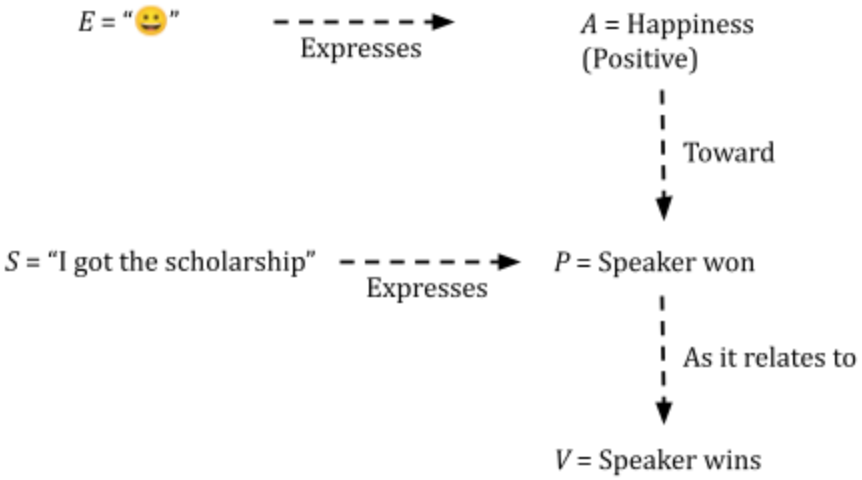
allowing for complex interpretations of text-emoji messages despite the strong restriction on target propositions. This leads to the core proposal:

(50) **Core Proposal**

Adding an affective face emoji E to a conversation immediately following an assertion of a discourse segment S conveys that the author has an affective attitude A toward a target proposition P relative to a discourse value V such that: (i) A is expressed by E, (ii) P is expressed or presupposed by S, (iii) V is held by the author, and (iv) P promotes or demotes V in context, in accordance with the valence of A.

This proposal can be simply illustrated using one of the cases from The Scholarship::

(41c) I got the scholarship 😀



Key to our proposal is that there are three different interpretive forces at work in the discourse contribution of a text-emoji message: the linguistic content of the text (P), the affective content of the emoji (A), and a value held by the author (V).[38] The aim of this section is to outline a formal approach to this core proposal that elucidates how these three forces jointly work.

4.2 Formal Semantics

To analyze the discourse effects of emoji, we propose a simple update semantics using possible worlds. At its heart is a mechanism for narrowing the possibilities taken to be live options in discourse, in the tradition of Stalnaker (1978), using a Common Ground of mutually accepted propositions. We take inspiration from sophisticated analyses of discourse phenomena that introduce structural elements to conversation states in ways that allow for interaction of contents

[38] There is a substantive question about what explains the mappings in a semantics of emoji (Maier 2020). We don't take a stand on this question. We simply assume there is a mapping.

from multiple sources (Roberts 1996; Farkas and Bruce 2010; Maier 2020; Rett *to appear*). This style of approach allows for the three interpretive forces mentioned above to differ in source but not in kind, so that they can smoothly interact.

Our proposal applies to discourses structured $S_1 \hat{} \ldots \hat{} S_n \hat{} E$, where S_{1-n} are discourse segments (typically clauses) with assertive content and *E* is an affective face emoji. Each S is associated with a content $[\![S]\!] = P$, which is the set of possible worlds where S is true.[39] Each E is associated with a content $[\![E]\!] = A(x, P, V)$, which is the set of worlds where the author has the relevant affective attitude toward the target proposition in relation to the appropriate background value. Before listing the specific denotations of '😀' and '😔', we must first introduce the elements of a *Discourse Record,* the conversation state that represents the information tracked by conversational participants and influences the interpretation of messages.

4.2.1 Simplified Update

To illustrate the basic mechanics of discourse update, we begin by presenting simplified versions of the discourse record and emoji denotations. These are sufficient to handle only the simplest cases, and omit values, modeling the emoji as contributing an absolute value-independent evaluation. Following this introduction, we provide a gloss on how values are approached in this system (Sec. 4.2.2) , and give updated emoji denotations and definitions of discourse record/update (Sec 4.2.3).

(51) **Discourse Record (Simple)**
A Discourse Record $D = \langle CG, P, c \rangle$ where:
(i) CG is the Common Ground: the set of mutually accepted propositions;
(ii) P is the Proposition that is immediately salient;
(iii) $c = \langle author_c, addressee_c \rangle$ is the current context.

A simplified discourse record tracks only live possibilities, a salient proposition, and information about who is communicating to whom. The salient proposition will function to be the target of an emoji, which we argued above must be communicated by the immediately preceding text in the cases we focus on.[40] P therefore corresponds to the very short term memory of the conversation, but does not necessarily correspond to the proposition(s) available for propositional anaphora. Linguistic assertions update the discourse record in the standard way, by adding propositions to the Common Ground, the set of mutually accepted propositions. The intersection of the CG, the Context Set (CS), represents all of the worlds compatible with what is accepted in the conversation. Newly asserted propositions in the CG shrink the CS to include only worlds compatible with them. In addition, an assertion updates *P* to reflect the pattern in Simple Targeting (16).

[39] For simplicity, we require that a segment's content include both at-issue and not-at-issue content.
[40] Note that "salient" is used as a term of art. We do not mean to suggest that there are no other salient propositions in a discourse. Instead, we mean *P* to represent a particular kind of status a proposition can hold in discourse—one that is available for targeting by an affective expression.

(52) **Assertive Update**

Where $D = \langle CG, P, c \rangle$ is a discourse record and S is a discourse segment:

$D[S] = \langle CG', P', c \rangle$ where:

(i) $CG' = CG \cup \{[\![S]\!]\}$

(ii) $P' = [\![S]\!]$

A discourse move structured $S \hat{} E$ will then first update the CG such that $[\![S]\!] \in CG$ and update P such that it reflects that the newly expressed content is now salient. In this first simplified version (which does not yet include values), an emoji merely comments on that target proposition.

