Prosodically marked mirativity

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1. Introduction

   Mirativity is the implicit encoding of speaker surprise or exceeded expectation (DeLancey, 1997). It is encoded using a variety of different strategies (Rett, 2012): morphologically, in e.g. sentence particles (in e.g. Finnish); polysemously, in e.g. mirative evidentials (in e.g. Cheyenne, Rett & Murray 2013); syntactically, in focus fronting (in Spanish; Cruschina 2012); and prosodically, in 'exclamation intonation' in e.g. English.

   The first goal of this paper is to motivate a unified semantic treatment of this 'sememe' – this fundamental unit of meaning – as it is encoded in a variety of ways across languages. The second goal is to apply the semantic treatment to English exclamation intonation as a case study. The details of this study suggest that there are several prosodic components to exclamation intonation in English, only one of which is clearly associated with the sememe of mirativity; the other features, we hypothesize, serve as optional, gradient markers of prosodic prominence.

2. Mirative marking
2.1. Defining mirativity

   We use the term 'mirative' as a label for any natural-language expression of exceeded expectation. The minimal pair in (1) differ only with respect to mirativity; (1-b) additionally involves the expression of exceeded expectation on the part of the speaker.

(1)   a.   Keisha won the race.
        b.   (Wow) Keisha won the race!

We use the term 'expression' in juxtaposition to the term 'description,' as in Kaplan (1997) and Castroviejo-Miró (2006). This suggests that, like any expressive speech act, a mirative construction can be uttered insincerely (Searle, 1969). And this seems true of exclamations. In a context in which the speaker is a seasoned traveler, and so is quite familiar with the exact size of modern airline seats, she can nevertheless felicitously utter (2) to a seatmate when she sits down. This doesn't negate the characterization of exclamations as portraying speaker surprise, or exceeded expectation, because the utterance still characterizes the speaker as being surprised that airline seats are so tiny; we just know, given the context, that the utterance is insincere.

(2)   (Wow) Airline seats are so tiny these days!

The characterization of mirativity as an expression (cf. description) of speaker surprise or exceeded expectation also suggests that mirativity is not-at-issue, i.e. not directly deniable in context or targetable

by truth-conditional operators like negation. This is in fact the case; we will examine this property in more detail in §3.1.

We use the terms 'surprise' and 'violated/exceeded expectation' to refer to the attitude miratives express. This is shorthand for the claim that miratives indicate that the speaker's expectations have been violated or exceeded (Merin & Nikolaeva, 2008; Rett, 2011); as DeLancey (2001) says (p.38) "No matter how high my expectations might have been, what I have just heard exceeded them". One common feature of all indications of violated expectation – regardless of how they are encoded – is that they are polysemous between flattery and insult, depending on the relevant expectations. Consider the sentence in (3).

(3)   You did better than the faculty expected you to.

There is a context in which this utterance is flattering: one in which the hearer assumes that the faculty had reasonably high expectations for her. But there is another in which it is insulting, in which the hearer gave an average performance but the faculty had had low expectations for her. This property of an explicit statement of violated or exceeded expectation in (3) also holds of exclamations, like *Wow, you did so well on that test!*.

We have characterized mirativity as speaker-oriented, i.e. reflecting surprise on the part of the speaker; this does seem to be the right characterization despite the ability of miratives – like all other speaker-oriented phenomena – to occasionally instead reflect the perspective of the hearer or some third party (Harris & Potts, 2009). There's also evidence that mirativity – at least in some constructions – needs to be tied to the here-and-now (Rett & Murray, 2013). The contribution of mirative evidentials has been characterized as reporting 'novel information' DeLancey (1997, 2001) or an 'unprepared mind' Peterson (2010); or as a "spontaneous reaction to a new, salient, often surprising event" (Aikhenvald, 2004:197).

2.2. Mirative strategies

There are a variety of different ways to mark mirativity in a language. Rett (2012) identifies three: independent miratives, which mark only mirativity; mixed-expression miratives, which mark mirativity at one level at some other content at another level; and dependent miratives, which mark mirativity only in certain contexts. As far as we know, mixed-expression and dependent miratives are exclusively morphologically marked. But within the class of independent miratives, there seems to be a variety of ways in which mirativity can be encoded: morphologically, syntactically, or prosodically. We illustrate each of these options in this section.

2.2.1. Independent miratives

Independent miratives can be encoded morphologically, in bound or free morphemes. An example of the former is the Finnish sentence particle *-pä*, exemplified in (4).

(4)   a.   Täällä on   paljon kukk-ia.
             here   be-3RD.SG a.lot flower-PRT.INDF.PL
             'There are lots of flowers here.'
       b.   Täällä-**pä** on   paljon kukk-ia.
             here-PA be-3RD.SG a.lot flower-PRT.INDF.PL
             '(Wow) There are lots of flowers here!'

An example of a free mirative morpheme is the Mandarin adverb *guoran* and its anti-mirative counterpart *jingran* (Wu, 2008).

(5)   Zhangsan **guoran/jingran** lai   le.
       Zhangsan MIR/ANTI-MIR   come PART
       'Zhangsan came (as expected/not expected by the speaker).'

It also appears as though mirativity can be encoded syntactically; Cruschina (2012, 2019) argues that this is the contribution of focus fronting in Spanish as illustrated in (6).

(6)   ¡Imagínate!   ¡Con el director quería   hablar!
        imagine.IMP.2SG with the director want.IMPF.3SG talk.INF
        'Guess what! The director he wanted to talk to!'

Finally, mirativity can be encoded prosodically, as it is in English exclamation intonation, illustrated in (1-b). This will be the subject of the in-depth study in §4.

2.2.2. Mixed-expression miratives

It appears as though some morphologically encoded mirative markers are mixed expressions, insofar as they mark mirativity at the not-at-issue level as well as some other at-issue meaning. This is how Malchukov (2004) categorizes Russian mirative conjunctions, exemplified in (7), in which the second conjunct is surprising independently of the first, similar to the archaic English 'lo and behold'.

(7)   On zabolel **da** **i**   umer.
        he fell.ill CONJ PTCL died
        'He fell ill and died (I didn't expect it).'

There has also been recent work on expressive intensifiers like the German *sau* ('female pig'); *total* ('totally'); and *voll* ('fully'; Gutzmann & Turgay 2011). while the mirative component of these is explicitly classified in this work as an expressive, there is reason to think that at least these types of expressives count as miratives for present purposes (Rett *forthcoming*).

(8)   Die Party war **sau** cool.
        the party was SAU cool
        'The party was very cool (I can't believe how cool!).'

2.2.3. Dependent miratives

Many mirative markers are dependent miratives, which is to say they are polysemous between a mirative marker and something else, depending on the context of utterance. Mirative evidentials, exemplified in (9) for Tsafiki (Dickinson, 2000), receive their mirative interpretation in contexts in which the content was recently learned through direct evidence (Rett & Murray, 2013).

(9)   Moto   jo-**nu**-e.
        motorcycle be-EVID-DECL
        speaker hears motor: 'It is apparently a motorcycle.'
        speaker thought he heard a car, but sees a motorcycle coming: 'It's a motorcycle!'

