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► **To cite this version:**

Jonathan Ginzburg, Chiara Mazzocconi, Ye Tian. Laughter as language. *Glossa: a journal of general linguistics* (2021-..), 2020, 5 (1), 10.5334/gjgl.1152 . hal-03878559

HAL Id: hal-03878559

<https://hal.science/hal-03878559v1>

Submitted on 29 Nov 2022

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RESEARCH

Laughter as language

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Understanding the import of laughter, has interested philosophers and literary scholars for millennia and, more recently, psychologists, biologists, neuroscientists, and linguists. However, the assumption has been that laughter lacks meaning akin to what words and phrases possess and that it does not contribute to the compositional construction of meaning. In this paper, we argue that, in fact, laughter (and other non-verbal social signals like smiling, sighing, frowning) has propositional content—it involves reference to external real world events, has stand alone meanings, and participates in semantic and pragmatic processes like repair, implicature, and irony. We show how to develop a formal semantic and pragmatic account of laughter embedded in a general theory of conversational interaction and emotional reasoning and show how to explain the wide, indeed in principle unbounded range of uses laughter exhibits. We show how our account can be extended to other non-verbal social signals like smiling, sighing, eye rolling, and frowning. Should laughter and its ilk be incorporated in the grammar? We suggest that they probably should be, *if one assumes a conversationally-oriented view of grammar*. But various open issues remain.

Keywords: laughter; dialogue; semantics; multimodal communication; non-verbal social signals; emotion and dialogue

1 Introduction

Understanding the import of laughter, has interested philosophers and literary scholars for millennia (e.g., (Plato 375BC?; Aristotle 340BC?; Hobbes 1651; Kant 1790; Stendhal 2005; Bergson 1901)). More recently, the group of interested researchers has widened considerably to include psychologists, biologists, neuroscientists, and linguists. Smiling and laughter are of much interest to biologists (Gervais & Wilson 2005) and to neuroscientists (Szameitat et al. 2010; Lavan et al. 2015) since, in contrast to verbal signals, there is significant evidence for continuity with apes (Vettin & Todt 2005; Ross et al. 2010) and these emerge at a far earlier stage than verbal signals with infants (Sroufe & Wunsch 1972; Nwokah et al. 1994).

The phonetic and affective aspects of laughter have been studied for some time (Bachorowski et al. 2001; Kohler 2008; Szameitat et al. 2009; Trouvain & Truong 2017). Laughter has also been studied within Conversation Analysis (CA) since the late 1970s and, as we discuss in our literature review in section 2, CA is the source for many insights about where laughter can occur, its elicitation, and the need at times to avoid responding using laughter. Within research on formal grammar laughter has typically been excluded as *paralinguistic*, going back to a typology proposed by Trager (1961)—for some discussion in the context of computational speech science see (Schuller et al. 2013). Trager's approach was insightfully criticized already by Crystal (1971), but the assumption has been generally that laughter lacks meaning akin to what words and phrases possess and

that it does not contribute to the compositional construction of meaning. This assumption, arguably, goes back at least to Immanuel Kant,¹ though has usually been implicit.²

In this paper we argue that, in fact, laughter (and more generally non-verbal social signals like smiling, sighing, and frowning briefly discussed in section 6) have propositional content, following earlier related views by (Plessner 1970; Wierzbicka 2000; Bavelas & Chovil 2000):³ in section 3 we show that they involve reference to external real world events, like event anaphors and in contradistinction to bodily signals like sneezing and hiccuping. They have stand alone meanings and participate in semantic and pragmatic processes like repair, implicature, and irony.

In section 4 we show how to develop a formal semantic and pragmatic account of laughter embedded in a general theory of conversational interaction. This novel view of laughter enables us to derive from first principles previous insights concerning laughter, including those from Conversation Analysis and those emanating from linguists working on humour, who have studied the notion of incongruity that seems key in explicating important aspects of the meaning of laughter. Moreover, we will show that our account can explain a wide, arguably unbounded range of uses laughter seems to exhibit (Mazzocconi et al. 2020) by positing a small number of meanings and deriving the uses by dialogical and domain-based reasoning.

We will show that many of the semantic/pragmatic properties of laughter can be captured in a straightforward fashion with an existing formal approach to dialogue semantics/pragmatics, namely the framework KoS (Ginzburg 2012), though this involves adopting independently motivated assumptions about the nature of input to semantics/pragmatics that are not assumed in most other semantic/pragmatic frameworks. At the same time, as we discuss in section 5, in order to capture certain additional features of laughter one has to integrate emotional reasoning into semantics/pragmatics, building on existing work in cognitive psychology and artificial intelligence (Russell 2003; Scherer 2009; Marsella et al. 2010; Barrett 2017; Sander et al. 2018).

All this will raise the issue of whether laughter (and other non-verbal social signals) are signals that should be incorporated in the grammar. As we discuss in section 7, one cannot answer such a question **definitively**, given the divergence of existing views of the nature of grammar. We will, nonetheless, point to criteria and views of grammar within which an affirmative answer seems plausible. This leads to a view of grammar which ties into a much earlier stage of communication with infants and to a partial continuity with apes, hence is obviously highly consequential.

¹ “[]music and that which excites laughter are two different kinds of play with aesthetical Ideas, or with representations of the Understanding through which ultimately nothing is thought... Thus we recognise pretty clearly that the animation in both cases is merely bodily, although it is excited by Ideas of the mind; and that the feeling of health produced by a motion of the intestines corresponding to the play in question makes up that whole gratification of a gay party, which is regarded as so refined and so spiritual.” (Kant 1790: §54, 3rd par.), Thanks to Bianca Cepollaro (p.c.) for pointing out to us the significance of the final passage, though she is not responsible for our potential overinterpretation.

² From CA researchers in a recent important collection of work on laughter: “It is not linguistic but it accompanies language use, often intertwined with speech, shaped by and shaping speech sounds.” (Intro to (Glenn & Holt 2013: 1)); “Although laughter lacks semantic or linguistic content, variations in its production contribute to its communicative value.” (Glenn & Holt 2013: 6); “Laughter does not have propositional content—it cannot be unpacked into a set of discrete words or phrases; rather it is something that is treated as accompanying talk or even as “flooding out” in response to “humor”.” (Hepburn & Varney 2013: p. 25). See also (Fitch 2016): “The very notion of ‘reference’ is heavily laden with assumptions that are questionable even for human language, inapplicable to other human communicative systems (e.g., music or laughter), and inappropriate for primate communication.”

³ Of these only Plessner is primarily concerned with laughter. Both Wierzbicka and Bavelas and Chovil’s work relates mainly to facial gestures, as we discuss in section 6.

2 Laughter: early and recent history

The study of laughter has a long history going back more than two millennia.⁴ Since the lion's share of this work was not carried out by linguists, it is important to mention at the outset one important qualification that has emerged in recent work by phoneticians, namely that rather than speaking of laughter *per se*, one should rather speak of **laughers** (Trouvain & Truong 2017). At least some of the past disagreements concerning the import of laughter can potentially be ascribed to a failure to distinguish among the distinct behaviours for which English has at least ten words.⁵ We will below point to one dimension in particular, **arousal**, that affects the use potential of distinct laughers.

In both Jewish (biblical) and Ancient Greek work there is evidence for two effects laughter can achieve:

- **expressing disbelief/sowing doubt:** God tells Abraham at age 99 that he and his aged wife Sarah will have a son,⁶ Abraham, out of foolish disbelief, fell on his face and laughed. (Genesis 17:17).
- **expressing mockery, ridicule:** when a group of boys laughed at the prophet Elisha for being bald, he cursed them in the name of the Lord: and two she-bears came out of the woods and mauled forty-two of the boys (Kings 2: 23–24); for Plato laughter is intrinsically associated with ridicule of the other and is, therefore, non-ethical (Morreall 2008). This view of laughter is reiterated by Hobbes: laughter as “sudden glory”, triumph from recognition of superiority over some other target. (Hobbes, 1651)

Two additional aspects related to meaning emerge in 18th and 19th century philosophy and in 20th century psychology. First, the association of laughter with *incongruity*, originating in a systematic way with Beattie (1779), who defends in some detail the thesis that “Laughter seems to arise from the view of things incongruous united in the same assemblage.” (Beattie 1779: 344 et seq). This view became influential via Kant (1a) and Schopenhauer (1b):

- (1) a. Laughter arises out of the sudden transformation of a strained expectation into nothing, or, in other words, its reduction to absurdity ... a parallelism between body and mind: the body's convulsions reflect its sympathy with the mind's jostling. (Kant, Critique of Judgment, <https://oll.libertyfund.org/titles/kant-the-critique-of-judgement>, §54)
- b. Laughter originates in every instance from nothing other than perceived incongruity between a concept and the real objects that had been thought through it... and is itself only the expression of this incongruity, a reflex reaction to mental stimuli. (Schopenhauer, The World as Will and Representation, https://archive.org/stream/theworldaswillan01schouoft/theworldaswillan01schouoft_djvu.txt, p.76)

A final aspect/effect of laughter we mention is psychological and has been articulated in various, not necessarily compatible forms. Freud (1905) suggests that certain events create sexual/aggressive energy; when the tension is undone dramatically, energy is released and the result is laughter. Relatedly, laughter has been viewed as indexing an increase in

⁴ For insightful surveys concerning this history, see in particular (Morreall 2008; 2020).

⁵ Trouvain & Truong (2017) offer the following list, for which they credit John Laver. Of these, the first nine seem to solely denote laughter-like activity: *giggle, cackle, guffaw, chuckle, chortle, snicker, titter, bray, horse-laugh, howl, hoot, choke, bleat, bellow, mock, groan, and neigh*. Trouvain & Truong 2017: 460.

⁶ The son was named Yicxaq (Eng. Isaac), literally ‘will laugh’.

pleasure (for speaker)—‘Laughter results from a pleasant psychological shift.’ (Morreall 1983: p.39) Conversely, laughter has been argued to be an attempt at positively affecting the pleasure of the interlocutors, via laughter’s acoustic properties in themselves or by conditioning through experience (Bachorowski et al. 2001).

These views of the import/effect of laughter have often been viewed as contradictory or competing. They are, if viewed as *the* import of laughter. We agree, however, with Raskin (1985) that if one considers them as pertaining to distinct aspects of the communicative situation where laughter might arise, no contradiction need arise. Instead, what emerges is the challenge of specifying a theory that can deliver certain of the requisite imports as inferences under certain conditions from others that one might posit as the basic/primary imports/contents. We will eventually show how to deduce:

- irony/disbelief from incongruity (section 4)
- superiority from pleasure (section 5)

Before we explain why we postulate incongruity and pleasure as basic and independent meanings for laughter, we turn first to consider the two most developed *linguistic* approaches relating, respectively, to humour and the effects of laughter on the sequential organization of conversation.