(53) **Emoji Semantics (Simple)**

$[\![😀]\!] = \lambda x \lambda p. \{ w : happy(x, p) \text{ at } w \}$

$[\![😟]\!] = \lambda x \lambda p. \{ w : unhappy(x, p) \text{ at } w \}$

(54) **Emoji Update (Simple)**

Where $D = \langle CG, P, c \rangle$ is a discourse record and E is an affective face emoji:

$D[E] = \langle CG', P, c \rangle$ where:

(i) $CG' = CG \cup \{[\![E]\!](author_c, P)\}$

The denotation of an emoji, in this first simplified version in (53), is a function from an individual x and target proposition p to a set of worlds where x is happy or unhappy about p.[41] The update definition requires that x be the message's author in the current context and that p be the currently salient proposition P. Together these allow for analyzing the easiest cases, such as (10), repeated here:

(10) I'm so hungry! 😟

The above definitions mean that the segment "I'm so hungry!" sets P to the proposition expressed and adds it to the CG. This newly salient proposition, along with the author from c, is passed to the emoji to add to the CG the proposition that the author is unhappy about being hungry. Where j is a constant for the author, the end result is the intuitive one, that $hungry(j) \wedge unhappy(j, hungry(j)) \in CG$.

4.2.2 Adding Values

The above simple analysis only goes so far. As we argued in section 3, cases of mixed emotions provide strong evidence that emoji do not merely comment on a target proposition, but on how that target proposition bears on a salient value held by the message's author. Here we provide an

[41] For simplicity, we treat *happy* and *unhappy* as bare relations between individuals and propositions. Our aim for this paper is not to give a semantics of attitude predicates, but rather to investigate the discourse effects of text-emoji pairs. One could, if they liked, supplement our analysis with a rich analysis of attitudes, perhaps in the style of Heim (1992) or Kratzer (1981,1991).

overview of the minimal requirements for values in order to be incorporated into the discourse semantics of emoji.

We formally treat values as propositions. That is, they are no different than the contents of assertions. An individual x's valuing a proposition V will be notated *val*(x, V). To value a proposition is, very roughly, to have it as a goal or to prefer that it come about *ceteris paribus.* A proposition P satisfies a value V when P entails V : $P \subseteq V$.

An intuitive feature of values is that they can be hierarchically structured. More simply, one can value something because they value something else. One can value climbing halfway up a mountain because they value climbing to its summit. To capture how our preferences track such features in the world, we introduce a *promotion* relation between propositions. A proposition P promoting another P' is notated $P \gg P'$. The value-promotion relation $\gg$ is transitive, so if $P \gg P'$ and $P' \gg P''$, then $P \gg P''$. The relation is also reflexive, so $\forall P . P \gg P$ (i.e., propositions trivially promote themselves). Despite holding between propositions, we will often call the relata of the promotion relation *outcomes,* to make clear the theoretical role promotion plays. Promotion is distinct from entailment, and instead should be taken to characterize the relation between outcomes that "lead to" others, or make others more likely. In what follows, we make natural assumptions about which outcomes promote others.

The promotion relation allows us to make the distinction between proximal and final values for an individual. For any value V valued by an individual x (i.e. *val*(x, V)), we say that for any V' such that $V' \gg V$, x has V' as an intermediate value for V. A value V is final for an individual x if *val*(x, V) and $\neg\exists V' . V \gg V'$.

Note that we do not aim to provide the truth conditions of *val*(x, V), which would involve a deep investigation into cognitive psychology and potentially require a full hyper-intensional semantics.[42] Alternatively, one could potentially flesh out values using quantification over Kratzerian ordering sources (see Kratzer 1981/2012, 1991). Our focus is not on how one comes to value a proposition or on the logic that one's values obey (if any). We therefore treat values, as well as the promotion relation, as given in order to narrow our focus to how emoji interact with values. We are interested in how valuing something bears on the felicity of affective expressions using emoji, and in how emoji signal the presence of certain values.

We have argued that emoji comment on how a target proposition bears on a value held by the message's author. The role that values play on this analysis has to do with the affective attitudes expressed by emoji. It will therefore be useful to detail some **Affective Axioms**: generalizations that characterize normal inferences regarding the relation between attitudes and values. These are meant to reflect patterns that are easily coordinated on in the common ground, and so are ubiquitous in conversation.

[42] This means, for example, that we allow for val to obtain in patterns that do not necessarily track logical consequence. So it may be that val(*x,V*) and ¬val(*x,V'*) even if $V' \subset V$.

(55) **Affective Axioms**

For any world w and common ground CG:

(A1) $\forall x_e, p_{\langle st\rangle}, V_{\langle st\rangle}.\, happy(x, p, V)^w \rightarrow val(x, V)^w$ and $\exists O, O'$:

a. $\bigcap (CG \cup \{[\![p]\!]\}) \subseteq O$

b. $\bigcap (CG - [\![p]\!]) \not\subseteq O$

c. $O \gg O'$

d. $O' \subseteq V$

(A2) $\forall x_e, p_{\langle st\rangle}, V_{\langle st\rangle}.\, unhappy(x, p, V)^w \rightarrow val(x, V)^w$ and $\exists O, O'$:

a. $\bigcap (CG \cup \{[\![p]\!]\}) \subseteq O$

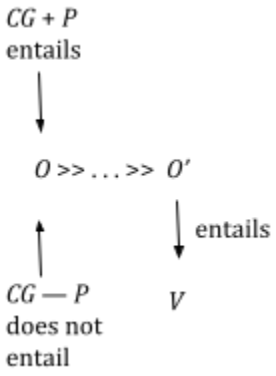
b. $\bigcap (CG - [\![p]\!]) \not\subseteq O$