Other mirative evidential languages place other licensing restrictions on the mirative interpretation of mirative evidentials. In Gitksan, the mirative interpretation requires that the clause be in the first person (Peterson, 1999), and in Hare, that the clause be in imperfect aspect (DeLancey, 1997, 2001).

(10)   a.   Mary e-wé' ghálayeyĩda **lõ**.
              Mary its-hide work.PERF EVID-INF
              'Mary worked on hides (given what I've inferred/heard)'
        b.   Mary e-wé' ghálayeda **lõ**.
              Mary its-hide work.IMPF EVID-INF
              'Mary is working on hides (I saw, to my surprise)'

In Cheyenne, the mirative interpretation is only available if the clause is in present tense (Murray, 2010, 2011), while in Georgian the mirative interpretation is only compatible with individual-level predicates (Korotkova, 2012). It remains to be seen what all of these semantic properties have in common, although Rett & Murray (2013) suggest that they are all compatible with a recent learning event.

3. A unified analysis

The diversity of ways in which languages encode mirativity is striking, but it highlights the necessity of providing semantic analysis at the level of sememes – the smallest unit of meaning – rather than at the level of morphemes. Specifically, the heterogeny of meaning encoded in e.g. sentence particles (evidentiality, mirativity, speaker certainty, etc.) suggests it's a mistake to talk about the semantics of sentential particles; rather we should isolate sememes like mirativity and provide a semantic account of them across strategies (see Waltereit 2001 for discussion). It further highlights the necessity of including supersegmental phonetic features like prosody in compositional semantic theory.

In this section, we briefly review the unified account of the sememe of mirativity presented in Rett (2019), in the context of what she characterizes as 'emotive markers' more broadly. The goal of this paper is to examine exclamation intonation in English – qua prosodically encoded mirativity – as a complicated application of that theory of mirativity, so we will focus on the general empirical claims and diagnostics in that work. It answers the following questions: does mirativity behave the same way across languages and strategies? If so, does it behave like any other sememe? How should we analyze it semantically? (How should we treat any differences?)

3.1. Illocutionary diagnostics

Rett (2019) argues that mirativity – along with other emotive attitude expressions, like *alas* – is a special sort of not-at-issue content, called 'illocutionary content'. We will briefly review the diagnostics for illocutionary content and her analysis of it here, before moving on to show how in §4 those generalizations and analysis can be extended to prosodically marked mirativity.

Mirativity, as it's defined above, counts as not-at-issue content: it's undeniable in discourse, and cannot be targeted by truth-conditional operators like negation. This is true of exclamations, as shown in (11) and (12), but also holds for all of the mirative strategies discussed in the previous section.

(11)   A: (Wow) Keisha won the race!
        B: That's not true, she came in second.
        B′: #That's not true, you knew she would.

(12)   (Wow) Keisha did not win the race!

In (11), the denial *that's not true* can be used by the hearer to target the propositional content of the exclamation – that Keisha won the race – but not the mirative component introduced by exclamation intonation, namely that the speaker is surprised by this proposition. And in (12) the negation – regardless of where it is in the sentence – can only target the proposition that Keisha won the race, not that the speaker is surprised that she did.

But Rett (2019) further argues that mirative markers – and other 'emotive markers,' which mark a speaker's emotive attitude towards a salient proposition – differ from canonical encoders of not-at-issue content, like appositives or evidentials, in the type of not-at-issue content they encode. Specifically, she argues that emotive markers are best characterized as encoding 'illocutionary not-at-issue content' – content that is not-at-issue by virtue of the fact that it pertains to *how* the speaker is using the utterance in the context of utterance – and that this type of content requires a distinct treatment to other, descriptive types of not-at-issue content. We will review that typology, illustrated in Figure 1, and the diagnostics used to establish it.

The typology largely results from a comparison of the semantic properties of canonical encoders of not-at-issue content, like the evidential *allegedly* and utterance modifier *frankly*, to emotive markers like *alas* and *fortunately*. These form the best minimal pairs because they are all morphologically encoded and range over propositions; the diagnostic results reported here for emotive markers like *alas* hold for morphologically encoded mirative markers, although most are unsuited for testing on prosodically encoded mirativity.
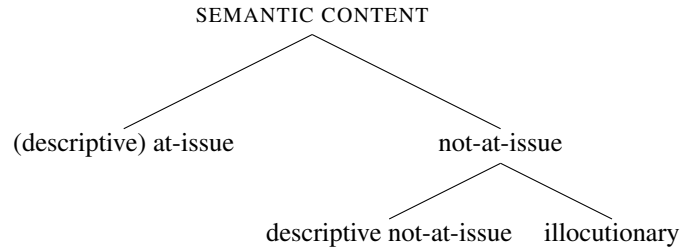
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                        SEMANTIC CONTENT
                       /              \
          (descriptive) at-issue      not-at-issue
                                      /           \
                      descriptive not-at-issue    illoccutionary
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Figure 1: Rett's (2019) typology of semantic content

3.1.1. Susceptibility to Moore's Paradox

In her account of mirative evidentials in Cheyenne, Murray (2010) reports a difference between the two polysemous meanings with respect to whether or not they result in Moore's Paradox, a standard example of which is illustrated in (13).

(13)   #It's raining, but I don't believe it's raining.

Murray's claim was that the denial of mirativity in a mirative evidential construction results in Moore's Paradox (which she marked as #), while the denial of evidentiality results in contradiction (which she marked as #$_\perp$). To the extent that English speakers recognize this difference, Rett (2019) reported that the English data pattern the same way.

(14)   a. #$_\perp$ Allegedly, Keisha lost the race, but no one alleged she did.
        b. # Alas, Keisha lost the race, but I'm not disappointed she did.
        c. # (Wow) Keisha lost the race! But I'm not surprised she did.

But a more robust test for this same effect comes from Yalcin's (2007) observation that Moore's Paradox is suspended in suppositional contexts, as shown in (15) for (13).

(15)   Suppose it's raining, but I don't believe it is raining.

And we get a contrast here, too; denial of the evidential adverbial, which encodes descriptive not-at-issue-content, is not suspended in a suppositional context (hence the # in (16-a)), but denial of the emotive marker, which encodes illocutionary not-at-issue content, is.

(16)   a. #Suppose that, allegedly, Keisha lost the race, but that no one alleged that she did.
        b. Suppose that, alas, Keisha lost the race, but that I'm not disappointed she did.

3.1.2. Scope-taking

In contrast to canonical encoders of not-at-issue content that range over propositions, Emotive markers associate with a single most salient proposition. The most notable consequence of this fact is that it makes them incompatible with utterances associated with multiple propositions. This is again illustrated in Cheyenne in (17), in which the mirative evidential is polysemous between an evidential (i.e. descriptive not-at-issue) and mirative (i.e. illocutionary not-at-issue) meaning.