2.1 Humour theories

Raskin (1985) develops a theory, the *Semantic-Script Theory of Humor*, (SSTH), a theory of *humour competence* whose intended coverage is primarily short verbal jokes.

Ideally, a linguistic theory of humor should determine and formulate the necessary and sufficient linguistic conditions for the text to be funny (Raskin 1985), p.47).

The main theoretical innovation one finds in (Raskin 1985) is an attempt to explicate textual incongruity formally:⁷

- (2) The SSTH Main Hypothesis:
- (i) The text is compatible, fully or in part, with two distinct scripts;
 - (ii) The two distinct scripts are *opposite* in a special predefined sense. ((4) in Raskin 1992))

Scripts were introduced by Schank & Abelson (1977) and can be explicated in various ways (Raskin 2017); the same applies to *opposite*. We will make a proposal of our own as regards incongruity, one that refines (2). The theoretical apparatus for explicating jokes in subsequent theories such as the General Theory of Verbal Humor (Attardo & Raskin 1991; 2017) is significantly more complex.⁸ However, (2) remains a key notion. This approach ties incongruity to the general theory of scripts, viewed as embedded in ontology construction (Raskin 2017); this might have seemed idiosyncratic when it appeared in the 1980s, but currently is closely related to frames (Fillmore 1985; Löbner 2015) and to semantics as ontology construction (cf. situation semantics (Barwise & Perry 1983; Ginzburg 2011)).

⁷ For reasons discussed in (Attardo & Raskin 2017), Raskin originally denied that this was an explication of incongruity. But in (Attardo & Raskin 2017) he apparently accepts this characterisation originally argued for by Attardo.

⁸ For other approaches see e.g., (Oring 2011; Ritchie 2018).

Nonetheless, work on humour theory exemplified by SSTH and the GTVH has different aims from ours: our aim is to explicate the possibilities of laughter occurrence in conversation, in particular the relation between laughter events and *laughables*, the triggers or objects of laughter (more on which see sections 2.2 and 3.). In contrast, the avowed quarry of humour theorists is characterizing *humour competence*. (3) taken from the corpus collected for (Priego-Valverde et al. 2018) exemplifies how laughter can emerge without the laughable *per se* having any incongruous aspect. In this case the laughable is the utterance “this morning’s semantics class”, which is an answer to the question “What would you like to speak about?”. Nothing in this question/answer sequence is incongruous relative to any script or other related notion encoding domain knowledge; the laughter arises from some implicit shared knowledge about the denoted event. Minimally, this means that a theory of laughter needs to involve contextual resolution of implicit aspects of laughables.^{9,10}

- (3) PC: t’aimerais parler de quoi?
 PC: would-like-2P-SG speak of what
 PC: what would you like to speak about
 MA: du
 MA: Of
 MA: About
 PC: <smile> du cours </smile> <laugh> de sémantique de ce matin </laugh>
 PC: <smile> of-DEF class </smile> <laugh> of semantics of this morning </laugh>
 About this morning’s semantics class
 (Priego-Valverde et al. 2018)

However, a more significant point, exemplified copiously below, is that much laughter in conversation is not related to jokes or witticisms; indeed, various corpus studies reveal a high percentage of speaker laughter which lacks the surprise element key to jokes (Provine & Yong 1991; Vettin & Todt 2004).

2.2 Conversation Analysis and laughter

Gail Jefferson initiated work within Conversation Analysis on laughter (e.g., (Jefferson et al. 1977; Jefferson 1979)). A crucial assumption that Jefferson makes is to treat laughter as a possible response in the range of responses an utterance generates. This is an assumption we adopt in the sequel. Specifically, Jefferson takes a strategic view of laughter, viewing it as a social activity that a speaker can invite others to join in, one which occurs frequently with material which has no humorous aspect as such. This is exemplified here by (4a). These are instances of *antiphonal* laughter, “responsive laughter” whereby the responder shares the initial laugher’s assessment of the situation. Jefferson also points out cases such as (4b), where laughter is not responded to with laughter, though the responder addresses the direct issue raised.

- (4) a. Roger: you are what dey refer to in rougher circles as a chickn shit.
 Roger: hhhhehh
 Ken: heh:heh:heh (example (18) in (Jefferson 1979))

⁹ *Resolution* is a potentially ambiguous term here since it also has a use referring to *resolution of incongruity*, which for some researchers is a crucial component of humour. We do not use *resolution* in this latter sense in the paper.

¹⁰ We use the notation <laugh> ... </laugh> <smile> ... </smile> to indicate spans of speech laughter and smiled speech respectively.

- b. Bee: So the next class hhh!hh fer an hour and fifteen minutes I watched his ha:nds hh hh hhh
 Ava: What's the matter with him?
 Bee: hh t hhh he keh he doesn't haff uh full use uff hiss hha fingers
 (example (12) in (Jefferson 1979))

Capturing these contrasting options is clearly a requirement for any theory of laughter in conversation, as is the need for distinguishing laughter potential in 2-person and multi-party conversation, in light of observations by Glenn (2003). Another notion arising from (Glenn 2003) is the notion of *laughable*: *laughter marks its referent as laughable and potentially funny*. This is a key starting point for any semantic theory of laughter. Work in CA has documented the use of laughter in a variety of non-humorous settings: medical (Haakana 1999) (where doctors often avoid responding to a patient's laughter with laughter), job interview situations (Glenn 2013) (see example (20a) below), political interviews (Romaniuk 2013), where politicians use laughter to deflect questions, exemplified here in (5), which is further discussed in section 4.

- (5) David Gregory; interviewing Chuck Schumer:
 DG: (1) Is Sarah Palin the future of the Republican party?
 CS: (2) .hh hh = W(h)well(h)heh heh heh .hhuh, I guess I shouldn't judge and let them f(h)ight among themselves. £ hnh [hehhheh
 DG: [What do you think though. =
 CS: = .h[h
 DG: [D'you think she's qualified to be President? (Extract 1 in (Romaniuk 2013))

Conversation Analysis work on laughter has, as we have seen, led to many important insights. As Glenn & Holt (2013) explain CA associates laughables as “referents” for laughter but, as with CA work in other domains,¹¹ explicitly assumes no semantics beyond this (repeated from footnote 2): “... Although laughter lacks semantic or linguistic content, variations in its production contribute to its communicative value.” (Glenn & Holt 2013: 6); indeed in their survey, Glenn and Holt point out how CA work recognizes a variety of effects laughter can produce, while offering a careful description of these uses and the positions in which they occur:

- (6) a. (same turn) a tension between what we say, how this could be interpreted by others and what we mean (Adelswärd 1989)
 b. in terminal position can modulate a (potentially or incipient) disaffiliative action (Shaw et al. 2013)
 c. as a “post-completion stance marker” (Ticca 2013)
 d. adjust the seriousness of its referent e.g., (Holt 2013)
 (Glenn & Holt 2013: p. 6).

But in the absence of anything more than a “referential semantics” in terms of laughables these remain an essentially arbitrary list of effects. Moreover, since CA avoids any explicit means of representing *emotion*, in saying that laughter can serve as a stance marker, it has no way to distinguish laughter in such cases from verbal post-completion stance markers

¹¹ See e.g., discussion of repair in (Ginzburg & Kolliakou 2018) and the remarks distinguishing the aims of CA from those of cognitive theories by Albert & De Ruiter (2018).

such as *yea* and *mmh*; (see concrete discussion of such cases in section 3.6 below.). Nor can one capture the non-translatibility of laughter potential (see below section 4.3.3).

3 Laughter as content bearing and interacting with verbal content

3.1 Laughter and external events

The view of laughter we develop assumes that laughter is *ambiguous* and in many cases has *propositional content* that arises from an *eventive source*. Starting with the last point, we wish to emphasize a certain similarity in behaviour with eventive anaphors, here exemplified by demonstrative NPs. Both can take as antecedents exophoric antecedents (see (7)), the event described by the preceding utterance (see (8)), an event occurring utterance medially—e.g., a sub-utterance or co-speech gesture (see (9)), and, finally, an event described cumulatively (Asher 1993) (see (10)):

- (7) a. (Context: loud bang is heard) A: what was *that*?
 b. ((Context: loud bang is heard): man slips over banana peel) A: laughs
- (8) a. A: He's coming home at 1am. B: I don't like *that*.
 b. A: Maeve these days drives a pink Cadillac. B: (laughs)
- (9) a. A: And I hate (makes strange gesture) *that* movement.
 b. A: He's her (laughs) friend.
- (10) a. A: He left, she arrived late, the plants were unwatered, the dog got ill. B: I didn't know about *that*.
 b. A: He left, she arrived late, the plants were unwatered, the dog got ill. B: (laughs)

Each of the events predicated about in (7)–(10) are what we refer to subsequently as the *laughable*, a notion introduced in a related if not identical sense in the CA literature (see section 2). This laughable *l*, we suggest, is a constituent of laughter content, which informally can be either (11a) or (11b). We leave both incongruity and pleasure unexplicated for now until sections 4 (for incongruity) and 5 (for pleasantness).¹²

- (11) a. Incongruous (I,E) ('I is incongruous relative to assumption E.')
- b. Pleasant (I,A) ('I is pleasant for A the laugher.')

Indeed already the data (7)–(10) provides us with the means to distinguish laughter from unintentional bodily sound productions like sneezing and hiccuping. With respect to e.g., (7)–(8), if C enters and sees B laughing, she could pose the question in (12a). B's response indicates that the laughter is directed at certain events she has perceived (visually, aurally, or via touch, as with tickling) with her laughter being used to express her view that this is, say, incongruous or pleasant—the difference here is immaterial; this contrasts clearly with (12b,c), where the trigger is bodily:¹³

¹² This division of labour was first proposed, to our knowledge, by (Ginzburg et al. 2015). We build directly on their explication of incongruity in section 4.

¹³ Of course, tickling has a bodily aspect as well. But is not a mere reflex—the tickled person must not view the tickler as threatening, nor can one self-tickle (Provine 1993; Gervais & Wilson 2005). We will not have much to say about tickle-based laughter here, the neural circuitry which has been an object of some studies—see e.g., Szameitat et al. 2010). Nonetheless, given the background conditions for it to come about, it arguably falls within our description of incongruity laughter.

- (12) a. C: Why are you laughing? (i) B: Look how that guy slipped! (ii) Mike just told me about Maeve's pink Cadillac.
 b. (A sneezes) B: Why are you sneezing? A: Too much pepper in the salad / I think I caught a cold.
 c. (A hiccups) B: Why are you hiccuping? A: It happens to me often / I must have eaten too fast.