c. $O \gg O'$

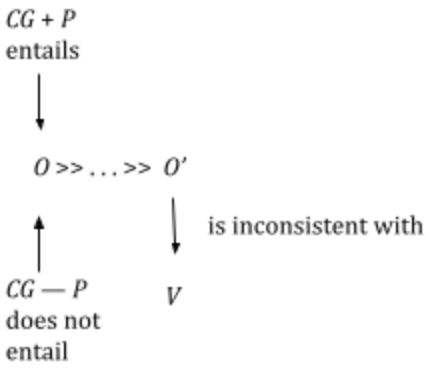
d. $O' \cap V = \varnothing$

These axioms allow for implementation of the proposal presented in (42), in Section 3.5.. Emoji express affective attitudes, which have consequences for the values held by the author and for the entailment and promotion structure that obtains in a network of outcomes involving the target proposition and those values. Axiom (A1) is that being happy about how a proposition *p* relates to a value *V* is equivalent to holding that value and recognizing that the proposition *contextually supports* the value. A proposition *p* contextually supports a discourse value when its inclusion in the CG satisfies some outcome O, (A1a), that promotes another O', (A1c), that satisfies the discourse value *V*, (A1d), when the CG without the proposition failed to satisfy that O, (A1b). On the other hand, Axiom (A2) requires that being unhappy about how a proposition *p* relates to a value *V* is equivalent to holding the value and recognizing that the proposition *contextually hinders* the discourse value. A proposition *p* contextually hinders a value when the inclusion of *p* in, but not exclusion from, the CG satisfies an outcome O, (A2a+b), that promotes another O', (A2c), that is inconsistent with the discourse value, (A2c). Schematically :

(56) ***P* contextually supports *V*:**



(57) ***P* contextually hinders *V*:**



This implementation of contextual entailment allows for isolating the consequences of the target proposition alone given conversational background knowledge. Happiness requires the target proposition *p* to improve the new CG by entailing an outcome *O* that promotes a value-entailing outcome *O'*. Unhappiness requires that the new CG entail an outcome *O* that promotes a value-excluding outcome *O'*. Note that a proposition's failing to support a value does not entail that it hinders the value. Accordingly, a proposition's failing to hinder a value does not entail that it supports the value.

In normal contexts, no outcome will be part of promotion chains that ultimately promote inconsistent outcomes. That is, for any standard outcome $O: \neg\exists O': (O \gg O') \wedge (O \gg \neg O')$. Furthermore, the target propositions involved in the cases we focus on are standardly atomic, so e.g. are not conjunctions of outcomes that promote exclusive outcomes. These two facts mean that in non-deviant contexts, a principle we call **Exclusivity** holds.

(58) **Exclusivity**

For any world w:

- $\forall x_e, p_{\langle st\rangle}, O_{\langle st\rangle}. happy(x,p,O)^w \rightarrow \neg\, unhappy(x,p,O)^w$
- $\forall x_e, p_{\langle st\rangle}, O_{\langle st\rangle}. unhappy(x,p,O)^w \rightarrow \neg\, happy(x,p,O)^w$

Exclusivity between two attitudes means that the presence of one entails the absence of the other. Note that this does not require that the absence of one entails the presence of the other. So one can be ambivalent toward a proposition as it relates to a value. But if one does hold some affective attitude toward a proposition's relation to a value, they cannot also hold the "opposite" attitude toward the same proposition-value relation. In the case of mixed emotions regarding the same proposition, the exclusive attitudes are therefore held with respect to different values.[43]

[43] Exclusivity furthermore means that in most cases, a linguistic segment followed by oppositely valenced emoji (e.g. of the form S^😀^😔) will be infelicitous, in the sense of requiring too much mental gymnastics. The reason is that emoji change neither the salient Proposition nor the salient Value in a Discourse Record. So the opposite emoji will typically express Exclusive attitudes toward the same proposition-value pair, thereby violating Exclusivity. We think this is the correct prediction in the majority of cases like this, but allow for the

These axioms enable emoji to have the discourse effects for which we have argued. Emoji express affective attitudes, which have consequences for the author's values and for how the target proposition may relate to them. The focus for the remainder of this section will be on showing how this obtains on a Discourse Record and on working through key cases.

4.2.3 Emoji with Values

The above features of values and attitudes enable us to expand on the above simple approach to emoji semantics. We begin by adding a Value to the Discourse Record:

(59) **Discourse Record (Final)**
A Discourse Record $D = \langle CG, P, V, c \rangle$ where:
(i) CG is the Common Ground: the set of mutually accepted propositions
(ii) P is the Proposition that is immediately salient
(iii) V is a Value such that $val(author_c, V)$
(iv) $c = \langle author_c, addressee_c \rangle$ is the current context.

A discourse record now additionally tracks a Discourse Value held by the message's author. Obviously, authors will have an indeterminate number of values. We consider V to be largely fixed by pragmatics when needed for the semantics of various kinds of affective expression. That is, the currently salient value that's relevant to the author in the conversation is a complex matter that is constrained by both discourse mechanics and general-purpose reasoning. In (38), repeated below, the explicit mention of loving cactuses establishes a value in the discourse.

(38) a. I love cactuses and she gave me a cactus 😀
b. # I love cactuses and she gave me a cactus 😟

In this case, the author explicitly mentions loving cactuses. Pragmatically, then, they should value having cactuses. So having cactuses is set as the Value for the discourse. This bears on which emoji is felicitous and which is not. These processes are relevant for how an emoji can force a particular value to be salient in discourse, as in, (41):

(41) a. Carlotta got the scholarship 😀
b. Carlotta got the scholarship 😟

The emoji, via the Affective Axioms, require that the Value in the discourse be one that the target proposition contextually promotes/demotes, as required by the relevant affective attitude. Carlotta's getting the scholarship trivially contextually supports the author's value of Carlotta's

---

possibility of outside contextual factors determining different salient values for the two emoji. But if such cases exist, they do not violate Exclusivity. Notably, the prediction seems to hold for a variant of our scholarship example in (i). While either of the two emoji is felicitous on its own, the combination is generally judged to be infelicitous. (Specifically, (i) does not have the reading 'I'm happy for her but sad for myself.')
i. # Carlotta got the scholarship 😀😟

winning, so Carlotta's winning is the preferred salient Value in (41a). Similarly, Carlotta's getting the scholarship contextually hinders the author's value of their own winning, so that is the preferred value in (41b).