(17)   a. Mó=é-x-hó′ táhevá-**hoo′o**   Aénohe?
            y/n=3-REM.PST-win-<u>NAR</u>.3SG Hawk
            'Given the stories you heard, did Hawk win?'
        b. *Mó=é-hó′ táhevá-**hoo′o** Aénohe?
            y/n=3-win-<u>NAR</u>.3SG   Hawk
            'Given your surprise, did Hawk win?'   *Cheyenne,* Murray (2010)

This is certainly true of exclamation intonation, which cannot occur in questions arguably for prosodic reasons (although see Braun et al. 2019; Dehé & Braun 2019, 2020 for discussion of the prosody of

utterances that are punctuated with '?!'). But it is also true of morphologically encoded mirativity markers, like the Finnish *pä*, which is not acceptable in standard *wh*-questions. And it is also true of exclamation intonation in constructions like disjunctions, which can be associated with multiple propositions.

The fact that emotive markers (like mirative markers) associate with a single salient proposition also means that they interact scopally with sentential operators differently than encoders of canonical or descriptive not-at-issue content. This is illustrated briefly in (18) and (19) (for more detail see Rett, 2019). The sentences in (18) feature an emotive marker, *alas*, that encodes illocutionary not-at-issue content which is incompatible with the material in the consequent of the conditional. In (18-a), this results in infelicity, because the sentence-initial *alas* scopes over the most salient proposition (the entire conditional). But in (18-b), it does not result in infelicity, because the embedded *alas* scopes over only the antecedent, not the whole proposition.

(18)   a.   #Alas, if Keisha loses, at least we'll flip the Senate.
        b.   If, alas, Keisha loses, at least we'll flip the Senate.

In contrast is (19), featuring an evidential adverbial, *apparently*, that encodes descriptive not-at-issue content which is incompatible with the material in the consequent of the conditional. Regardless of the syntactic position of *apparently*, these sentences are infelicitous, because in both of them, *apparently* ranges over the entire conditional. The embedded evidential in (19-b) cannot range only over the antecedent.

(19)   a.   #Apparently, if Keisha loses, I will run for office.
        b.   #If, apparently, Keisha loses, I will run for office.

We will treat these as diagnostics for illocutionary not-at-issue content, in service of our adaptation of the semantic analysis of emotive markers we briefly discuss in the next section; see Rett (2019) for a more detailed discussion.

3.2. A semantics for illocutionary content

It's clear that mirativity, like other illocutionary content, is not-at-issue (henceforth 'NAI'). But it also seems to differ from canonical not-at-issue content in that it pertains to the speaker's attitude towards her utterance, rather than the world. And it, correspondingly, exhibits distinct semantic behavior. The semantic account in Rett (2019), briefly described here, aims to explain how illocutionary content can be modeled in a way that explains its not-at-issueness as well as its distinct semantic behavior.

Consider the utterance in (20), which encodes three different types of content. The at-issue content, which can be directly denied or targeted by negation, is the proposition *Keisha won the race*. The appositive *who hates politics* encodes descriptive not-at-issue content, the proposition that Keisha hates politics. and the exclamation intonation encodes illocutionary not-at-issue content regarding the speaker's exceeded expectations.

(20)   (Wow) Keisha, who hates politics, won the race!

        a.   **at-issue**: Keisha won the race
        b.   **descriptive NAI**: Keisha hates politics
        c.   **illocutionary NAI**: speaker hadn't expected Keisha to win the race

In established semantic treatments of utterances – like the analysis in Farkas & Bruce (2010) and those that build on it – at-issue and canonical not-at-issue content receive a compositional semantic treatment in addition to illocutionary mood, as all of these things are encoded in what could be considered the 'parts' of language (morphology or prosody). Traditionally central in these accounts is the notion of the 'Common Ground' (Stalnaker, 1973), a set of propositions mutually agreed upon by all interlocutors for the purpose of conversation. At-issue content constitutes a proposal to admit a proposition into the Common Ground. (It's the nature of this proposal that allows for direct discussion about the truth of at-issue content.) Farkas & Bruce (2010) therefore models at-issue content by having it update something called the 'Projected Set': a sort of waiting room where propositions go to be either rejected or admitted

CONTENT TYPE	THEORETICAL TREATMENT	SOURCE
at-issue	updates the Projected Set	Farkas & Bruce (2010)
	(to be admitted or not into the Common Ground)	Stalnaker (1973)
descriptive not-at-issue	updates the Common Ground	Murray (2010)
illocutionary not-at-issue	updates speaker's Discourse Commitment set	Rett (2019)

Table 1: Theoretic treatment of types of semantic content in Rett (2019)

into the Common Ground. Following Murray (2010, 2014), descriptive not-at-issue content directly updates the Common Ground. Its content is snuck into the set of mutually agreed-upon propositions – or checked against it – which accounts for the inability of descriptive not-at-issue content to be directly denied or negated.

Farkas and Bruce's model of a discourse structure K includes the following ingredients:

1. the **common ground** (CG), the set of propositions believed by all discourse participants (for the purpose of the conversation);

2. sets of **discourse commitments** (DC): for each participant x, the set of propositions x publicly commits to in the conversation;

3. the **Table** T, modeling discourse salience;

4. the **projection set** (ps), the set of beliefs that are being considered for addition into the CG.

They adopt their treatment of illocutionary mood from Krifka (2001), but they do not differentiate between at-issue and not-at-issue content; I borrow from Murray (2010, 2014) to do this (in (iv)).[1]

(21)   *Declarative operator* (**D**), for sentences S_p with at-issue content p and not-at-issue content q:
$\mathbf{D}(S_p, a, K_i) = K_o$ such that
    (i) $DC_{a,o} = DC_{a,i} \cup \{\langle \mathsf{believes}, p \rangle\}$
    (ii) $T_o = push(\langle S_p; \{p\}\rangle, T_i)$
    (iii) $ps_o = ps_i \,\overline{\cup}\, \{p\}$
    (iv) $CG_o = CG_i \cup \{q\}$

The notion of a set of Discourse Commitments – one set for each interlocutor, plus a set for the discourse – originated in Gunlogson (2001) as a way of dealing with speaker bias. Her observation was that rising declaratives like *That's a persimmon?* seem to be questions, and thus denote sets of propositions, but nevertheless reflect a bias on behalf of the speaker. Gunlogson modeled Discourse Commitment sets in terms of interlocutors' beliefs, and characterized the public set as those propositions "mutually recognized as committed to them."

Rett (2019) proposes to differentiate illocutionary not-at-issue content from descriptive not-at-issue content by treating it using a distinct component of the Farkas & Bruce model, the speaker's Discourse Commitment ('DC') set.[2] Essentially, she argues that DC sets are the best way of modeling sincerity conditions, i.e. the commitment implicit in the utterance of a declarative sentence with content p that the

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[1]   This declarative operator is amended from the one in Farkas & Bruce (2010) to reflect a formal change in the nature of the DC set, as specified in footnote 2.

[2]   Formally, this change is as in (i).