One could be tempted also to say that there is a contrast in (12) in that sneezing and hiccuping are *involuntary*. However, while some cases of external–event–directed laughter seem to be as voluntary (say in the sense of “consciously planned signals”) as verbal speech, and while in some neuroscience studies of laughter under experimental conditions in a laboratory, a distinction has been drawn between genuine, “involuntary” and fake, “planned” laughter (Wild et al. 2003; McGettigan et al. 2013), this is far harder to assess for laughter in spontaneous conversation (Wierzbicka 2000; Gervais & Wilson 2005).

Nonetheless, while this dimension is significant pragmatically, we do not take it to be qualitatively more significant than it is for verbal utterances. Indeed one can find similar, “involuntary” occurrences with the latter, in other words verbal utterances that take place without the speaker's (full) “conscious control”—apologies, as in (13a), exclamations (13b), or “errors” such as making an utterance in the “wrong” language (13c):

- (13) a. (A and B bump into each other while they enter a train) A,B: Sorry!
 b. (A drops chalk near blackboard in full hearing of students): Shit!
 c. (A after flying from France to Glasgow, hands passport to border control official, who returns it after brief examination): Merci, oh I mean thanks.

At the same time, the two main imports communicated by laughter—however packaged—incongruity and pleasure are both susceptible to occur “spontaneously” and “reflectively”. Thus, when someone laughs at a joke, an instance of an incongruity, we are likely to consider whether the laugh is “genuine/spontaneous” or “fake/forced”. A child laughing wildly while playing with a toy is an example that would obviously be viewed as spontaneous pleasure, as would a mutually flirtatious couple (Fuchs & Rathcke 2018), though in the latter case the issue of “genuine/spontaneous” or “fake/voluntary” is certainly one that can arise.

Given that interlocutors are aware of the possibility that laughter can be “spontaneous” or not, this is an important pragmatic issue that potentially arises in any context when non-spontaneity is associated with lack of sincerity.¹⁴ This, then, actually ties laughter (and smiling, frowning, crying etc) to verbally expressed speech acts, for which an analogous sincerity issue arises frequently, as much emphasized by Austin (1962); Searle (1969).

With some initial notion of what laughter content consists of, we now turn to data illustrating further motivation to posit such content, its interaction with verbal content, and the ambiguity of laughter.

3.2 Laughter: stand alone uses

One additional piece of evidence for the claim that laughter has propositional content is that it can be used as a stand-alone utterance whose content incorporates content from the immediate context and such that changes in the linguistic context lead to different contents for a laugh: it can convey—we will suggest in section 4 via pragmatic inference—a

¹⁴ There are plenty of contexts where “non-spontaneity” is *not* associated with lack of sincerity, for instance intra-utterance laughter which conveys scare quotation, discussed in section 3.3.

negative response to a polar question, as in (14a)¹⁵ or disbelief in the previously uttered assertion, as in (14b), based on an advertisement from the Paris metro, the biblical (14c), and (14d); (14e,f), taken from newspaper reports on parliamentary debates, offer essentially such a paraphrase verbatim:

- (14) a. (Context: Bayern München goalkeeper Manuel Neuer faces the press after his team's (*Dreierkette*) defense has proved highly problematic in the game just played (3-2 against Paderborn).)

Journalist: (smile): Dreierkette auch 'ne Option? (*Is the three-in-the-back also an option?*) Manuel Neuer: fuh fuh fuh (brief laugh) ∼ The three-in-the-back is not an option! (audio: <https://tinyurl.com/yxhh7pvf>)

- b. A: I will take care of your savings. B: (laughs)
 ∼ I don't think you will take care of my savings!



- c. God: You will at age 99 with your aged wife Sarah have a son. Abraham: laughs. ∼ I don't think I will at age 99 have a son ...
- d. Theresa May: They will know we built them a better Britain. B: (laughs) ∼ that's a ridiculous claim (I don't believe that they will know we built them a better Britain) (<https://www.youtube.com/watch?v=HxN1STgQXW8> at about 2:25.)
- e. "While I was agreeing the future of Nato with President Trump, he was joining a protest march against him," she said, inadvertently *prompting loud laughter from MPs at the idea that her talks with Trump had secured the future of Nato* (emphasis added—authors) <https://www.mirror.co.uk/news/politics/mps-openly-laugh-theresa-boasts-12941471>
- f. She has listened very carefully to what has been said, she says. *That triggers loud laughter.* (emphasis added—authors)
 There is broad support for many aspects of the deal, she says. *That triggers more laughter.* (emphasis added—authors) (The Guardian, Dec 10, 2018)

¹⁵ Ein Lachen kann sehr unterschiedliche Bedeutungen haben. Es kann herzlich sein, aber auch höhnisch. Als Manuel Neuer nach dem zittrigen 3:2-Sieg des FC Bayern gegen Paderborn lachte, lautete die klare Botschaft: nein. Es war sozusagen ein verneinendes Lachen. <https://www.sueddeutsche.de/sport/bayern-paderborn-neuer-flick-1.4811661> A laugh can have very different meanings. It can be warm, but also derisive. When Manuel Neuer laughed after FC Bayern's shaky 3-2 win over Paderborn, the clear message was: no. It was a negative laugh, so to speak.

As expected from a signal bearing propositional content, laughter can have a force that may be disputed in conversation, as illustrated in (15):¹⁶ in (15a) the audience laughter indicates that they view the speaker's claim as non-serious; the lecturer's retort disputes this reaction (though in a somewhat double-edged way, transferring the belief in the claim he appeared to be making to General MacArthur); in (15b) Unknown disputes Danny's laugh and the funniness it putatively ascribes to someone being tied to a railway track:¹⁷

- (15) a. Lecturer: so the Korean war started and the United Nations' forces were commanded by one General Douglas MacArthur, General Douglas MacArthur, in case you don't know, won the second world war single handedly
Audience: (laugh)
Lecturer: er (laugh) it's not funny, he believed it! (BNC)
- b. Unknown: They they put him on the rail, they tied him to the railway track so he'd get run over by a train but I don't think he did.
Danny: <laugh>
Unknown: It's not funny. It's bloody disgusting. (BNC KPA, 2880-2883)

3.3 Meaning-affecting placement

Just as with other meaning-bearing linguistic elements, varying the placement of laughter can vary the content—this applies to other non-verbal social signals such as smiles, sighs, eyebrow raising, sniffles (see (Krahmer et al. 2002) for eyebrow raising and focus.). Here we point to the effect achievable by low arousal laughter *within an utterance*. This

¹⁶ We emphasize that the possibility of disputing its force is a necessary condition of having propositional content; whether it is a sufficient condition is more complex because it is not always clear when a communicative dispute arises what exactly is being disputed, as many debates concerning presuppositions and non-at-issue meaning reveal. In clear cut cases like sneezing and burping one can question the cause, as discussed above, but not the intention, but it is difficult to deny the point of the act or its target, in contrast to laughter:

- (i) (A sneezes/burps) # That doesn't warrant sneezing/burping about.
(ii) That doesn't warrant laughing about.

An anonymous reviewer for *Glossa* brings up the example of screaming:

- (iii) (A screams in horror at sudden appearance of black bat) B: Why are you screaming? It's a blackbird.

However, screaming is far from being a clear cut case of an action that lacks propositional content. It can clearly occur non-volitionally, though as we have already discussed above, this applies to a variety of verbal utterances as well. On the other hand, screaming can be perfectly volitional, allowing the screamer to express their fear or alarm concerning some event and in this respect allows for a similar reaction as (ii) above:

- (iv) (A screaming, followed by) Help! They're stealing my laptop!/My arm is stuck in the door!
(v) That doesn't warrant screaming (?about).

¹⁷ These examples use *funny* as a means of "lexifying" incongruity. And in line with the finding that humour appreciation is the commonest use of laughter in conversation (Mazzocconi et al. 2020), this seems to be the most frequent word used therefor. But other words such as *weird* or *unusual* are possible, as exemplified in (i,ii):

- (i) Cherrilyn: a mongey [sic], a mongrel! <laugh> Fiona: Oh weird! (BNC, KBL 4121-4122)
(ii) Anon 2: The auctioneer came to me, Oh I suppose you'll want to borrow some money now. I said, No thank you. I said, Everything's all arranged. <laugh> Anon 1: Was that er would that have been considered unusual to have had the money to pay that amount in those days? (BNC, HF3, 386-389)

enables such laughter to serve as a scare-quoting device (Predelli 2003): in (16a(i)) the term *long term friend* is presented as a euphemism, whereas in (16a(ii)) it is the term *friend* which is at issue; (16b) exemplifies an analogous effect where in (i) the issue is what is to be pressed, whereas in (ii) it is what entity the red object is; similar remarks apply to (16c), which involves a sigh rather than a laugh:¹⁸

- (16) a. (i) A: Jill is John's, (laugh) long-term friend. (ii) A: She is John's long-term (laugh) friend.
 b. (i) A: You need to press on the (laugh) red button. (ii) A: You need to press on the red (laugh) button.
 c. A: They said (sigh) Jill needs to leave. (ii) A: They said Jill needs to (sigh) leave.

3.4 Laughter and conversational implicature

At least some of the implicatures that have been the focus of much work in pragmatics since (Grice 1989) and whose origin (grammar or intentional reasoning) is currently a source of much debate (e.g., (Chierchia 2006; Geurts & van Tiel 2013)) can be triggered as a result of laughter and smiling. In (17a) a quantity implicature arises by exploiting a <laughter, smile> scale,¹⁹ whereas in (17b) a relevance implicature arises, presumably on the basis that a laugh in such a context—unless it is seen to be a nervous laugh—expresses pleasure at the news communicated by A, which is inappropriate:

- (17) a. A: (Tells joke.) B: (Smiles politely, but does not laugh.) (Quantity) implicature: joke not very funny.
 b. Child: And my sister's hamster died. Uncle: (laughs/smiles) A (to herself): This guy cares about nothing. (relevance implicature)

3.5 Irony

As we saw when discussing scare quotation, laughter can be used to *mark* irony—to indicate that an utterance is meant to deviate from its literal meaning. By the same token, irony can affect laughter, smiling, or crying: in all cases, there is a composition of a basic meaning of the non-verbal signal with a meaning roughly paraphrasable as 'I don't really mean this'. Mouthing "ha ha" as a reaction to a joke or humourously intended comment conveys that the speaker does not actually find the joke funny or the comment humorous, as in (18a,b); similar comments *mutatis mutandis* apply to smiling, crying and sighing, as in (18c,d,e):

¹⁸ We emphasize that the laughter needs to be *low* arousal; high arousal laughter in such a case will, it seems, be either infelicitous or viewed as relating to an entirely distinct laughable:

(i) Jill is John's, (high arousal laugh) long-term friend.

¹⁹ A similar, though weaker effect will be achieved by low arousal laughter—the desired laughter is *high* arousal. An anonymous reviewer for *Glossa* suggests that this could equally be viewed as a manner implicature, given that smiling is less ostentatious than laughter. It is unclear whether such an explanation could extend to the differing effect of a smile or a frown reaction to a joke, where the latter reaction will lead to greater disappointment for the joke teller, though the two signals seem to be, more or less, comparable in terms of their facial "power".