To account for the highly varied sources and explanations for salient values in discourse, we leave V in a discourse record as largely unconstrained. Its effects, though, are deeply important to our analysis. To allow for its influence, the discourse value is incorporated into the semantics of face emoji:

(60) **Emoji Semantics (Final)**
$[\![😀]\!] = \lambda x \lambda p \lambda V\,.\,\{w : happy(x, p, V) \text{ in } w\}$
$[\![😒]\!] = \lambda x \lambda p \lambda V\,.\,\{w : unhappy(x, p, V) \text{ in } w\}$

(61) **Emoji Update (Final)**
Where $D = \langle CG, P, V, c\rangle$ is a discourse record and E is an affective face emoji:
$D[E] = \langle CG', P, V, c\rangle$ where:
(i) $CG' = CG \cup \{[\![E]\!](author_c, P, V)\}$

These changes help to explain the more complex behavior of emoji in cases focused on throughout this paper. Emoji comment on the relation between a strictly selected target proposition and a pragmatically selected value. How this simple update semantics captures intuitions about both simple cases and complex ones involving mixed emotions is the next focus.

4.3 Selected Cases

Throughout this section, our predictions are based on contradictions in the Common Ground, when $\bigcap CG = \varnothing$. In this system, such situations end the possibility of discourse. In real conversations, such contributions will typically initiate a search for different background assumptions or a request for clarification. But for the sake of making predictions, we assume that the background assumptions are fixed. We show how discourse records dynamically evolve through the stages of a message, changing which propositions count as the salient P or V as well as the evolving CG. Naturally, the CG will include countless more propositions than the ones listed, which are just the propositions relevant to the analysis.

On the question of how discourse values (*V*) are introduced, all of our examples in 4.3.1–4.3.3 are set up in a way where no discourse value is salient at the beginning of the discourse, and a search for the discourse value is triggered *by the emoji* as it is added. Crucially, this search has different properties in the three examples; in 4.3.1, there is only one accessible discourse value; in 4.3.2, there are two possible discourse values, and the choice of emoji (positive vs. negative) determines which of them is selected; finally, in 4.3.3, the discourse value is not just selected by the emoji, but biased by lexical material in the accompanying text.

4.3.1 The Hunger

We begin with The Hunger, which illustrates the ordering effects that emoji exhibit. Here, and in all the cases that follow, we use 'j' as a constant for the message's author—for all c , $author_c = j$.

(21)

a. I'm really hungry 😟 just ordered some food
b. # I'm really hungry, just ordered some food 😟

Table 1: Discourse Record for (21a)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial)*			1. $\forall x_e.\, val(x, sated(x))$ 2. $\forall x_e.\, order-food(x) \gg sated(x)$	
D_1	"I'm really hungry"	$hungry(j)$		3. $hungry(j)$	
D_2	"😟"	$hungry(j)$	$sated(j)$	4. $unhappy(j, hungry(j), sated(j))$	
D_3	"just ordered some food"	$ordered-food(j)$	$sated(j)$	5. $ordered-food(j)$ 6. $\neg unhappy(j, ordered-food(j), sated(j))$	1, 2, 5, (A2)

Let's first consider the discourse record for (21a), given in Table 1, with the unhappy emoji after the first clause (*I'm really hungry*). The discourse-initial state (D_0) begins with the reasonable assumptions that everybody values being sated, and that anybody who orders food considers that to promote (to be an intermediate value to) being sated. The first assertion by the author resulting in D_1 adds its content (*hungry(j)*) to the CG and sets that content as the salient proposition (*P*). The emoji changes the discourse to D_2 , which has the author's being sated as the discourse value (*V*) and includes in the CG their unhappiness with being hungry as it relates to the value. The discourse value is set as $sated(j)$ because the emoji semantics feed some discourse value V to $\lambda V\,.\, unhappy(j, hungry(j), V)$.[44] Pragmatically, V must be some value that accords with (A2) (the affective axiom of unhappiness); it should be one that the salient Proposition (*hungry(j)*) contextually hinders. More technically, it must be a V such that $hungry(j)$ entails an outcome that promotes some outcome that entails $\neg V$. Given the topic and general purpose reasoning, the author's being sated is the natural candidate for such a value, since being hungry clearly hinders

[44] One might wonder why the Discourse Value is not set earlier, perhaps at the first mention of the author's hunger. There is nothing in principle wrong with this, and it is possible that discourse records track something like our Discourse Value in ways not reflected in this paper. We make the simplifying assumption that V in a discourse remains empty until otherwise required by some kind of expression of affect, such as an emoji or explicit mention of preference. This is all that is needed in order to demonstrate the discourse effects of emoji, and in particular illustrates the presupposition-like effect they can have in setting the Discourse Value. In taking this approach, we do not deny that other values can be salient in complex ways throughout conversation.

that value. The second assertion, resulting in D_3, adds its content to the CG and changes P to that new proposition. Though it has no substantive effect in this case, the inference is generated that the author is not unhappy about having ordered food as it relates to being sated.[45] This is thanks to the fact that ordering food entails no outcome *O* that promotes another outcome *O'* that rules out being sated (*V*).

Let's now consider the discourse record for the (21b) in Table 2, with the unhappy emoji after the second clause (*just ordered some food*), which is judged infelicitous. As shown below, here we end up with a discourse crash.

Table 2: Discourse Record for (21b)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial)*			1. $\forall x_e.\, val(x, sated(x))$ 2. $\forall x_e.\, order-food(x) \gg sated(x)$	
D_1	"I'm really hungry"	$hungry(j)$		3. $hungry(j)$	
D_2	"just ordered some food"	$ordered-food(j)$		4. $ordered-food(j)$	
D_3	"😟"	$ordered-food(j)$	$sated(j)$	5. $unhappy(j, ordered-food(j), sated(j))$ 6. $\neg unhappy(j, ordered-food(j), sated(j))$ 7. Crash	1, 2, 4, (A2) 5, 6