(i)   **Flavored Discourse Commitments**
      Let DC_a be a set of pairs representing the public commitments of a with respect to a discourse in which a and b are the participants, where:

      a. $\langle \mathsf{believes}, p \rangle$ is a public commitment of a iff 'a believes p' is a mutual belief of a and b;
      b. $\langle \mathsf{is\text{-}disappointed}, p \rangle$ is a public commitment of a iff 'a is disappointed that p' is a mutual belief of a and b; and
      c. $\langle \mathsf{is\text{-}surprised}, p \rangle$ is a public commitment of a iff 'a is surprised that p' is a mutual belief of a and b.

speaker believes that p. And since denying these sincerity conditions amounts to Moore's Paradox, it stands to reason that other content associated with Moore's Paradox should be similarly treated. To adapt Gunlogson's DC sets for mirativity and other emotive markers, Rett (2019) converts them from sets of propositions reflecting an interlocutor's beliefs to sets of ordered pairs of an emotive attitude (belief, surprise, disappointment) and a proposition.

The semantic contribution of a mirative marker is thus modeled in (22) and exemplified in (23).

(22)   MIR, for clauses C with content p: $\text{MIR}(C, a, K_i) = (C, a, K_o)$ such that
    (i) $DC_{a,o} = DC_{a,i} \cup \{\langle \text{is-surprised}, p \rangle\}$
    (ii) $T_o = push(\langle C; \{p\}\rangle, T_i)$

(23) $[\![\text{Keisha won the race!}]\!] = \mathbf{D}(\text{MIR}(S, a, K_i)) = K_o$ such that
    (i) $DC_{a,o} = DC_{a,i} \cup \{\langle \text{believes}, \text{Keisha won the race}\rangle\}$
    (ii) $T_o = push(\langle S; \text{Keisha won the race}\rangle, T_i)$
    (iii) $ps_o = ps_i \;\overline{\cup}\; \{\text{Keisha won the race}\}$
    (iv) $DC_{a,o} = DC_{a,i} \cup \{\langle \text{is-surprised}, \text{Keisha won the race}\rangle\}$

An utterance of the sentence exclamation in (23) – by virtue of the fact that it is uttered with declarative mood – modifies the speaker's DC set to include the information that the speaker believes p, i.e. that Keisha won the race (Step (i)). But by virtue of the fact that it contains a mirative marker, its utterance also modifies the speaker's DC (in Step (iv)) with the information that the speaker is surprised at p. Emotive markers interact scopally with at-issue and descriptive not-at-issue content via subsentential dynamic update; more details can be found in Rett (2019).

The main take-home message for the purpose of the present study is that mirative markers, like all emotive markers, encode NAI content, but it's qualitatively different than canonical, 'descriptive' NAI content: it operates at an illocutionary level. It's possible and arguably quite natural to model this illocutionary content in extant update semantic theory by treating it as restricting the speaker's set of Discourse Commitments (rather than the discourse's Common Ground). It's notable that this, like most semantic operations, is a categorical one, without much room for modeling gradient effects.

4. Prosodically marked mirativity

Now that we've reviewed the landscape of mirative-marking strategies and a general-purpose semantic treatment of mirativity, we turn to the heart of the present study, which is to answer the questions: What does prosodically marked mirativity look like in English? To what extent is it amenable to the compositional semantic treatment that seems appropriate for morphologically encoded mirativity? We will argue here that English exclamation intonation is multi-faceted, marking something like the illocutionary content modeled above as well as gradient secondary effects like surprise and emphasis.

4.1. Prosody: a brief overview

Previous work on the semantics of prosody has revealed that prosody can be used to mark illocutionary mood (Pierrehumbert, 1980; Jeong & Potts, 2016); orientation to the speaker or hearer (Gunlogson, 2001; Rudin, 2018); or other content like speaker uncertainty or incredulity (Hirschberg & Ward, 1992).

In English, utterances are associated with intonational contours, or tunes. Tunes are composed of one or more intermediate phrases, and intermediate phrases each have at least one pitch accent. Pitch is measured with respect to a speaker's fundamental frequency (f0), and pitch accents are composed of one or more pitch targets (either High or Low). In the MAE_ToBI annotation system for English (Beckman & Ayers Elam, 1997), the pitch target marked with a star is anchored to the stressed syllable.

Intermediate phrases are distinguishable in having their own pitch accent, their own phrase accent, and a moderate amount of final lengthening (i.e. more lengthening than a typical word boundary, but not as much as an Intonation Phrase break). The Intermediate Phrase is also the locus of (optional) pitch range reset, which resets the ceiling for high targets after a down step. We follow standard procedure in annotating these prosodic features in MAE_ToBI (Beckman & Ayers Elam, 1997), while noting that

MAE_ToBI has some limitations (e.g. it cannot mark some things, like the relative height of a speaker's high targets).

4.1.1. Pitch accents

The foundational unit of English intonation is the pitch accent. Pitch accents mark words as prominent in terms of both acoustics and information structure. Pitch accents associate with the stressed syllable of a word, and in the case of bitonal pitch accents, the pitch target denoted by the star aligns with the stressed syllable. American English has five phonological pitch accent types (Pierrehumbert, 1980), characterized in the MAE_ToBI system as H*, L*, L+H*, L*+H, and H+!H*. In what follows we'll observe that exclamations in English are, across the board, pronounced with L+H* pitch accents.

4.1.2. Intermediate phrases

Because it will prove to be central to our study of exclamation intonation, we will illustrate the notion of intermediate phrases by discussing a minimal pair that differs only in the number of intermediate phrases inserted. In (24), the question *Does the governor of Iowa endorse a radio program?* is pronounced with a single intermediate phrase. The head of this intermediate phrase is the pitch accent associated with the stressed syllable in *Iowa*, also known as the nuclear pitch accent. This pronunciation of the question is most natural in a context in which the Question Under Discussion (or topic) is 'Which governors endorse a radio program?'

(24)

f0 (Hz)	Does	the	governor	of	Iowa	endorse	a	radio	program
	H*		H*		L*				H-H%
	1	0		1	1	1	1 1	1	1
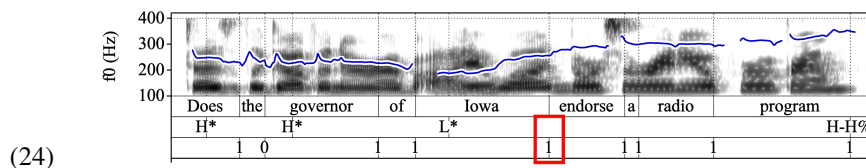
In contrast, the same question in (25) is pronounced with two intermediate phrases, one whose nuclear pitch accent is on the stressed syllable in *Iowa* and the other whose is on the stressed syllable in *radio*. The boundary between the two intermediate phrases, indicated by the number 3, involves a phrase accent (H-) and lengthening of the word *Iowa* as compared with its pronunciation in (24). This utterance of the question is most natural out of the blue, in a neutral context (Pierrehumbert & Hirschberg, 1990).

(25)

f0 (Hz)	Does	the	governor	of	Iowa	endorse	a	radio	program?
	H*		H*		L*	H-		L*		H-H%
	1	0		1 1		3	1 1		1	
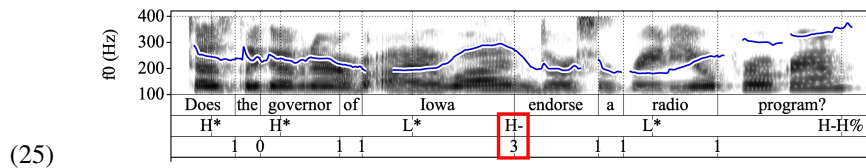
In what follows we'll observe that English exclamations – in contrast to their non-mirative counterparts – involve the insertion of additional intermediate phrases.