- (18) a. A: Tells joke. B: Ha ha.
 b. MR. WHITE: You talked to Nice Guy Eddie? Why the fuck didn't you say that in the first place? MR. BLONDE: You didn't ask. MR. WHITE: Hardy-fuckin-har. (From the film *Reservoir Dogs*.)

- c. Wes Brown smiles as he is mistakenly sent off. (The Independent, 28.02.2015)



- d. A: And we were only give two macaroons each. B: (Mock cries).
 e. Mock sighing C: [Well do] you wanna grab me a beer?
 P: tsk (h::) ..Guess.
 C: Please?
 P: (hx::).
 C: ... Watch out for the lasagna. (Example (7) in (Hoey 2014))

3.6 Laughter ambiguity: a non-incongruous force

The data we have seen hitherto all involve laughter that communicates an essentially “disruptive” or “negative” force—used to communicate irony, scare quotation, question unworthiness etc. We will unify these within one meaning *incongruity laughter*. However, not all laughter has such a force. There is a significant class of “positive”, affiliative, empathetic laughters, which we will unify as *pleasant* (a notion we introduced earlier and is explicated in detail in section 5.). In his novel *The Book of Laughter and Forgetting* Kundera (1996) explicitly suggests the existence of two forces laughter can have, which correspond quite closely with the opposition we propose to make here.²⁰

(19) exemplifies such an empathetic laughter, where there is no incongruity to associate with the laughable, the pleasing prospect of Fred's holiday:

- (19) Example from a conversation at a bar (BNC, KDP)†
 Richard: Right, thanks Fred. You're on holiday after today?; Fred: mh mh (affirmative);
 Richard: Lovely. <laughter/>

(20) seems to function as an acknowledgement; the laugh is a more effective means than a simple, verbal acknowledgement; a verbal acknowledgement (e.g., *Right* or *Yeah*) would involve explicitly agreeing with a compliment and could be perceived as arrogant; Empa-

²⁰ Things deprived suddenly of their supposed meaning, of the place assigned to them in the so-called order of things ... In origin, laughter is thus of the devil's domain. The first time an angel heard the devil's laughter, he was dumbfounded. He knew that he must react swiftly somehow, ... he aped his adversary. Opening his mouth, he emitted broken, spasmodic sounds in the higher reaches of his vocal range but giving them an opposite meaning: whereas the devil's laughter denoted the absurdity of things, the angel on the contrary meant to rejoice over how well ordered, wisely conceived, good, and meaningful everything here below was. Kundera 1996: 86–7.

thetic or affiliative laughter conveys pleasure of sharing the situation with the speaker and, only indirectly (by a mechanism elucidated in section 5) acts as agreement:²¹

- (20) Interviewer: ... [cough] Right, [cough][cough] you seem to be pretty well qualified. John: I hope so (laugh) yes (laugh) (BNC, JNV)

Laughter can occur simultaneously with speech, both in cases of *speech laughter*, where a speaker speaks and laughs simultaneously (Kohler 2008), and where one interlocutor is speaking and the other is laughing. Is this an aspect that distinguishes speech from laughter?²² A detailed answer would need to consider and compare in a detailed way overlapping in speech and laughter, which we cannot do here. Nonetheless, at least qualitatively, one can offer a negative answer in that verbal acknowledgements/back channels, akin to but distinct in effect to empathetic laughs, can certainly occur simultaneously with speech by another interlocutor, particularly during a long turn by the latter (e.g., where the latter is a lecturer responding to questions in an academic setting.). This applies equally to other proposition-denoting gestures such as (negation-conveying) head shaking (Kendon 2002) and head nodding (Wagner et al. 2014), as well as their non-sentential analogues *yes* and *no*.

4 Adding laughter to dialogue interaction

In section 3 we offered various arguments as to why laughter should be assigned *propositional content*. We showed it participates in various semantic and pragmatic processes. Thus, it can be used to reverse the force of or dispute an assertion and to dismiss the seriousness of a question; its placement affects its content, which can be ambiguous and give rise to clarification requests; it can trigger conversational implicatures; it can be used ironically. We noted in passing that these features seem to apply more generally, to other facial gestures such as smiles and sighs and frowns, though we concentrate here on laughter.

Our task in this section is to develop a formal explanation as to how this content arises and how this gives rise to the various inferences associated with laughter that we saw above. A key claim we make is that by **assigning laughter a content predicating incongruity of a laughable we directly derive the basic laughter invites laughter characteristic argued for by Jefferson**. Since we are explicating laughter in dialogue we need an account of cognitive states and their evolution in dialogue; this we exposit in sections 4.1.1 and 4.1.2. We introduce basic notions concerning common sense reasoning in section 4.1.3 needed to explicate *incongruity*. A final component we will need are a means of representing *laughables* which is sufficiently fine-grained to capture the language-dependence of humour (see our discussion of a joke in section 4.3.3). We tie this in to the fine-grained representations needed for grounding and repair in dialogue, which we introduce in section 4.1.4.

4.1 Background on KoS and TTR

4.1.1 Cognitive states in dialogue

We formulate our account within the framework of KoS (Ginzburg 1994; Ginzburg & Cooper 2004; Larsson 2002; Purver 2006; Fernández 2006; Ginzburg & Fernández 2010;

²¹ In (20) there are two possible laughables, the interviewer's utterance and John's utterance 'I hope so'. Communicating incongruity about the former would be strange in an interview situation; similarly, it would be somewhat strange to do so about one's own utterance in this case ("It's funny for me to be saying 'I hope so' in this context.") One can equally observe that a hypothetical variant where John laughs without making any verbal utterance is still entirely felicitous and in such a case the incongruous possibility seems even less plausible.

²² We thank an anonymous reviewer for *Glossa* for raising this question.

Ginzburg 2012)).²³ KoS is a theory that combines an approach to semantics inspired by situation semantics and dynamic semantics with a view of interaction influenced by CA. On the approach developed in KoS, there is actually no single context — instead of a single context, analysis is formulated at a level of cognitive states, one per conversational participant. Each cognitive state consists of two ‘parts’, a private part and the dialogue gameboard that represents information that arises from publicized interactions.

The type definition—in a formal sense we will shortly elucidate— of a cognitive state is given in (21a). We focus on the public part—the dialogue gameboard, though will consider an aspect of the private part when discussing how to integrate emotion into the former. The structure of the dialogue gameboard is given in (21b) — the *spkr,addr* fields allow one to track turn ownership, *Facts* represents conversationally shared assumptions, *VisSit* keeps track of the visual situation including the focus of visual attention, *Pending* and *Moves* represent respectively moves that are in the process of being or have been grounded, *QUD* tracks the questions currently under discussion. Of these contextual parameters one, *VisSit*, is probably never entirely identical across participants since distinct interlocutors do not share the same pair of eyes, and moreover much of the time interlocutors have each other as their focus of attention. Nonetheless, there are various devices such as pointing or the verbal *Look!* to effect alignment. This point will apply later with renewed force when we extend the dialogue gameboard to incorporate emotion.

- (21) a. $\text{TotalCognitiveState} =_{\text{def}}$
- $$\left[\begin{array}{l} \text{dialoguegameboard} : \text{DGBtype} \\ \text{private} : \text{Private} \end{array} \right]$$
- b. $\text{DGBType (provisional definition)} =_{\text{def}}$
- $$\left[\begin{array}{l} \text{spkr} : \text{Ind} \\ \text{addr} : \text{Ind} \\ \text{utt-time} : \text{Time} \\ \text{c-utt} : \text{addressing}(\text{spkr}, \text{addr}, \text{utt-time}) \\ \text{Facts} : \text{Set}(\text{Proposition}) \\ \text{VisSit} : \left[\text{InAttention} : \text{Ind} \right] \\ \text{Pending} : \text{list}(\text{locutionary Proposition}) \\ \text{Moves} : \text{list}(\text{illocutionary Proposition}) \\ \text{QUD} : \text{poset}(\text{Question}) \end{array} \right]$$

To understand better the specification in (21), we offer a short discussion concerning the logical underpinnings of KoS. KoS is formulated within the framework of Type Theory with Records (TTR) (Cooper 2005; 2012; Cooper & Ginzburg 2015; Cooper 2020). TTR is a model-theoretic descendant of the by and large proof theoretic Martin-Löf Type Theory (Ranta 1994; Betarte & Tasistro 1998) and of situation semantics (Barwise & Perry 1983; Cooper & Poesio 1994; Seligman & Moss 1997; Ginzburg & Sag 2000). TTR enables one to develop a semantic ontology, including entities such as events, propositions, and questions, whence types characterizing questions and propositions, in (21). As we will see shortly, with the same means TTR enables the construction of a *grammatical* ontology con-

²³ KoS is a toponym – the name of an island in the Dodecanese archipelago – bearing a loose connection to *conversation-oriented semantics*.

sisting of utterance types and tokens and of an interactional domain in which agents utilize utterances to talk about the semantic universe. For current purposes, the key notions of TTR are the notion of a *judgement* and the notion of a *record*.

- **The typing judgement:** $a: T$ classifying an object a as being of type T . Examples are given in (22). (22a,b) involve *basic* “atomic” types IND (ividual) and TIME. In (22c) $\text{run}(\text{arg1}_{\text{IND}} = b, \text{arg2}_{\text{TIME}} = t)$ is a *p(redicate)-type*, that arises by assigning the entities b, t , respectively to the argument roles of *run*; arg1_{IND} requires its fillers to be *of type* IND, whereas $\text{arg2}_{\text{TIME}}$ requires its fillers to be *of type* TIME; we will usually notate such types as (22d). Ranta (1994) proposed that elements such as s in (22c) be viewed as events or situations.

- (22) a. $b: \text{IND}$
 b. $t: \text{TIME}$
 c. $s: \text{run}(\text{arg1}_{\text{IND}} = b, \text{arg2}_{\text{TIME}} = t)$
 d. $\text{run}(b, t)$

- **Records:** A record is a set of fields assigning entities to labels of the form (23a), partially ordered by a notion of *dependence* between the fields—dependent fields must follow fields on which their values depend. A concrete instance is exemplified in (23b). This is a record with four fields x , *e-time*, *e-loc*, and $c_{\text{temp-at-in}}$ to which are assigned respectively a number, a time, a location, and a situation *sit1*; the example is further discussed in (25). Records are used here to model events and states, including utterances, and dialogue gameboards.