On the surface, the explanation for the crash is that the author communicates that they're unhappy about having ordered food, when contextually such an affective state is impossible. More technically, the crash is generated because the CG including $ordered-food(j)$ is more proximal to satisfying $sated(j)$ than is the CG without that proposition. D_0 and D_1 are identical to their counterparts in (21a). By next asserting that they ordered food, the author adds that content to the CG and sets that as P in D_2. V is set in D_3 as a result of the emoji's use, which requires that there exist some salient discourse value to have its semantic effect. As before, general purpose reasoning about the conversation's topic and content strongly bias the author's being sated as the operative value. The emoji then requires that the author is unhappy about having ordered food as it relates to that value. But with $sated(j)$ as the new V, background knowledge in the CG entails that the author cannot be unhappy about having ordered food in relation to that value, since ordering food supports being sated—just as in the final inference added to the CG in (21a). Thus a contradiction arises. The emoji requires one affective orientation that is prohibited by background knowledge. Note that this illustrates the varied influences on the discourse value. Despite the fact that selection of this value inevitably results in a crash, reasoning about the discourse's topic and content overrides other

[45] (A2) does not entail that the author should be happy about having ordered food, though it permits it.

considerations. This mechanism can be similarly used to explain the strangeness of (24b), the discourse record for which is presented in Table 3:

(24b) # Just ordered some food. I'm really hungry 😀

Table 3: Discourse Record for (24b)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial)*			1. $\forall x.\, val(x, sated(x))$ 2. $\forall x.\, order-food(x) \gg sated(x)$	
D_1	"Just ordered some food"	$ordered-food(j)$		3. $ordered-food(j)$	
D_2	"I'm really hungry"	$hungry(j)$		4. $hungry(j)$	
D_3	"😀"	$hungry(j)$	$sated(j)$	5. $happy(j, hungry(j), sated(j))$ 6. $\neg happy(j, hungry(j), sated(j))$ 7. Crash	1, 4, (A1) 5, 6

At D_3, the author should intuitively still not be happy about being hungry, despite the fact that they've already taken steps to solve the problem. The emoji's introduction, as before, triggers a search for an appropriate Discourse Value. Quite clearly, the author cares about being sated. The emoji then adds the proposition that the author is happy about being hungry as it relates to that value, since the author's being hungry is the currently salient Proposition at D_3. But background knowledge about how hunger relates to being sated (it excludes it) prohibits one who values being sated from being happy about being hungry as it relates to being sated. More technically, there is no outcome O entailed by $hungry(j)$ that promotes an outcome O' that entails the discourse value $sated(j)$. The new information about being hungry does not place the conversation on an "outcome chain" that leads to being sated. As with (21b), background knowledge and the requirements of the affective axioms are what drive the contradiction. But note that it is also crucial that the salient Proposition changes between D_1 and D_2. The emoji cannot target $ordered-food(j)$, in accordance with Simple Targeting. So it is unable to target the proposition that would make sense in context.

4.3.2 The Scholarship

The Scholarship is a case of genuinely mixed emotions. We have argued that mixed emotions can be usefully characterized with relations between propositions and antecedently held values. In this case, the relevant values are the proposition that the author wins the scholarship and the proposition that Carlotta wins. Here we walk through the discourses that result from the message that Carlotta won, coupled with varying emoji.

(41) *Context: The author and Carlotta are the finalists competing for a scholarship, which exactly one of them will receive. The author and Carlotta are close friends. The author texts you:*

a. Carlotta got the scholarship 😀
b. Carlotta got the scholarship 😟

Table 4: Discourse Record for (41a)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial state)*			1. $win(j) \leftrightarrow \neg\, win(c)$ 2. $\forall x_e.\, val(x, win(x))$ 3. $friends(j, c)$ 4. $\forall x_e, y_e.\, friends(x, y) \rightarrow val(x, win(y))$	
D_1	"Carlotta got the scholarship"	$win(c)$		5. $win(c)$	
D_2	"😀"	$win(c)$	$win(c)$	6. $happy(j, win(c), win(c))$	

First, let's consider Table 4, the discourse record for (41a), with the happy emoji. Discourse initially, it is commonly accepted that exactly one of the two finalists will receive the scholarship, that they each value winning, that they're friends, and that they each value the other's winning.[46] The assertion restricts the live worlds to those where Carlotta won, resulting in D_1. The proposition that Carlotta won is also set as the salient P. At D_1, there is not necessarily any one salient value, since there are two available (*win(c)* and *win(j)*), and the fact reported has consequences for each. V remains empty until D_2 because it is not until then that the author expresses an affective state. They do so via the emoji, as V must have a value to be passed to $\lambda V.\, happy(j, win(c), V)$. The two options that are contextually available are clearly the author's winning and Carlotta's winning. Unlike with The Hunger, in which the discourse's topic strongly selects for a single value, here there are no contextual features that obviously differentiate between the values available. Crucially, what this example allows us to demonstrate is how use of a happy or unhappy emoji can serve to disambiguate which of the two possible values is being expressed. This is because selecting one as the discourse value will result in a contradiction, and the other will not.

In the discourse record for (41a) shown above in Table 4, Carlotta's winning is set as V in D_2 and the emoji updates the CG with $happy(j, win(c), win(c))$. Thus, the emotion expressed makes sense with the current salient proposition and discourse value.

However, if we select the author winning as V (as shown in Table 5), we end up with a contradiction. This is because the background knowledge in the conversation, coupled with the

[46] This does not necessarily mean that they each value the other's winning as much as they value their own, or that each value is equally accessible for the discourse. It is possible, for example, that values about oneself tend to be stronger, and therefore more likely to be a discourse's value, all else being equal. An explanation along these lines is likely the reason why (41d) is infelicitous—the speaker's self-directed value is far more salient.

affective axioms, entails that the author cannot be happy about Carlotta's winning as it relates to their more selfish value of $win(j)$. The contradiction that would result can be seen in the alternate derivation of (41a), where V is set to *win(j)* in D_2:

Table 5: Alternate Discourse Record for (41a)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial state)*			1. $win(j) \leftrightarrow \neg\, win(c)$ 2. $\forall x_e.\, val(x, win(x))$ 3. $friends(j, c)$ 4. $\forall x_e, y_e.\, friends(x, y) \rightarrow val(x, win(y))$	
D_1	"Carlotta got the scholarship"	$win(c)$		5. $win(c)$	
D_2	"😀"	$win(c)$	$win(j)$	6. $happy(j, win(c), win(j))$ 7. $\neg happy(j, win(c), win(j))$ 8. Crash	1, 2, 5, (A1) 6, 7

In this alternate derivation, setting the author's winning as V triggers the inference that $\neg happy(j, win(c), win(j))$. This can be inferred because being happy about the proposition as it relates to the value would require, according to (A1), Carlotta's winning to contextually support the author's winning. But that is impossible, since Carlotta's winning actually rules out the possibility of the author's winning. So the alternate discourse results in a crash. Between the two possible options, then, Carlotta's winning is far preferable as a discourse value, since its selection is the only one that would allow the conversation to progress. This explains the preferred interpretation of (41a), on which the author explicitly communicates that they're happy about the result because of what it means for Carlotta.