4.1.3. Tunes and illocutionary moods

Utterances vary in their canonical tunes – their combinations of pitch accents and boundary tones – and these canonical tunes have been associated with different illocutionary moods (see especially Pierrehumbert, 1980; Pierrehumbert & Hirschberg, 1990). Declarative sentences (e.g. *Miriam made the lemonade*) tend to have H* pitch accents followed by an L-L% falling boundary tone, while polar questions and rising declaratives (e.g. *Miriam made the lemonade?*) tend to have L* pitch accents with a final H-H% rise (Gunlogson, 2001). Confirmation questions and rising imperatives (e.g. *Make the lemonade now?*) tend to have H* pitch accents paired with an H-H% rising boundary tone.

Pitch accents are also associated with perlocutionary effects (Jeong & Potts, 2016). For instance, falling intonation has been associated with authoritativeness/assertion; level intonation with annoyance; and rising intonation with politeness/positivity (cf. hedging).

4.2. The prosody of English exclamations

There are four different exclamation types in English. Sentence exclamations, exemplified in (26-b), form a minimal pair with declarative sentences, differing only in their prosody.

(26) a. Keisha carves gorgeous sculptures.
      b. (Wow) Keisha carves gorgeous sculptures!   **sentence exclamation**

But there are subtypes of exclamation with non-declarative syntax; these are called exclamatives. (27-a), which exemplifies a *wh*-exclamative, involves movement of a *wh*-phrase that can range over degrees (but it does not include the subject-auxiliary inversion associated with English constituent questions). (27-b), which exemplifies an inversion exclamative, does involve subject-auxiliary inversion, but can only be formed with a strict subset of the English auxiliaries (Rett, 2016). (27-c), which exemplifies a nominal exclamative, consists of a morphologically complex definite DP. Rett (2009) argues that what these exclamatives have in common is that they denote degree properties.

(27) a. (Wow) What gorgeous sculptures Keisha carves!   ***wh*-exclamative**
      b. (Wow) Can Keisha carve gorgeous sculptures!   **inversion exclamative**
      c. (Wow) The gorgeous sculptures Keisha carves!   **nominal exclamative**

Following Rett (2011), we consider discourse particles like *wow* to be optional in these constructions; we will say more about their role in §4.2.4. Crucially, while at least two of the exclamative types (*wh*- and inversion) are superficially similar to question strategies in English, there are important syntactic differences between exclamations and questions (McCawley, 1973). Exclamatives additionally differ from rhetorical questions (e.g. *How cool is that?!*, as well, in their morphosyntactic restrictions (e.g. the presence/absence of subject-auxiliary inversion) and in their ability to cooccur with discourse particles like *wow*.

4.2.1. Elicitation

We undertook the present study to address the following questions: Are English exclamations marked with uniform prosody? If so, how are they marked? And how can we represent prosodically marked mirativity semantically?

Our elicitation involved two consultants: one male, one female. Our stimuli fell into eight conditions: 4 (construction type) x 2 (plus/minus the discourse particle *wow*). Each condition contained 32 items (256 total), and their distribution was between subjects, meaning each consultant saw only one instance of a given stimulus (either with or without a discourse particle, totalling 128 stimuli per subject). Two groups of stimuli are exemplified below.

(28) *You don't expect Julian to make beautiful paintings, but you find out he did. You tell Sara:*
      a. (Wow) Julian makes beautiful paintings!
      b. (Wow) What beautiful paintings Julian makes!
      c. (Wow) Does Julian make beautiful paintings!
      d. (Wow) The beautiful paintings Julian makes!

(29) *You don't expect Ariel's stories to cause confusion, but you find out they have. You tell Sara:*
      a. (Wow) Ariel's stories caused confusion!
      b. (Wow) What confusion Ariel's stories caused!
      c. (Wow) Did Ariel's stories cause confusion!
      d. (Wow) The confusion Ariel's stories caused!

Our fillers formed four conditions (also by construction type, intended to be minimal syntactic pairs for each exclamation construction type): declarative sentences; *wh*-questions; polar questions; and definite subjects or clefts. There were 32 fillers in each condition (128 total), and these were presented between subjects as well, meaning each consultant saw half of the fillers in each condition (totalling 64 fillers per subject). Two examples are below.

(30) a. Anna is good at chess.
      b. What is Anna good at?
      c. Is Anna good at chess?
      d. The game Anna is good at is chess.

(31) a. James is an expert at knitting.
      b. What is James an expert at?
      c. Is James an expert at knitting?
      d. The thing James is an expert at is knitting.

Consultants were instructed to read the sentences as they would naturally be uttered in an out-of-the-blue context. The recordings of their utterances were transcribed in Praat (Boersma & Weenink, 2020) using MAE_ToBI by one of the authors, and confirmed by another trained transcriber.

4.2.2. Elicitation results

Both consultants consistently: 1) pronounced exclamations with L+H* pitch accents; 2) pronounced exclamations with extra-high targets; and 3) inserted additional intermediate phrase boundaries. These characteristics differentiated the exclamations from their syntactically similar non-exclamation counterparts across construction type. We will address them in turn.

First, consultants pronounced exclamations with L+H* pitch accents. These results, broken down by consultant, are summarized in Tables 2 and 3. The second most frequent pitch accent type was H*. Some of those H* pitch accents occurred in utterance-initial position, where they are effectively neutralized with L+H* because there is no material to realize the L target before the stressed syllable.

	L+H*	H*	H+!H*	L*	L*+H
SE	.96	.04	–	–	–
WH	.85	.10	.05	–	–
INV	.94	.04	–	–	.02
NOM	.93	.03	–	.04	–
average	**.92**	**.05**	**.01**	**.01**	**<.01**

Table 2: proportion of items with L+H* pitch accents, **female**

	L+H*	H*	H+!H*	L*	L*+H
SE	1	–	–	–	–
WH	.96	.04	–	–	–
INV	1	–	–	–	–
NOM	.94	.06	–	–	–
average	**.98**	**.03**	**–**	**–**	**–**

Table 3: proportion of items with L+H* pitch accents, **male**

We analyzed a representative sample of filler items to compare the pitch accent type distribution.[3] We annotated six items in each of the four filler conditions for both of the speakers for a total of 48 items. The results are summarized in Tables 4 and 5. While both speakers still employ L+H* pitch accents in the filler conditions (29% for the female speaker; 24% for the male speaker), they are balanced by the notable presence of several other pitch accent types, particularly H*, L* and L*+H. The pitch accent distribution for both speakers is typical for each of the filler utterance types. Moreover, the fillers confirm that the near exclusive usage of L+H* in all four exclamative types is a unique feature of exclamation intonation.