- (23) a.
$$\left[\begin{array}{l} l_1 = \text{val}_1 \\ l_2 = \text{val}_2 \\ \dots \\ l_n = \text{val}_n \end{array} \right]$$
- b.
$$\left[\begin{array}{ll} x & = -28 \\ \text{e-time} & = 2\text{AM, Feb 17, 2019} \\ \text{e-loc} & = \text{Nome} \\ c_{\text{temp-at-in}} & = \text{sit1} \end{array} \right]$$

- **Record Types:** a record type is a record where each field represents a judgement rather than an assignment, as in (24a). The basic relationship between records and record types is that a record r is of type RT if each value in r assigned to a given label l_i satisfies the typing constraints imposed by RT on l_i . More precisely, as in (24b):

- (24) a.
$$\left[\begin{array}{l} l_1 : T_1 \\ l_2 : T_2 \\ \dots \\ l_n : T_n \end{array} \right]$$

b. The record

$$\left[\begin{array}{l} l_1 = a_1 \\ l_2 = a_2 \\ \dots \\ l_n = a_n \end{array} \right] \text{ is of type: } \left[\begin{array}{l} l_1 : T_1 \\ l_2 : T_2 \\ \dots \\ l_n : T_n \end{array} \right]$$

iff $a_1 : T_1, a_2 : T_2, \dots, a_n : T_n$

c. Type inclusion:²⁴ $T_1 \sqsubseteq T_2$ iff for all assignments to basic types it is the case that if $a:T_1$ then $a:T_2$

To exemplify this, (25a) is a possible type for (23b), assuming the conditions in (25b) hold. Record types are used to model utterance types (often referred to in formal grammar as *signs*) and to express rules of conversational interaction.

$$(25) \quad \text{a. } \left[\begin{array}{l} x \quad \quad \quad : \text{Ind} \\ \text{e-time} \quad \quad : \text{Time} \\ \text{e-loc} \quad \quad \quad : \text{Loc} \\ \text{c}_{temp-at-in} \quad : \text{temp_at_in}(\text{e-time}, \text{e-location}, x) \end{array} \right]$$

b. -28 : Ind; 2:00AM, Feb 17, 2019 : Time; Nome : Loc; sit1 : temp_at_in (2:00AM, Feb 17, 2019, Nome, -28)

4.1.2 Conversational rules

Contextual reasoning will be important here in several ways. First, we characterize dialogue regularities (e.g., A's assertion p gives rise to the possibility that B accepts p or alternatively that B initiates discussion of the question p ?) in terms of *conversational rules*, mappings between two cognitive states the *precondition(s)* and the *effects*. We will eventually suggest that laughter *inter alia* serves to signal that a more marked conversational option has been selected. Conversational rules can come in two flavours, rules that each interlocutor applies in the same way to their cognitive state (*participant neutral*) and rules that are specified only for particular interlocutors (*participant sensitive*). The latter kind of specification is, in principle, more general and is particularly important for an algorithmic perspective involving generation see e.g., (Larsson 2002; Cooper 2020). Most of the conversational rules we will specify will be participant neutral, as exemplified in the rules given in (26):

(26) a. Ask QUD-incrementation: given a question q and ASK (A,B,q) being the LatestMove, one can update QUD with q as MaxQUD.

$$\left[\begin{array}{l} \text{pre} \quad : \left[\begin{array}{l} q \quad \quad \quad : \text{Question} \\ \text{LatestMove} = \text{Ask}(\text{spkr}, \text{addr}, q) \quad : \text{IllocProp} \end{array} \right] \\ \text{effects} \quad : \left[\text{QUD} = \langle q, \text{pre.QUD} \rangle \quad : \text{poset}(\text{Question}) \right] \end{array} \right]$$

²⁴ For detailed discussion concerning systems of types and type assignments, see (Cooper 2012; 2020).

- b. QSPEC: this rule characterizes the contextual background of reactive queries and assertions—if q is MaxQUD, then subsequent to this either conversational participant may make a move constrained to be q -specific (i.e., either About or Influencing q).

$$\left[\begin{array}{l} \text{pre} \\ \text{effects} \end{array} : \left[\begin{array}{l} \text{QUD} = \langle q, Q \rangle : \text{poset}(\text{Question}) \\ \text{r} : \text{Question} \vee \text{Prop} \\ \text{R} : \text{IllocRel} \\ \text{LatestMove} = \text{R}(\text{spkr}, \text{addr}, \text{r}) : \text{IllocProp} \\ \text{c1} : \text{Qspecific}(\text{r}, q) \end{array} \right] \right]$$

- c. Assert QUD-incrementation: a straightforward analogue for assertion of (26a): given a proposition p and ASSERT (A,B,p) being the LatestMove, one can update QUD with $p?$ as MaxQUD.

$$\left[\begin{array}{l} \text{pre} \\ \text{effects} \end{array} : \left[\begin{array}{l} p : \text{Prop} \\ \text{LatestMove} = \text{Assert}(\text{spkr}, \text{addr}, p) : \text{IllocProp} \\ \text{QUD} = \langle p?, \text{pre.QUD} \rangle : \text{poset}(\text{Question}) \end{array} \right] \right]$$

- d. Accept move: specifies that the background for an acceptance move by B is an assertion by A and the effect is to modify LatestMove.

$$\left[\begin{array}{l} \text{pre} \\ \text{effects} \end{array} : \left[\begin{array}{l} \text{spkr} : \text{Ind} \\ \text{addr} : \text{Ind} \\ p : \text{Prop} \\ \text{LatestMove} = \text{Assert}(\text{spkr}, \text{addr}, p) : \text{IllocProp} \\ \text{QUD} = \langle p?, \text{pre.QUD} \rangle : \text{poset}(\text{Question}) \\ \text{spkr} = \text{pre.addr} : \text{Ind} \\ \text{addr} = \text{pre.spkr} : \text{Ind} \\ \text{LatestMove} = \text{Accept}(\text{spkr}, \text{addr}, p) : \text{IllocProp} \end{array} \right] \right]$$

- e. Fact Update/ QUD Downtdate: given an acceptance of p by B, p can be unioned into FACTS, whereas QUD is modified by the function NonResolve. NonResolve is a function that maps a partially ordered set of questions $\text{poset}(q)$ and a set of propositions P to a partially ordered set of questions $\text{poset}'(q)$ which is identical to $\text{poset}(q)$ modulo those questions in $\text{poset}(q)$ resolved by members of P .

$$\left[\begin{array}{l} \text{pre} \\ \text{effects} \end{array} : \left[\begin{array}{l} p : \text{Prop} \\ \text{LatestMove} = \text{Accept}(\text{spkr}, \text{addr}, p) : \text{IllocProp} \\ \text{QUD} = \langle p?, \text{pre.QUD} \rangle : \text{poset}(\text{Question}) \\ \text{FACTS} = \text{pre.FACTS} \cup \{p\} : \text{Set}(\text{Prop}) \\ \text{QUD} = \text{NonResolve}(\text{pre.QUD}, \text{FACTS}) : \text{poset}(\text{Question}) \end{array} \right] \right]$$

We exemplify a participant sensitive rule that relates to one of the most basic communicative interactions from infancy, namely visual attention directing, where A directs B to an object *o* (Lücking 2018). This is a visual situation update rule, analogous to the QUD and FACTS update rules above. The sole difference is that in this case B needs to modify her visual situation so that it includes *o* as the visual focus, whereas A must already have updated his visual situation to effect such an act. The notation we use for such rules is exemplified in (27a), where the rule applies to the dialogue gameboard of current addressee, with the obvious change in the case where it applies to the current speaker. (27b) provides the specification for visual situation update rule:

- (27) a.
$$\left[\begin{array}{l} \text{tcs} = \left[\begin{array}{l} \text{dgb} : \text{DGBType} \\ \text{private} : \text{Private} \end{array} \right] : \text{TCS} \\ \text{B} = \text{dgb.addr} : \text{IND} \\ \text{B.pre} = \text{T1} : \text{DGBType} \\ \text{B.effects} = \text{T2} : \text{DGBType} \end{array} \right]$$
- b. Visual situation update:
- $$\left[\begin{array}{l} \text{tcs} = \left[\begin{array}{l} \text{dgb} : \text{DGBType} \\ \text{private} : \text{Private} \end{array} \right] : \text{TCS} \\ \text{B} = \text{dgb.addr} : \text{IND} \\ \text{B.pre} : \left[\begin{array}{ll} \text{o} & : \text{Ind} \\ \text{LatestMove} = \text{DirectAttention}(\text{spkr}, \text{addr}, \text{o}) & : \text{IllocProp} \end{array} \right] \\ \text{B.effects} : \left[\text{VisSit.InAttention} = \text{o} : \text{Ind} \right] \end{array} \right]$$

We exemplify how certain of these rules work in (28), which involves discussion and disagreement at the illocutionary level. A poses a query, which via *Ask QUD-incrementation* updates Moves and via *QSPEC* licences B’s assertion, which in turn updates Moves via *Assertion QUD-incrementation*. A rejects B’s assertion, and then offers her own proposal, which B accepts. This licences acceptance, incrementation of FACTS and downdating of QUD via *Accept* and *Fact update/QUD downdate*, respectively:

- (28) a. A(1): Who’s a good candidate?
 B(2): Petra.
 A(3): (3a) No, (3b) Pauline is.
 B(4): OK.
- b.
- | Utt. | DGB Update (Conditions) | Rule |
|---------|---|------------------------|
| initial | MOVES = $\langle \rangle$
QUD = $\langle \rangle$
FACTS = cg1 | |
| 1 | LatestMove := Ask(A,B,q0)
QUD := $\langle q0 \rangle$ | Ask QUD-incrementation |

2	LatestMove := Assert(B,A,p1) (About (p1,q0)) QUD := <p1?,q0>	QSPEC Assert QUD-incrementation
3a	LatestMove := Assert(A,B, ¬ p1) (About (¬p1,p1?)) QUD := <¬p1?, p1?,q0>	QSPEC Assert QUD-incrementation
3b	LatestMove := Assert(A,B, p2) (About (¬p2,q0)) QUD := <p2?, ¬ p1?, p1?,q0>	QSPEC Assert QUD-incrementation
4	LatestMove := Accept(A,B, p2) QUD := <q0> FACTS := cg1 ∪ {p2} ∪ {¬p1}	Accept Fact update/QUD downdate

4.1.3 Topoi and enthymemes

Conversational reasoning is important here in part because one of the relata of incongruity is in some sense an inference rule that represents “congruity” (what is expected). To capture this we use the Aristotelian notions of *topos* and *enthymeme* introduced into TTR in work by Breitholtz and Cooper (Breitholtz & Cooper 2011; Breitholtz 2014). Topoi represent general inferential patterns (e.g., *given two routes choose the shortest one*). Enthymemes are the actual arguments conveyed in dialogue or other discourse which are drawing on topoi. In other words, they are applications of topoi in particular cases, e.g., *given that the route via Walnut street is shorter than the route via Alma, choose Walnut street*. We adopt the formalization of Breitholtz & Cooper (2011); Breitholtz (2014) in which topoi and enthymemes are functions from records (the context) to record types (the conclusion). (29) is a simplified illustration of the route choice topos, discussed in detail in (Breitholtz 2014).

$$(29) \quad \text{a. } \lambda r: \left[\begin{array}{l} x:Ind \\ y:Ind \\ c_{route}:route(x) \\ c_{route_1}:route(y) \\ c_{shorter_than}:shorter_than(x, y) \end{array} \right] \cdot [c_{choose}:choose(r.x)]$$

$$\text{b. } \lambda r: \left[\begin{array}{l} x=Walnut\ Street:Ind \\ y=Alma:Ind \\ c_{route}:route(x) \\ c_{route_1}:route(y) \\ c_{shorter_than}:shorter_than(x, y) \end{array} \right] \cdot [c_{choose}:choose(r.x)]$$

The basic relationship between enthymemes and topoi on this view is given in (30):

- (30) a. An enthymeme $E = \lambda e : D1 . R1(e)$ belongs to a topos $\tau = \lambda e : D.R(e)$ if:
 b. $D1 \sqsubseteq D$ (*the enthymeme’s domain is a subtype of the topos’s domain*), and
 c. for any, $e : D1$, $E(e) \sqsubseteq \tau(e)$ (*for any element e of the enthymeme’s domain, applying the enthymeme to e is a subtype of applying the topos to e*).