Let us now consider the discourse record for the version of (41b) that uses the unhappy emoji:

Table 6: Discourse Record for (41b)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial state)*			1. $win(j) \leftrightarrow \neg\, win(c)$ 2. $\forall x_e.\, val(x, win(x))$ 3. $friends(j, c)$ 4. $\forall x_e, y_e.\, friends(x, y) \rightarrow val(x, win(y))$	
D_1	"Carlotta got the scholarship"	$win(c)$		5. $win(c)$	
D_2	"😞"	$win(c)$	$win(j)$	6. $unhappy(j, win(c), win(j))$	

In this case, both the discourse-initial state D_0 and the one resulting from the assertion D_1 are the same as before. The unhappy emoji establishes a different salient value, for reasons structurally identical to those in the previous case. Because of the requirements of the affective axiom (A2), which are relevant because of the semantics of "😞 ", the discourse value must be one such that that the new CG with $win(c)$ entails an outcome that promotes the value's negation. $win(j)$ is a value held by the author that meets this requirement, but $win(c)$ is not. So Carlotta's winning as V would result in a contradiction: the author would be unhappy for Carlotta, but the author can only be happy for her. The author can, however, be unhappy for themselves. So the author's winning is preferred as the salient value.

These cases illustrate the dual influences on the selection of discourse values. General-purpose pragmatic reasoning typically makes for a good guide to which values an individual possesses, and at times may make those values salient in conversation, as in The Hunger. But knowing that an individual has some value is not enough for that value to affect the discourse in the ways focused on by our analysis. Instead, use of linguistic and affective expressions, emoji in this case, strongly influence which values are salient in discourse. Those discourse values provide necessary context for communicated messages. This is why the author, no matter their message, can be assumed to have the exact same attitudes in (41a) and (41b). What changes with the message is which attitudes are expressed.

4.3.3 The Game

We are now in a position to more fully realize the analysis of The Game initially presented in Section 3.5. Our analysis utilizes intuitive assumptions about outcome promotion, and shows how flexibility in selection of the discourse value can achieve the correct predictions. We begin with the cases that explicitly mention winning, repeated here:

(25a) There's a 50% chance we'll win 😀
(26a) # There's a 50% chance we'll win 😟

As we argued in Section 3.5, the natural promotion chains relevant for all cases in (25a) and (26a) are ones whose elements are *at least* outcomes for either winning or losing, depending on which is mentioned. When winning is mentioned, the outcomes are *at least X% chance of winning* outcomes that promote others in the following way:

(62) $\geq 10\%_{win} \ \ldots \gg \geq 50\%_{win} \ \ldots \gg \geq 75\%_{win} \ \ldots \gg 100\%_{win}$

For example, any outcome on which the chances of winning are at least 20% promotes an outcome on which the chances of winning are at least 25%, and so on. This series of outcomes, and their promotion relations, enable the following derivations of (25a) and (26a) in Tables 7 and 8. These discourse records illustrate why (25a), with the happy emoji, is felicitous and why (26a), with the sad emoji, is infelicitous. The sad emoji yields a contradiction:

Table 7: Discourse Record for (25a)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial state)*				
D_1	"There's a 50% chance we'll win"	$50\%_{win}$		1. $50\%_{win}$	
D_2	"😀"	$50\%_{win}$	$100\%_{win}$	2. $happy(j, 50\%_{win}, 100\%_{win})$	

Table 8: Discourse Record for (26a)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial state)*				
D_1	"There's a 50% chance we'll win"	$50\%_{win}$		1. $50\%_{win}$	
D_2	"😟"	$50\%_{win}$	$100\%_{win}$	2. $unhappy(j, 50\%_{win}, 100\%_{win})$ 3. $\neg unhappy(j, 50\%_{win}, 100\%_{win})$ 4. Crash	1, (A2) 2, 3

In each case, the assertion adds the proposition that there are 50-50 chances to the CG and establishes that proposition as the salient P. The use of an emoji in each cases requires that some V be established, since, as always, the emoji take the V as an argument. We have argued that the use of the word "win" strongly biases selection of $100\%_{win}$ as the discourse value, where outcomes falling on an *at least* scale promote it, as shown in (62). The use of "😀" in (25a) requires, according to (A1), that there be some outcome O entailed by $50\%_{win}$ that lies on a promotion chain toward an outcome O' that entails the discourse value of certain victory. $\geq 50\%_{win}$ is just such an O (in fact every *at least* outcome lower than it is also such an O), which licences the use of the happy emoji. The use of "😟" in (26a), on the other hand, would require that there be some O on a chain toward the negation of the discourse value (i.e. contradicting it). No such O exists in standard contexts, which, we have argued, reflect the promotion chain in (62). Because the salient P cannot find an O for hindering V, it cannot be that the author is unhappy about having 50-50 chances as it relates to the discourse value of winning. Structurally, the exact same explanations are at work for (25b) and (26b), the versions that talk about losing. This shown by the discourse records in Tables 9-10:

(25b) # There's a 50% chance we'll lose 😀
(26b) There's a 50% chance we'll lose 😟

Table 9: Discourse Record for (25b)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial state)*				
D_1	"There's a 50% chance we'll lose"	$50\%_{lose}$		1. $50\%_{lose}$	
D_2	"😀"	$50\%_{lose}$	$0\%_{lose}$	2. $happy(j, 50\%_{lose}, 0\%_{lose})$ 3. $\neg happy(j, 50\%_{lose}, 0\%_{lose})$ 4. Crash	1, (A1) 2, 3