Second, consultants pronounced exclamations with extra-high targets, as illustrated in Table 6. We identified a target as extra-high iff it exceeded the expected height for the position (e.g. after a downstep) and iff it exceeded the consultant's default pitch maximum by at least 5%. Consultants' default pitch

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[3] This representative sample was comprised of a random sample of items, but for each selected item, all four variations were analyzed.

	L+H*	H*	H+!H*	L*	L*+H
DEC	.40	.33	–	.20	.07
WHQ	.50	.33	.08	.08	–
POLQ	–	–	–	.625	.375
DEF	.30	.65	–	.04	–
average	**.29**	**.36**	**.02**	**.23**	**.11**

Table 4: pitch accent distribution in representative sample filler items, **female**

	L+H*	H*	H+!H*	L*	L*+H
DEC	.39	.61	–	–	–
WHQ	.31	.63	–	.06	–
POLQ	–	–	–	.87	.13
DEF	.24	.62	–	.14	–
average	**.24**	**.49**	**–**	**.24**	**.03**

Table 5: pitch accent distribution in representative sample filler items, **male**

ranges were calculated based on their production of filler items such as those in (30) and (31). The threshold for extra-high targets was 320 Hz for the female speaker and 250 Hz for the male speaker.

|	female	male
SE	.66	.91
WH	.81	1
INV	.41	.81
NOM	.75	.97

Table 6: proportion of items with at least one extra high target by speaker

In contrast, our male consultant didn't have any extra-high targets in any of his fillers. Our female consultant did have some; in our representative sample, she pronounced one-third of her fillers with one extra-high target (although none of her fillers had two). Her extra-high targets were concentrated in the definite filler condition (where five out of six in the representative sample had one extra-high target). While there is still a clear difference, even with our female consultant's data, in the distribution of extra-high targets between the exclamations and fillers, it's not clear to us what the possibly idiosyncratic distribution of extra-high targets in definite constructions signifies.

Finally, consultants inserted additional intermediate phrase boundaries in the exclamation stimuli (but not the fillers). These additional intermediate phrases, as discussed in Section 4.1.2, were characterized by additional mid-sentence pitch-range resets and additional nuclear pitch accents (NPAs) relative to fillers. The result was that more words in exclamations were more prominent than fillers.

Below are example utterances from each construction type condition. In the example of sentence exclamation in (32), every word with the exception of the verb is pitch accented with a L+H*. The first pitch accent on *Angelique* includes an extra-high target. In fact, the speaker placed two pitch accents on *Angelique*. This puts exclamations in similar prosodic territory to careful or emphatic speech styles in allowing words to receive more than one pitch accent. Note also in this example the presence of an intermediate phrase break after the verb (indicated on the Breaks tier with *3-*), which is identifiable due to the presence of a L- phrase accent as well as a pitch range reset. The pitch range reset, shown on the Tones tier with *%r*, is present based on the peak height of the L+H* target on *delicious* (258 Hz), which is higher than the previous H on the final syllable of *Angelique* (214 Hz).

(32)   sentence exclamation (no sentence particle):
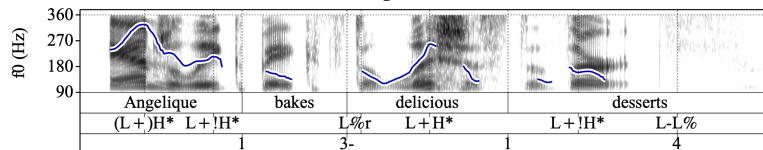
The *wh*-exclamative in (33) also includes a series of L+H* pitch accents. The pitch accents on *what* and *desserts* both involve extra-high targets.

(33)   *wh*-exclamative (no sentence particle):

	What	delicious	desserts	Angelique	bakes!
	L+H*	L+H*	L+ˆH*		L-L%
	1	1	1	1	4
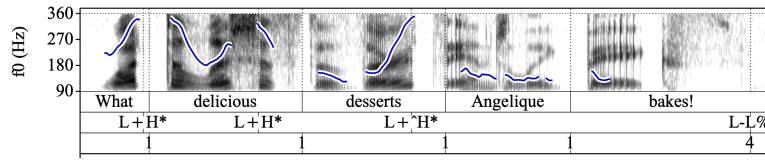
The inversion exclamative in (34) has a L+H* accent on every content word. This example also includes an extra-high target on the first syllable of *Angelique*, as well as an intermediate phrase boundary with pitch range reset after *bake*.

(34)   inversion exclamative (sentence particle):

	Wow,	does	Angelique	bake	delicious	desserts!
	L+H*	L-	L+H* L+!H*	L+!H*%r	L+H*	L+!H* L-L%
	3	1	1	1m	1	4
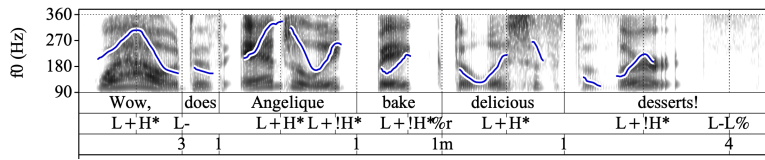
This utterance as well as the one in (35) exemplify the typical production of the particle *wow*. As we have seen is standard for exclamatives, the particle receives a L+H* pitch accent. Immediately following the particle is an intermediate phrase break with a L- pitch accent. Occasionally this boundary was strengthened to be an intonation phrase break with an L-L% boundary tone, but it was never realized a juncture smaller than an intermediate phrase break.

Finally, (35) is an example of a nominal exclamative. In this utterance, the pitch accent type is once again exclusively L+H*. *Delicious* is marked with an extra-high target and is immediately followed by an intermediate phrase break. In this case, however, there is no obvious pitch range reset, as the peak following the boundary is quite a bit lower than the one preceding it.

(35)   nominal exclamative (sentence particle):

|	Wow,	the	delicious	desserts	Angelique	bakes
	L+H* L-		L+ˆH* L-	L+!H*		L-L%
	3	1	3-	1	1	4
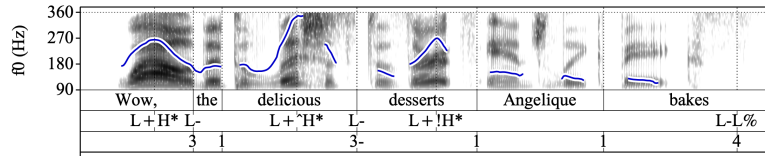
4.2.3. Nuances across construction type

These three prosodic properties are necessary but not sufficient for describing the intonational contour of the four constructions we're looking at. Each construction manifests all three properties, but they do so slightly differently, forming a unique tune. They differ in their macrorhythm (peak frequency), and in what types of words get marked as prominent.

We speculate that these differences arise because intonation is functioning to maximally differentiate each exclamation type from its non-exclamation counterpart (sentence exclamations vs. simple declaratives; *wh*-exclamatives vs. *wh*-questions; inversion exclamatives vs. *yes/no* questions; nominal exclamatives vs. topicalized definites). The intonational patterns of each member of the pairs are the complete opposite of one another in terms of acoustic salience, what is prominent, and macrorhythm. We will briefly illustrate these differences for the two *wh*-constructions and the two inversion constructions.