4.1.4 Propositions

The final logical notion we introduce is the situation semantics notion of an Austinian proposition (Barwise & Etchemendy 1987). Deriving from Austin’s theory of truth (a true

assertion involving a situation token matching a situation type), they were originally proposed to explicate assertions and relatedly beliefs. In TTR they are identified with records of the form (31a) whose truth conditions are defined in (31b):

- (31) a. $\left[\begin{array}{l} \text{sit} = s \\ \text{sit-type} = T \end{array} \right]$
 b. A proposition $p = \left[\begin{array}{l} \text{sit} = s_0 \\ \text{sit-type} = ST_0 \end{array} \right]$ is true iff $s_0 : ST_0$

Subsequently, such propositions have been used in modelling utterance processing (Ginzburg 2012). Ginzburg (2012) proposes that dialogue interaction is, to a large extent, structured by a series of branching points where an utterance is either grounded (Clark 1996) or gives rise to clarification interaction or repair.²⁵ Ginzburg (2012) shows that the specific conditions for grounding and possibilities for repair of an utterance u can be read off the *locutionary proposition* defined by u and a grammatical type T_u , intuitively the *sign* (in the Saussurean sense) associated with u . That the locutionary proposition involves the entire sign and not merely its semantic components is motivated, in part, by the fact that this enables the locutionary proposition to characterize the forms that are possible means to ground or request clarification about u and these exhibit significant syntactic and phonological parallelism with u (Ginzburg & Cooper 2004), as exemplified in (32b,c). (32d) exemplifies lexical entries we will posit below for laughter and its ilk. Here it is a somewhat simplified lexical entry for the particle *mmh* used to by B to acknowledge understanding of a prior utterance by A. It has fields for phonological and syntactic types, as well as for the *contextual parameters* of the utterance (DGB-PARAMS) needed to resolve the content of an utterance of *mmh* on a given use. In this case the contextual parameters are an utterance token and the conversational participants:

- (32) a. A locutionary proposition $\left[\begin{array}{l} \text{sit} = u_0 \\ \text{sit-type} = T_{u_0} \end{array} \right]$ is true iff $u_0 : T_{u_0}$, in other words iff the sign fully classifies the utterance; otherwise, repair interaction ensues.
 b. (i) A: Do you fear him? B: Fear? (= What do you mean by ‘fear’ or Are you asking if I *fear* him) / #Afraid?(ii) A: Are you afraid of him? B: Afraid? (= What do you mean by “afraid”? or Are you asking if I am **afraid** of him) / #Fear?
 c. A: She is an advocate. B: What do you mean an advocate/#an attorney?
 d. $\left[\begin{array}{l} \text{phon} : \text{mmh} \\ \text{syncat} : \textit{interjection} \\ \text{dgb-params} : \left[\begin{array}{l} \text{spkr} : \text{Ind} \\ \text{addr} : \text{Ind} \\ \text{u} : \text{sign} \\ \text{c1} : \text{address(addr,spkr,u)} \end{array} \right] \\ \text{cont} = \text{Acknowledge}(u,\text{spkr}) : \text{IllocProp} \end{array} \right]$

²⁵ We assume these two latter terms are synonymous, the former often used in the dialogue community, the latter among CA researchers.

4.2 A minimal theory of laughter: laughables and incongruity

We propose to view laughables as Austinian propositions, comprising the laughable event and its description, a record type. (33) offers some examples: in (33a) the laughable is simply a perceived event of a man slipping over a banana peel; in (33b) the laughable is the utterance by A ‘Bill is absurd’, whereas in (33c) the laughable is the utterance “friend”:²⁶

$$(33) \quad \text{a. exophoric: man slips over banana peel} \mapsto \left[\begin{array}{l} \text{sit} = 1 \\ \text{sit-type} = \left[\begin{array}{l} \text{x: Ind} \\ \text{c1: Man(x)} \\ \text{y: Ind} \\ \text{c2: b-peel(y)} \\ \text{c3: slip-over(x,y)} \end{array} \right] \end{array} \right]$$

$$\text{b. utterance: A: Bill is absurd.} \mapsto \left[\begin{array}{l} \text{sit} = 1 \\ \text{sit-type} = \left[\begin{array}{l} \text{x: Ind} \\ \text{c2: utter(x, "Bill is absurd")} \end{array} \right] \end{array} \right]$$

$$\text{c. utterance medial: A: He's her heh friend.} \mapsto \left[\begin{array}{l} \text{sit} = 1 \\ \text{sit-type} = \left[\begin{array}{l} \text{x: Ind} \\ \text{c2: utter(x, "friend")} \end{array} \right] \end{array} \right]$$

Like Raskin we think that *incongruity* needs to be explicated in terms of a *clash*. For Raskin the clash is between two objects (scripts) at the level of types. However, given that incongruity in conversation must apply to laughables (real world events), we refine slightly a proposal by (Ginzburg et al. 2015) to yield a view of incongruity as a clash between (an enthymeme triggered by) the laughable and a topos that represents ‘congruity’, i.e., the much more probable course of action.²⁷ That is, the laughable *l* satisfies the domain type of an enthymeme, but there is a clash between the range of this enthymeme and that of a topos which would license an enthymeme more expected in the circumstances. In (34), *p* is a proposition comprised of *l*, the laughable event, and *L* a type that classifies *l*, *E* is the triggered enthymeme, and τ

²⁶ An anonymous reviewer for *Glossa* asks in what way (33a) encodes incongruity. It does not: as will become clear shortly incongruity is a relative concept, where the additional parameter is a topos encoding “congruity” (roughly, a rule/norm that holds with fairly high probability.). Slipping on a banana peel is incongruous, arguably (there are various explications possible) because normally people are aware of what lies on the path on which they are treading; an alternative explanation derives from the fact that in walking people usually control their balance (hence slipping on mud or ice is equally viewed as ‘comical’ as a quick search through youtube will show.). Similar notions of incongruity can be invoked for bumping into a lamp post.

²⁷ The definition proposed by Ginzburg et al. (2015) had the enthymeme as an additional independent argument, whereas we abstract away from the latter, which seems somewhat more parsimonious. For some initial discussion of this issue as it relates to clarification questions about laughter, see (Mazzocconi et al. 2018).

is the clashing topos— E 's domain is a subtype of τ , but its range (L_1) is incompatible with τ 's range:

- (34) Incongruous (p, τ) iff for $p = \left[\begin{array}{l} \text{sit} = 1 \\ \text{sit-type} = L \end{array} \right] : \text{TrueProp}$, $\tau = \lambda r:T1(T2) :$
 (Rec \rightarrow RecType), there exists $E = \lambda r:L(L_1) : (\text{Rec}\rightarrow\text{RecType})$ such that $L \sqsubseteq T_1$ and $L_1 \perp T_2$

We exemplify this definition with several distinct types of effects we have seen before:

i. Irony marking of an assertion:

- (35) Lecturer: ... And then of course you've got Ronald Reagan ... and
 <laughter/> history ended with Ronald Reagan. (BNC, JSM)

This relies on the enthymeme “If A says that history ended with Ronald Reagan, then A means that in fact it did not.” This clashes with the sincerity topos “If A says p , then A means p ”. Hence it conveys the content in (36):

- (36) Content: Incongruous (laughable:Lecturer's utterance that history ended with Ronald Reagan, topos: If A says p , A intends p)

How does this arise in context? We do not offer here a precise account of topos resolution, but sketch a hypothesis based on markedness.²⁸ Whenever a declarative utterance is made by A which involves a proposition p there are (inter alia) two possible understandings available: A asserts p or A intends to convey a content incompatible with p . *A priori*, the former is far likelier, so a laugh can be viewed as a means of signalling the choice of the much less likely possibility.

ii. Query cancellation

- (37) David Gregory; interviewing Chuck Schumer:
 DG: (1) Is Sarah Palin the future of the Republican party?
 CS: (2) .hh hh = W(h)well(h)heh heh heh .hhuh, I guess I shouldn't judge and let them f(h)ight among themselves. (Romaniuk 2013)

How does laughing enable questions to be deflected? To answer this, we need an account of how questions can be deflected. We follow the one offered in (Ginzburg 2012).²⁹ On this view given that A poses q , for B not to address q , B has to accommodate the issue ?Wish(B,q) [*whether B wishes to discuss q*] into QUD and provide an utterance about this issue. This can lead to q being downdated from QUD.³⁰

In this case the deflection relies on the enthymeme *if DG posed the question whether Sarah Palin is the future of the Republican party, then CS will address the issue of whether CS wishes to discuss whether Sarah Palin is the future of the Republican party*. This conflicts with the topos associated with our earlier conversational rule QSPEC (*if A poses q , then either A or B utter a q -specific utterance.*).

²⁸ Formalizing this account requires a probabilistic conversational rule system, as for instance proposed by Lison (2015). We hope to do so in future work.

²⁹ See Chapter 8, § 8.3.1.

³⁰ The question was intended seriously by David Gregory, who repeated it when Chuck Schumer avoided answering it. In contrast, in the Manuel Neuer example (14a), the question was a somewhat jocular suggestion, the laughter can be viewed there as sharing the incongruity.