Table 10: Discourse Record for (26b)

	Contribution	P =	V =	CG =	Infer
D_0	*(discourse initial state)*				
D_1	"There's a 50% chance we'll lose"	$50\%_{lose}$		5. $50\%_{lose}$	
D_2	"😒"	$50\%_{lose}$	$0\%_{lose}$	6. $unhappy(j, 50\%_{lose}, 0\%_{lose})$	

As with the previous cases, the assertion adds its content to the CG and appropriately sets P. Importantly, though the propositions are notated differently in Table 10 than they are in Table 9 (with "lose" vs. "win"), the contents of P in both cases are equivalent to the proposition expressed when "win" was used. The tangible difference is in what outcome is set as the value for the discourse. As before, an *at least* scale is established whose elements promote higher percentage outcomes. However in (25b) and (26b) saying "lose" establishes that the percentages are attached to losing as opposed to winning. The outcome-promotion chain then is:

(63) $\geq 10\%_{lose} \ldots \gg \geq 50\%_{lose} \ldots \gg \geq 75\%_{lose} \ldots \gg 100\%_{lose}$

The salient P, which is the same proposition in all four cases, now in (25b) and (26b) only entails outcomes that ultimately promote $100\%_{lose}$, which is inconsistent with the discourse value $0\%_{lose}$. Because of this promotion-structure, it cannot be that $happy(j, 50\%_{lose}, 0\%_{lose})$. So when such a requirement is imposed by the emoji in (25b), the discourse crashes. The only available affective expression is the *unhappy* one in (26b).

5. Face emoji in the landscape of linguistics

In the preceding sections, we have explored the semantic contribution of face emoji in sentence-final position to linguistic discourse. In this section we conclude by provisionally positioning our analysis of face emoji within the broader landscape of linguistics and semantic

analysis. We offer a partial comparison of face emoji with more familiar natural language expressions of affect, and with extant analyses of facial expressions with speech.

A wide range of natural language phenomena have been recognized as expressive of affective attitudes and emotions.[47] They include:

(64) Partial typology of affective language
- a. curse words: *fucking, damn*[48]
- b. epithets: *bastard, idiot*
- c. slurs: *Frog, Kraut*
- d. use-conditional items: German discourse particles, Japanese honorifics
- e. interjections: *wow, yay, oops, boo, alas, ouch*[49]
- f. evaluative adverbials: *fortunately, sadly, luckily, unfortunately*
- g. intonation/prosody: rise-fall-rise intonation[50]
- h. punctuation: exclamation point (!), full stop (.)[51]
- i. predicates of personal taste: *fun, tasty*[52]
- j. socio-cultural expressions: *foreigner*[53]

A full analysis of how face emoji fit into this landscape is a complex question, beyond the scope of this paper. Such an investigation might begin with Pott's (2005, 2007) proposal that the class of **expressives**, including curse words, epithets, slurs, and honorifics, are distinguished by six characteristic criteria. Whether face emoji meet these criteria is a rich and subtle question which we set aside for future work.

That said, we believe that there are especially fruitful parallels to be drawn between the uses of face emoji discussed in this paper and the class of expressions that Rett (to appear a) has called **emotive markers.** Emotive markers include interjections and many evaluative adverbials in sentence-peripheral position. While recognizing that emotive markers and face emoji are ultimately distinct phenomena, subject to their own constraints, we wish to draw attention to three notable commonalities.

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[47] See e.g. Foolen (2015), McCready (2021), among others. A classification of face emoji as *expressives* is in line with the earlier proposals for face emoji by Maier (2020) and Grosz, Kaiser & Pierini (2021).
[48] On curse words, epithets, slurs, and honorifics, see Potts (2005, 2007) and Gutzmann (2015, 2019).
[49] See Rett (to appear a, to appear b) on interjections and evaluative adverbials. See Haegeman (1984), Wilkins (1992), Ameka (1992), Wharton (2003), McCready (2008), Norrick (2009), Goddard (2013), Riemer (2014), Sauter (2014) and Zyman (2018) for earlier discussion of *interjections*, see also Ernst (2009), Maienborn & Schäfer (2011) and Liu (2012) for discussion of evaluative adverbials.
[50] See Pierrehumbert & Hirschberg (1990), Scherer (2003), Constant (2012) and Jeong & Condoravdi (2018).
[51] See Dresner & Herring's (2010:253) discussion of the enthusiastic *Oh, great!* (with exclamation point) and its sarcastic opposite *Oh, great.* (with a full stop) in digital communication. See also Herring (2012).
[52] See Lasersohn (2005, 2009), Stephenson (2007), McCready (2007), Moltmann (2009), Pearson (2013), Bylinina (2014).
[53] See Mitchell (1986), Partee (1989), Oshima (2006).

First, emotive markers appear in clause-peripheral positions, as in (65a) (adapted from Rett, to appear a). In this respect they are like face emoji, as in (65b), but differ from Pottsian expressives, (65c), which are often clause-medial.

(65) a. Alas, Jane lost the race.
b. Jane lost the race 😟
c. Jane lost the damn race.

However, it is interesting to note that emotive markers are generally more natural in clause-initial position, while emoji gravitate to clause-final positions. Thus the following variants of (65a) and (65b) in (66ab) are both marked. The possibility that clause-initial vs. clause-final positions have syntactic or semantic effects is a promising subject for future research.[54]

(66) a. Jane lost the race, alas.
b. 😟 Jane lost the race

Second, on Rett's analysis, emotive markers offer an affective comment on the proposition expressed by their clausal complement. Thus (65a) expresses not merely general sadness on the part of the author, along with the fact that Jane lost the race, but sadness *about* Jane losing the race. This account has obvious parallels with our own theory of propositional targets for face emoji.

Finally, both emotive markers (67) and face emoji (68) seem to make semantic contributions that are broadly not-at-issue, in the sense that they are not available for propositional anaphora or explicit denial.