A standard *wh*-question is exemplified in (36). It has the same overall tune as a simple declarative sentence: H* L-L%. Crucially, in *wh*-questions, the *wh*-phrase is not prosodically prominent in English (Pierrehumbert, 1980), which is perhaps surprising given its discourse status as a topic.

(36) *wh*-question intonation

what	does	Greta	know	how	to		do	
		H*					L-L%	
1	1	1	1	0	1		4	
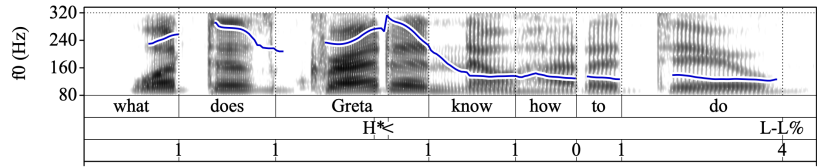
In contrast, (37) is a *wh*-exclamative. Its *wh*-phrase is highly prominent, marked with (L+)H* in 87.5% of our *wh*-exclamative stimuli. And its *wh*-phrase is also prominent by virtue of its being extra-high (in 62.5% of our *wh*-exclamative stimuli).
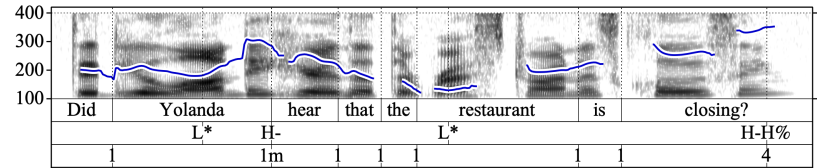
(37) *wh*-exclamative intonation

What	delicious	desserts	Angelique	bakes!	
L+H*	L+H*	L+^H*		L-L%	
1	1	1	1	4	
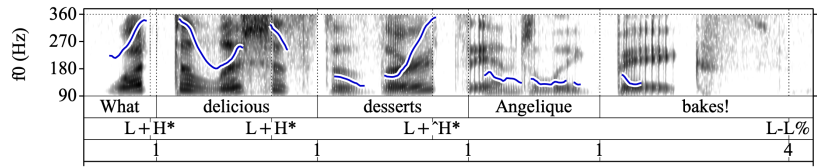
We conjecture, then, that this particular manifestation of exclamation intonation in *wh*-exclamations – their unique patterns of salience relative to other exclamation construction types – result at least in part from a drive to prosodically differentiate *wh*-exclamatives from their syntactic counterparts in a maximal way.

Similar contrasts between polar questions and inversion exclamatives also illustrate this broader point. A standard polar question is exemplified in (38). It has an L* H-H% canonical tune, and its pitch accents are relatively sparse, resulting in a slow macrorhythm frequency with few peaks and valleys.

(38) polar question intonation

Did	Yolanda	hear	that	the	restaurant	is	closing?
	L*	H-			L*		H-H%
1	1m	1	1		1	1	4

In contrast, in inversion exclamatives like (39), most content words are marked with their own L+H* pitch accent. This results in a markedly faster macrorhythm, with many peaks and valleys.

(39) inversion exclamative intonation

Wow,	does	Angelique	bake	delicious	desserts!	
L+H* L-		L+H* L+!H*	L+!H%r	L+H*	L+!H*	L-L%
3	1	1	1m	1	4	
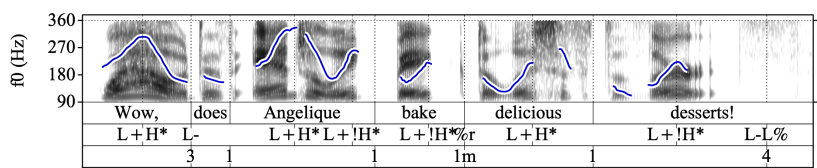
In sum, the results of the study, presented in Section 4.2.2, show that all four subtypes of exclamations exemplify the same three prosodic characteristics, which we are thus associating with mirativity marking: L+H* pitch accents; extra-high targets; and the insertion of additional intermediate phrases. But, at least superficially, the four subtypes of exclamation sound different: their tunes are differentiable prosodically. This is because each of the four constructions manifest the three prosodic characteristics slightly differently; we suggest that they do this with the goal of maximally differentiating themselves from their closest syntactic non-mirative counterpart.[4]

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[4] Another plausible suggestion for at least some of the varied manifestations across constructions comes from Heidi Harley (p.c.), who observed that the two constructions that involve movement – *wh*- and nominal exclamatives – both show highness on their moved element (the *wh*-phrase and definite nominal respectively). If mirativity were anchored to the left – residing high in the tree – and these movement processes were triggered somehow by mirativity

4.2.4. A note about discourse particles

Rett (2011) took for granted that discourse particles like *wow* are optional in exclamation; in particular, that the utterance of an exclamation without a discourse particle is still a) acceptable and b) understood as an exclamation. We used the data here to test that assumption.

Virtually all exclamations – in either the +*wow* or −*wow* condition – were pronounced with L+H* pitch accents; we know this because the overwhelming majority (averaging 95%, see Tables 2 and 3) of exclamations across all conditions were pronounced with L+H* pitch accents.

It seems likely that, if the presence or absence of a discourse particle did have an effect, it would be on the height of the targets, or on the number of extra-high targets in an exclamation. The data on extra-high targets, broken down by discourse particle condition for each speaker, are in Table 7.

	−*wow*	+*wow*
SE	. 78	.78
WH	.94	.88
INV	.69	.53
NOM	.78	.94

Table 7: proportion of items with at least one extra high target

These suggest that discourse particles make a complex contribution to the prosody of an exclamation. There is clearly no effect of *wow* on sentence exclamations. In *wh*-exclamatives and inversion exclamatives, the presence of *wow* suggests a decrease in the number of extra-high targets. But the direction of this effect is reversed for nominal exclamatives, which have more extra-high targets when *wow* is present.

Table 7 reflects the relative quantity of extra-high targets between these two conditions; we were also curious about the relative *height* of the extra-high targets between the conditions. To investigate we focused on the first peak (following the discourse particle, if present) in each item. The mean first peak heights are shown in Table 8.

	−*wow*	+*wow*
female	351.7	360.5
male	281.6	262.7

Table 8: mean first peak heights (Hz) in the presence or absence of discourse particle by speaker

The results are inconclusive; there was an effect of the discourse particle in the male speaker, with higher first peaks when *wow* is present ($p =.026$). No such effect was found, however, in the female speaker ($p > .1$). Further research, likely involving further elicitation from more speakers, is needed to better understand the possible effect of the discourse particle to the height of extra-high targets.

In sum, it seems clear that discourse particles like *wow* are indeed optional in exclamations, insofar as they do not effect the pitch accent with which the exclamation is pronounced. But discourse particles do appear to increase the number of extra-high targets in some exclamatives, and decrease them in another, so it is unclear whether they have a systematic effect on the quantity of extra-high targets in an exclamation. It is also unclear whether or not discourse particles affect the height of extra-high targets. There is clearly more work to be done in order to understand the exact nature of the interrelationship between exclamation intonation and the prosodic contribution of exclamation discourse particles.