Hence CS's laugh conveys the content in (38):

- (38) Content: Incongruous (laughable: DG's utterance asking if Sarah Palin is the future of the Republican party, topos: if A poses q , then A/B utter a q -specific utterance)

As with irony marking, the laugh emerges as a signal for a *marked choice*: when a question is posed, addressing it is the unmarked choice.³¹

iii. Scare quotation

- (39) B: Are you interested in drama? A: well I I'm interested in it in a (pause) (laughs) ((comfortably)) re:laxed way, you know. (London Lund Corpus).³²

Here we have an interaction between laughter and self communication management.³³ Here the laughable is A's upcoming speech event u . The pause potentially indicates that A is not entirely sure how to express the next word or phrase. A chooses a particular sub-utterance but uses the laugh to signal that this choice deviates from the standard use of this phrase. In light of semantic work such as (Ginzburg et al. 2014) and psycholinguistic work such as (Lowder & Ferreira 2018), we assume that a hesitation by A means that the immediately subsequent utterance addresses the issue of *What does A mean to say after u_0 ?* The laugh in this case signals that A does not quite mean 'comfortably relaxed' as the utterance to follow "[in] a". The default, unmarked alternative would be for this utterance to represent exactly what A meant to say after "[in] a". This is the same mechanism as for irony marking of a statement, but applied to word/phrase choice, as a consequence of self communication management.

Hence (39) conveys the content in (40):

- (40) Content: Incongruous (laughable: A's utterance 'comfortably relaxed', topos: if A utters u , A means $\mu(u)$, u 's conventional meaning)

Note that different placements of a laugh within the same utterance type will result in potentially different contents being conveyed, given that which sub-utterance is the one in focus alters the issue raised and the scope of the scare quotation. Moreover, as with focus marking, the exact target of the scare quoting laughter is potentially ambiguous.

³¹ An anonymous reviewer for *Glossa* suggests that Schumer's response would have been marked even without the interpolated laughter particles since it does not provide a polar answer to a yes/no interrogative. An answer that does not provide a polar answer is less desirable clearly, but is not marked in the same way as refusal to address the question:

- (i) It's rather unlikely at this point.
 (ii) Only if she continues to bring in major donations to the party.

³² The example given here is simplified from the original.:

C: Paul you're are you interested in modern drama. I mean is it one of your things, it won't come round next year, but it'll come the year after. A: well I I'm interested in it in a (pause, laughs) comfortably relaxed way

³³ Also known as *self-repair* or *disfluency*.

- (41) A: well I I'm (pause) (laughs) interested in it in a comfortably relaxed way, you know. \mapsto Content: Incongruous (laughable: DG's utterance "interested", topos: if A utters u, A means $\mu(u)$, u's conventional meaning)

4.3 Incongruity laughter: a lexical entry

We can now offer a lexical entry for a laugh that expresses incongruity.^{34,35} This lexical entry indicates about the signal whose phonological type is *lphonotype*, on which more shortly, that given a context which supplies a laughable p and topos τ , the laugh has as content the proposition that p is incongruous relative to τ . Moreover, the laughable is incongruous to a contextually given degree δ , constrained by a relation whose other argument is the arousal encoded in the laughter's phonetics.

- (42) incongruous laughter

$$\left[\begin{array}{l} \text{phon} : \text{lphonotype} \\ \\ \text{dgb-params} : \left[\begin{array}{l} \text{spkr} : \text{Ind} \\ \text{addr} : \text{Ind} \\ \text{t} : \text{TIME} \\ \text{c1} : \text{addressing}(\text{spkr}, \text{addr}, \text{t}) \\ \delta : \text{Int} \\ \text{c2} : \text{Arousal}(\delta, \text{phon}) \\ \text{p} = \left[\begin{array}{l} \text{sit} = \text{I} \\ \text{sit-type} = \text{L} \end{array} \right] : \text{Prop} \\ \tau = \lambda r : (T1)T2 : (\text{Rec})\text{RecType} \\ \text{c2} : \text{SubType}(\text{L}, T1) \end{array} \right] \\ \\ \text{content} = \left[\begin{array}{l} \text{sit} = \text{s} \\ \text{sit-type} = \left[\text{c3} : \text{Incongr}(\text{p}, \delta, \tau) \right] \end{array} \right] : \text{Prop} \end{array} \right]$$

FIX FIX FIX!

A number of key aspects remain underspecified in this entry for reasons we explain now:

- **Form:** we have mentioned above that the arousal associated with a laugh is a significant parameter. First, it distinguishes different words for laughs: a snigger represents a low arousal laugh, whereas a cackle represents a high arousal laugh; second, a

³⁴ An anonymous reviewer for *Glossa* disagrees with our postulating lexical entries for laughter, indicating it to be "*prima facie* absurd, especially because then it might be argued that every intentional act type is in the lexicon." In fact, Harris (1968) and Postal (2004) (motivated in part by considerations of direct quotation), have argued that the lexicon (and the grammar by extension) needs to be an open system. Be that as it may when we say 'lexical entry' we mean types associating context, phonological types, and meanings and given that laughter can be described on all those levels, postulating lexical entries in this sense seems a perfectly fruitful and reasonable thing to do. Whether these lexical entries belong in a natural way along with "canonical" words is an issue we discuss in more detail in section 7.

³⁵ We emphasize throughout that laughter is a communicative signal. There is no dearth of evidence that laughter and smiling are significantly more common in social settings, though they can of course occur when an individual is alone (Devereux & Ginzburg 2001). The fact that laughter can occur when an individual is alone does not of course refute its social nature, just as the fact that people make word containing utterances in such situations does not devalue the social status of words. We believe that whatever account explicates such uses for words applies also to laughter. We thank two anonymous reviewers for *Glossa* for raising issues related to this.

high arousal laugh is inappropriate for intra-utterance scare quotation and for empathetic acknowledgement, whereas a low arousal laugh to a joke communicates a scalar implicature that the laugher does not find the joke particularly funny. Arousal is encoded by a number of parameters, including intensity, duration, and posture (Kousidis et al. 2015), but in the absence of a clear account, we will simply assume this as a scalar value readable off the phonetic representation of a laugh this value for current purposes we restrict to be H(igh arousal), M(edium arousal), and L(ow arousal). The phonological representation of a laugh is known to be subject to both large inter-subject and intra-subject variation (Urbain & Dutoit 2011), and so we leave that unanalyzed as a type lphonetype, which given what we said about arousal will have three subtypes: H, M and, L.³⁶ To the extent we need to specify laughs that have specific arousal profiles we can add restrictions on the arousal, exemplified in (43):³⁷

$$(43) \quad \begin{array}{l} \text{a.} \\ \text{b.} \end{array} \quad \left[\begin{array}{l} \delta : \mathbb{N} \\ c2 : \text{Arousal}(\delta, \textit{phon}) \\ c_{\textit{arousal}} : \delta \geq \text{Higharousal} \end{array} \right]$$

$$\left[\begin{array}{l} \delta : \mathbb{N} \\ c2 : \text{Arousal}(\delta, \textit{phon}) \\ c_{\textit{arousal}} : \delta \leq \text{Lowarousal} \end{array} \right]$$

- **Contextual parameters** Both the laughable and the topos that are the relata of the incongruity relation are specified here as contextual parameters to be resolved from information from the DGB. We have seen that laughables can originate from the content of the latest move made (examples (14), (37)), from the ongoing utterance (examples (16)), from the visual situation (example (7b)). These can be both anaphoric and cataphoric (for the latter: examples (16), (3)), so we defer attempting to formulate a precise theory of resolution to future work (see (Tian et al.2016) for some discussion of the placement of laughter relative to speech.). A similar point applies to the resolution of the topos—as we have illustrated above, resolutions can be topoi that are conversational rules, rules potentially applicable in the current context. While this is a common case, it is not invariably so, as example (3) above shows (“Today’s semantics class (laugh)’): in that case laughter is triggered by recollection of an event whose incongruity is not accessible in the current context, but is down to a common experience shared by the interlocutors.

4.3.1 Antiphonal laughter: sharing incongruous judgement

How to analyze the contribution of laughter in a dialogue? For now we show that merely assuming the propositional content in section 4.3, we can capture some basic patterns it manifests in dialogue pointed out by Jefferson, discussed in section 2. There is no need to postulate any special purpose conversational rules, though the framework would enable us to do so if necessary.³⁸

³⁶ Bachorowski et al. (2001) suggest that voiced laughter (“song”-like) is viewed more positively than unvoiced laughter (“snort”-like and “grunt”-like). Whether this distinction, deriving from a study under laboratory conditions, has semantic-pragmatic effects in interaction remains unstudied as far as we are aware.

³⁷ We make here the simplifying assumption of absolute thresholds for arousal, rather than relative ones in terms of average phonetic properties. For some discussion on arousal and valence see (Kuhbandner & Zehetleitner 2011). We return to this later in footnote 50.

³⁸ Such a rule would need to either postulate a distinct, non-propositional content or, say, to include the phonological form as an additional affective factor.

Armed with the lexical entry in the previous subsection, we can now consider the dialogue in (44a), for which we assume the laughable can be represented as in (44b). We view the sharing of the incongruity judgement concerning Roger’s statement, as akin to the sharing of a “normal” linguistically expressed proposition, as in (44c):

- (44) a. Roger: you are what dey refer to in rougher circles as a chickn shit.
 Roger: hhhhehh
 Ken: heh:heh:heh

b.
$$p0 = \left[\begin{array}{l} \text{sit} = 1 \\ \text{sit-type} = \left[\begin{array}{l} \text{x: Ind} \\ \text{y: Ind} \\ \text{c2: Assert(x,chicken-shit(y))} \end{array} \right] \end{array} \right]$$

- c. A: You are annoying. B: I *am* annoying / Yes!

Assume the laughter proposition has a similar force to a normal assertion. This yields a QUD update, as in step 4 below. This enables B to express the same proposition and share in incongruity classification of *l*:³⁹

Utt.	DGB Update (Conditions)	Rule
4	LatestMove := Assert (B,A,Incongruous (p0, e1, τ ₁)) QUD := <Incongruous(p0, τ ₁)?>	Assert QUD–incrementation Accept
5	LatestMove := Accept (A,B,Incongruous (p0, e1, τ ₁)) QUD := <> FACTS := cg1 ∪ { Incongruous(p0, e1, τ ₁)}	

4.3.2 Disputing laughter

Now consider (45a,b), the former repeated from example 14:

- (45) a. Unknown: They they put him on the rail, they tied him to the railway track so he’d get run over by a train but I don’t think he did.
 Danny: <laugh>
 Unknown: It’s not funny. It’s bloody disgusting. (BNC KPA, 2880-2883)
- b. Julie: That hurt me!
 Vicki: <laugh>
 Gary: Was that funny?
 Vicki: Ah, it was. (BNC KCU, 841-843)

In both cases the incongruity signalled by the laugh is not accepted by the person responding, in a way any proposition in dialogue can be rejected/doubted: by the conversational

³⁹ Whether the incongruity here is irony (‘I don’t really mean to say you’re a chicken shit.’) or of a more social nature (saying something crude to one’s interlocutor.), we will not try to resolve here.

rule QSPEC whenever $p?$ is MaxQUD, one can react with an utterance that makes $p?$ explicit or affirms the negation of p . So these dialogues evolve like the dialogue in (28) *mutatis mutandis*.⁴⁰

4.3.3 A simple joke

We conclude this section with the consideration of a fairly simple joke, to wit (46a). Our aim here is not to enter into various important details humour theorists consider about a jocular interaction, see e.g., (Attardo 2017; Ritchie 2018), rather it is to show how this can and should fit in continuously with “ordinary” dialogue processing.⁴¹ There are possible incongruities based on clashes with topoi such as (46b,c)—the addressee expects a profound answer and, moreover, is surprised by the very improbable mixing of English and German (and possibly both incongruities play a role.)