(67) a. A: Alas, Jane lost the race.
b. B: That's not true, she won!
c. B: # That's not true, you're glad she lost!

(68) a. A: Jane lost the race 😟
b. B: That's not true, she won!
c. B: # That's not true, you're glad she lost!

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[54] We note that message-initial emoji seem to function as 'stage setting' devices, which scope over the entire message, whereas message-final emoji exhibit adjacency effects, preferring to comment on the immediately preceding utterance. For that reason, (i) seems to be acceptable (as the negative '*sad I had to leave early*' is within the scope of the emoji), whereas (ii) is infelicitous (as the emoji only scopes over the positive '*I'm glad I went*'). Examples (iii)-(iv) seem to exhibit the opposite pattern. Underlining marks the intuitive scope of the emoji in these examples.

i. 😟 <u>I'm glad I went to the party, but I'm sad I had to leave early</u>
ii. ?/# I'm sad I had to leave the party early, <u>but I'm glad I went</u> 😟

iii. ?/# 😀 <u>I'm glad I went to the party, but I'm sad I had to leave early</u>
iv. I'm sad I had to leave the party early, <u>but I'm glad I went</u> 😀

By contrast, an explicit avowal of emotion that is anaphorically linked to the target proposition, as in (69), contributes at-issue content in the standard way.[55]

(69) a. A: Jane lost the race. I'm so upset about it!
b. B: That's not true, she won!
c. B: That's not true, you're glad she lost!

In addition to the study of affective *language*, there is a long tradition of research within linguistics, but outside theoretical semantics, on facial expressions as they arise in conjunction with speech and signed language.[56] The formal semantics literature has recently taken a step towards the analysis of facial expressions that accompany speech by treating them as a form of co-speech gesture, and analyzing them within the emerging framework of gesture semantics.[57]

Representative studies of facial expressions that accompany speech include Schlenker (2018a,b) and Esipova (2019, 2020). Schlenker (2018a,b) discusses a *disgusted* facial expression; Esipova (2019, 2020) discusses *mirative* facial expressions; and Esipova (2020) also adds a discussion of the *eye-roll*.[58] While all of these facial expressions have counterparts in the realm of emoji (🤢 , 😮 , and 🙄 , for example[59]), these studies have investigated questions that are largely distinct from, but complementary to, the issues pursued here.

For example, Schlenker (2018b) focuses on the semantic contribution that the *disgust* facial expression makes to the presupposition projections of accompanying text. Schlenker argues that this content is not-at-issue, but enters into complex relations of "cosupposition" with the at-issue linguistic content. The evidence for these conclusions come from linguistic contexts where a facial expression accompanies a sentence or predicate that is itself embedded under negation, a quantifier, or attitude report. We have not examined such embedded uses of face emoji or their projective behavior here, but we believe this would be an important step for future research.

At the same time, the analysis offered here goes beyond Schlenker's discussion in a different dimension. Although Schlenker treats iconic gestures and facial expressions as making the same kind of semantic contribution, the means by which they determine propositional content in fact

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[55] Thanks to Masha Esipova (p.c.) for suggesting a paraphrase of this sort.
[56] On facial expressions with spoken language, see e.g. Russell & Fernández-Dols 1997, Fernández-Dols & Russell 2017. On facial expressions in sign language see e.g. Nespor and Sandler 1999, Reilly et al. 1990; Sandler 2005; Wilbur 2000; Dachkovsky and Sandler 2009.
[57] Recent work on the semantics of co-speech gesture include Lascarides & Stone 2009a,b, Ebert & Ebert 2014, Schlenker 2018a,b, 2019, Esipova 2019, Ebert, Ebert, & Hörnig 2020.
[58] Maier (2020: slide 13) also proposes an analysis for the smile as a facial expression. Notably, his sketch of an analysis, which treats smiling as an expressive similar to the word *oops*, does not assume that smiling comments on a proposition, but it expresses a positive attitude of the speaker towards the addressee. Since our focus is on face emoji that interact with text, this addressee-oriented use of the smile falls outside of our purview – that being said, the smiling face with smiling eyes emoji 😊 clearly has a use in the spirit of Maier (orthogonal to the present discussion) where it just expresses goodwill or friendliness towards the addressee.
[59] Note that eye-roll emoji have certain properties that set them apart from other face emoji. For example, eye-rolls frequently occur in a message-medial position:
i. Some people 🙄 have apparently forgotten how walls and gates work.

differ in systematic ways. Iconic gestures offer direct illustrations or exemplifications of objects and events described in the linguistic text (Lascarides and Stone 2009a,b). But facial expressions like *disgust* express attitudes *about* the objects and events described in the linguistic text, in precise parallel with the analysis of face emoji offered here. The style of analysis pursued in this paper, which distinguishes between the subject, affective attitude, and propositional target of emoji, would contribute to a more granular explanation of the semantic contribution of facial expressions.

Ultimately, we view the present account as only an initial step towards understanding the semantic contributions of face emoji in discourse. We look forward to future research in the super-linguistic spirit which integrates the insights and methodologies that have animated recent studies of expressives, emotive markers, gestures, and facial expressions.

6. Conclusion

In this paper, we have proposed a semantic analysis of the contribution that face emoji make to written linguistic discourse. We have discussed the interpretation of face emoji in sentence-final position, identified properties of emoji-text relations that are more constrained than one might initially expect, and outlined a formal semantic analysis of the interplay between the face emoji and the accompanying written text. Our analysis treats face emoji as propositional modifiers, which comment on a target proposition in view of how it bears on a contextually given discourse value. Such values reflect the author's desires, priorities, or wishes. Our analysis explains a range of emoji-based data, including ordering effects, contextual entailments, and the influence of lexical choice and framing effects on the expression of affect.

Outside of written digital communication, there are two clear points of comparison for face emoji: natural language expressions that are expressive of affective attitudes and the facial expressions in embodied, face-to-face communication. However, we maintain that emoji are a form of expression in their own right; there is no perfect correspondence to any purely linguistic phrase, nor to any embodied facial expression. This paper describes what we take to be some of the fundamental semantic features of this unique mode of modern communication.

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