4.3. Discussion

We've observed three different prosodic properties that seem to be consistently associated with exclamations in English across construction subtypes: L+H* pitch accent; extra-high targets; and additional intermediate phrases. The questions we take up in this discussion are how, if at all, these

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marking, we might expect the moved elements to bear the mirativity marking (in this case, the high tone). This insight is similar to the observations made in Repp & Seeliger (2020) for a subtype of German exclamatives.

properties should be semantically represented, and to what extent they're amenable to the treatment of mirativity and emotive markers presented in Section 3.2.

Of the three properties, only one – pitch accent – is independently associated with illocutionary content like mood (Pierrehumbert, 1980; Pierrehumbert & Hirschberg, 1990) or discourse commitment (Gunlogson, 2001). This makes the pitch accent an extremely attractive candidate for the semantic treatment Rett (2019) proposes for mirativity and other emotive marking. It has the additional virtue of being categorical; like morphological and syntactic strategies of mirativity marking, a construction either has or does not have an L+H* pitch accent. This makes its assimilation to these other strategies in a semantic account straightforward.

The other two properties – extra-high targets and additional intermediate phrases – are gradient, and we are aware of no independent construction in which they are associated with illocutionary content. These properties are additionally optional or at least variable in a way that the pitch accent selection is not. We suggest here that, while the L+H* pitch accent is the core, compositional mirativity marking in English exclamations, these other two characteristics bolster the mirative element of the utterance by virtue of their prosodic iconicity.

Specifically, L+H* pitch accents are likely semantically arbitrary: there are other ways, reviewed in Section 2.2, of marking mirativity cross-linguistically that do not involve L+H* pitch accents. And there are other uses of L+H*, even in English, that are not associated with mirativity (e.g. prosodic focus-marking; Pierrehumbert, 1980; Selkirk, 1995).

In contrast, extra-high targets are likely semantically non-arbitrary: they seem to do what they do to the interpretation of the utterance by virtue of their prosodic properties. It seems plausible to us that all mirative constructions, regardless of the type of mirative strategy they involve, involve extra-high targets, although much more research needs to be done on this issue.[5] We are aware of little work on extra-high targets in English outside of exclamation intonation, but they have been noted to be a hallmark of child-directed speech (Song et al., 2010) and are arguably also a property of sergeant imperatives like *Attention!*.

The final prosodic property, additional intermediate phrases, also seems at least plausibly semantically non-arbitrary (although it is unclear for this property, as well, whether it occurs with other mirative strategies). But extra boundary insertion is a hallmark of focus marking in English (Pierrehumbert, 1980) and other languages (Royer & Jun, 2019), so it is an open question whether this means extra boundary insertion is arbitrary, or whether mirativity and focus share a semantic property for which extra boundary insertion is a non-arbitrary marker.

We also note that all three of these prosodic properties are conspiring to achieve maximal acoustic prominence. The L+H* pitch accent is the most acoustically salient pitch accent in the English inventory (Ayers, 1996), since the low pitch immediately preceding the high target facilitates an acoustic contrast for the high target on the stressed syllable. The extra-high target further expands the salience of the peak, particularly in this position. Finally, recall that the final pitch accent in an intermediate phrase is the nuclear pitch accent, which has privileged status as the most prominent pitch accent of the intermediate phrase. As such, inserting more intermediate phrase boundaries elevates more pitch accents to nuclear status. We see the selection of these prosodic features for exclamation intonation as potentially non-arbitrary, a natural output of the phonologization of the mirative sememe in English.

5. Conclusion

Mirativity is the implicit marking of unexpectedness or surprise on the part of the speaker. Cross-linguistically, it is encoded independently; with other meaning (in 'mixed-expression miratives'); or polysemously (in 'dependent miratives'). It is encoded morphologically, syntactically, or prosodically, depending on the language. Left open here is a discussion of cross-linguistic typology: which languages use prosody to mark mirativity? Is there a correlation with languages that use prosody for focus-

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[5] Recall that our female consultant – in contrast to our male consultant – pronounced some fillers with one extra-high target, and that these EHTs were concentrated in the definite filler condition. We are in the process of expanding this study to include more consultants to test the extent to which these extra-high targets are systematic or the result of idiosyncratic stylization.

marking?[6]

Given this wide variation of strategies, we need a semantic account of mirativity that can treat this sememe across strategy types. In particular, we need a semantic account that can treat prosody as one of the 'parts' in the 'parts and whole' notion of semantic compositionality. In terms of the formalism, Rett (2019) argues that mirativity is not part of the descriptive content of an utterance, either at the at-issue or not-at-issue level. And diagnostics confirm some notable differences between the semantic behavior of mirativity (and other emotive markers) on the one hand and descriptive not-at-issue markers (e.g. evidential adverbs) on the other. We follow Rett (2019) in modeling these differences in a dynamic context-based framework that characterizes descriptive content as updating the Common Ground, and illocutionary content – like mirativity – as updating a speaker's Discourse Commitments (see Table 1).

In the prosody study reported here, we found that all types of exclamations in English have three common prosodic properties: L+H* pitch accents; extra-high targets; and additional intermediate phrase boundaries. There is a clear role for the L+H* pitch accent in exclamations: there's independent evidence that pitch accents operate at the illocutionary level (Gunlogson, 2001; Jeong & Potts, 2016), which is how mirativity is characterized in Rett (2019).

But there's a question of what to do with the other prosodic components of mirativity marking in English. It's tempting to think that there's something non-arbitrary about the use of extra-high targets and additional targets to signify surprise or unexpectedness. And the fact that these properties are gradient and super-tonal suggests that they are not necessary components of mirativity marking, i.e. that they add some gradient expression to the core semantic property of mirativity encoded in the pitch accent.

There are several ways to test the hypothesis that the L+H* pitch accent is the core marker of mirativity in English exclamations, while the extra-high targets and additional intermediate phrases are secondary expressive components that bolster the mirative meaning. We're currently running a naturalness rating task to see how important the super-tonal properties are for things like perceived degree of speaker surprise, sincerity, etc. The stimuli for that study are drawn in part from the present elicitation and involve trained MAE_ToBI consultants pronouncing the annotation of the stimuli without the super-tonal properties.

Finally, as we addressed in the discussion, the question of which of these components should be represented compositionally and which are iconic, or semantically non-arbitrary, requires a great deal more of cross-linguistic study. In particular, it would be interesting to see the extent to which the super-tonal properties of extra-high targets and additional boundaries are present in other mirative constructions crosslinguistically, especially those whose mirative markers are non-prosodic. If this is the case, then it suggests that our analysis of the L+H* pitch accent as the mirative marker in English is on the right track.

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[6] Mirativity is focus-sensitive; the meaning of an utterance like *Wow, Keisha brought the peach cobbler!* changes quite substantially based on whether *Keisha* or *peach cobbler* is focus-marked. Since prosodically-marked mirativity requires prominence, and since it's hard to raise pitch on clitics, we might thereby expect that languages that use prosody to mark mirativity also use it for focus. Thanks to Henry Davis (p.c.) for this intriguing suggestion.

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