- (46) a. Joker: What, according to Freud, comes between fear and sex? fünf.
 b. If an utterance u has two possible classifications, one by far more probable, the speaker intends the latter.
 c. If speaker asks a deep question q , s/he expects a non-trivial answer.

A joke like (46) does not survive translation, as exemplified by the fact that translating it into French, as in, say, (47)— does not work (apart from as a metajoke among humour theorists):

- (47) Joker: Qu'est-ce qui se situe entre la peur et le sexe? # fünf/# cinq /#five.

This highlights the fact that humour, especially puns, does not always get preserved in translation. We think that this follows from a basic fact about dialogical processing that is tricky for semantic approaches in which context is characterized merely at the level of content (e.g., the QUD model of (Roberts 1996), SDRT (Asher & Lascarides 2003)).

Consider a variant of (46), the dialogue in (48a) and its French correlate in (48b).

- (48) a. A: What comes between vier and sechs?
 B: Fear?
 A: The German word.
 B: Ah.
 b. A: Qu'est-ce qui se situe entre la peur et le sexe?
 B: #Fear?

The straightforward reason for the contrast is that an utterance of /lapeur/ does not have the same clarificational potential as /fi:r/—reprise fragments such as “Fear?” and “la Peur?” have a requirement for phonological parallelism with their antecedent (see brief

⁴⁰ Utterances like “What’s so funny?” and “What are you laughing at?” function as *other repair* or *clarification requests*. For a corpus study of such uses and some analysis, see (Mazzocconi et al. 2018).

⁴¹ Joke telling constitutes a certain discourse genre/language game (or part of several types of genres such as Standup) some of whose characteristics are the following:

- the joke teller acquires the turn,
- s/he is not required to be talking about a real situation and,
- s/he is expected to provide a punch line at the end eliciting laughter.

Nonetheless, we believe that many if not most aspects of this, in particular the trigger for laughter, can be explicated using regular mechanisms of conversational semantics and pragmatics; for an initial account along those lines see (Maraev et al. (in preparation)).

discussion of (32b,c) above) (Ginzburg & Cooper 2004; Ginzburg 2012). On the view of context we adopt here, that of KoS, this is a direct consequence of the fact that MOVES and PENDING have locutionary propositions as their values. This works for explicating the clarificational potential of utterances, but also (with a dimension provided by common sense inference) their *incongruity potential*.

5 Emotion and laughter

In section 4 we showed how laughter can give rise to a variety of conversational effects, mostly via a use of laughter that imputes incongruity to a laughable. We had also earlier pointed to the need for a distinct laughter meaning given the need to capture uses of laughter that are “positive”, “agreeing”, “non-disruptive”, which we glossed as *Pleasant(l,A)* (*the laughable l is pleasant for laugher A*) in section 3, without further explication. In this section we offer some explication of this and more generally of emotive aspects of laughter—we need to capture the fact that, with some arguable exceptions, laughter is associated with pleasure experienced by the laugher and, potentially though certainly not invariably, the other interlocutors.

5.1 Cognitive and computational models of emotion

We will explicate pleasure in laughter by attempting to incorporate a cognitive theory of emotion into our dialogue theory. There are a variety of theories of emotion. Although important early work on facial gestures came from researchers espousing theories postulating a small number of *basic emotions* see e.g., (Ekman et al. 1987), there has been little evidence to support the existence of physiological characteristics that instances of a single emotion share but that other emotions do not (Scherer & Ellgring 2007; Barrett 2017). A variety of approaches have emerged that avoid such an assumption. We mention here two influential approaches, *emotion constructivism* and approaches based on *appraisal*; both provide useful means for classifying laughables, smileables, sighables etc and the emotional episodes they give rise to.⁴² Emotion constructivism e.g., (Russell 2003; Barrett 2017) views emotional episodes as arising from a categorisation process of the triggering event in terms of previous event “exemplars” on the basis of a resemblance in terms of certain dimensions. In the account of Russell (2003) these include *core affect* (a two dimensional matrix of (un)pleasantness and arousal), *affective quality*, and the object causally involved in the event. Appraisal approaches also view emotional episodes in terms of appraising events in relation to concerns. An initial automatic appraisal takes place that does not require conscious processing. This is followed by a secondary appraisal that often includes conscious reflection and that can lead to new intentions. As an example of such an approach consider the Component Process Model (CPM) of appraisal developed by Klaus Scherer (see e.g., (Scherer 2009)). On this view, appraisal of an event and its consequences can be structured on the basis of a number of criteria or *stimulus evaluation checks*, each of which has certain physiological correlates:⁴³

⁴² For discussion of the similarities and differences between these approaches, see (Brosch 2013; Barrett 2017; Sander et al. 2018).

⁴³ As we have mentioned above, the CPM does not assume the existence of a limited set of discrete emotions (“basic emotions”) or affect programmes as assumed in some other theories (Oatley & Johnson-Laird 2014), but considers the possibility of an unbounded number of different types of emotional episode. The nature of the emotional episode is exclusively determined by the pattern of appraisal results and the specific patterning over time driven by the recursively generated appraisal results. At the same time the CPM does recognize the existence of *modal emotions*—modal outcomes that occur more frequently due to event contingencies and psychobiological prewiring.

- (49)
- a. Does the event have consequences for my needs or goals? Physiological correlates include:⁴⁴ EEG alpha changes, modulation of the P3a in ERPs; heart rate deceleration, vasomotor contraction, increased skin conductance responses, pupillary dilatation, local muscle tonus changes ...
 - b. Is the event intrinsically pleasant or unpleasant, independently of my current motivational state? Physiological correlates: Pleasant: inhalation, heart rate deceleration, salivation, pupillary dilatation; lids up, open mouth and nostrils, lips part and corners pulled upwards, gaze directed; ... Unpleasant: Defence response, heart rate acceleration, increase in skin conductance level, decrease in salivation, pupillary constriction; slight muscle tonus increase; brow lowering, lid tightening, eye closing, nose wrinkling, upper lip raising,...
 - c. Who was responsible and what was the reason?
 - d. Do I have sufficient power to exert control if possible? Physiological correlates: High control/High power: Shift toward ergotropic, trophotropic balance; increase in depth of respiration, slight heart rate decrease, increase in systolic and diastolic blood pressure, changes in regional blood flow, increased flow to head, ... Low power: Protection/Submission Extreme ergotropic dominance; faster and more irregular respiration, strong increase in heart rate and heart stroke volume, increase in systolic and decrease in diastolic blood pressure, increase in pulse volume amplitude),

The computational framework EMA (EMotion and Adaptation) (Gratch & Marsella 2004; Marsella et al. 2010; Traum et al. 2008) implements a view of appraisal quite close to that of the Component Process Model. There are some significant differences, nonetheless. Thus, EMA does not subscribe to the assumption that the stimulus evaluation checks are strictly ordered, and we follow EMA in this respect. EMA treats appraisal as a set of feature detectors that map features of the agent's current view of the agent-environment relationship into appraisal variables.

5.2 Adding emotion to the DGB

In order to integrate emotion-related information into the Dialogue Gameboard, we posit an additional field we will dub *Mood*. Mood represents the publicly accessible emotional aspect of an agent that arises by publicly visible/audible actions (such as non-verbal social signals). This can but need not diverge from the private emotional state—as with insincere illocutionary acts, one manifestation of a “fake” laugh/smile is a laugh/smile that does not reflect genuine pleasure;⁴⁵ it can also involve the lack of a genuine belief that the laughable is incongruous.

We view Mood as a complex entity built from categorisation dimensions/appraisal values. More specifically, we assume that it is a weighted sum of these values.⁴⁶ We treat

⁴⁴ All the physiological correlates listed here are taken from Table 1 in (Scherer 2009).

⁴⁵ For extreme examples of such divergence, see (Skradol 2009), which discusses laughter in Stalin's Russia; see also Armando Iannucci's 2017 film 'The Death of Stalin'.

⁴⁶ One could, in principle, keep track of a list of appraisals (as is the case for MOVES). But this goes counter to some indications in the psychological literature:

An individual with talent for introspection might be able to specify current goals and ongoing activities, the present state of physical comfort and discomfort, mental content and many subtle aspects of subjective experience, of which valence is only one. What happens to these moments? The answer is straightforward: with very few exceptions, they simply disappear. (Kahneman & Riis 2005)

each appraisal as being a record of the type *Appraisal*, given in (50). We posit this type to be, following Russell (2003), the Component Process Model and EMA, a record type with three fields *pleasant*, *responsible*, *power*, each field corresponding to a Russellian dimension or an answer to a stimulus evaluation check. We restrict attention here to these dimensions, which seem needed for the purposes of this paper. Pleasantness is specified via a scalar predicate *Pleasant* which can be positively valenced (value tracked by the label *pve*) or negatively valenced (value tracked by the label *nve*) or both (when both *pve* and *nve* have non-zero values.); the latter case corresponds to the case of mixed emotions (Minsky 2007), which in practice are relatively common (Oatley & Duncan 1994). Specifically for our current interest, this can be exemplified on the one hand by the case of a joke told in a funeral and, conversely, by the case of a sigh occurring when one is generally in a rather elated mood. Power is specified in terms of a scalar predicate *Powerful* whose lower bound (zero) arises when the agent perceives total lack of control vis à vis the appraised event.

$$(50) \quad \text{a} \quad \text{Appraisal} = \left[\begin{array}{l} \text{pleasant} : \text{Pleasure} \\ \text{responsible} : \text{RecType} \\ \text{power} : \text{Power} \end{array} \right]$$

$$\text{b.} \quad \text{Pleasure} = \left[\begin{array}{l} \text{Pred} = \text{Pleasant} : \text{EmotivePred} \\ \text{affect} : \left[\begin{array}{l} \text{pve} : \mathbb{N} \\ \text{nve} : \mathbb{N} \end{array} \right] \end{array} \right]$$

$$\text{Power} = \left[\begin{array}{l} \text{Pred} = \text{Powerful} : \text{EmotivePred} \\ \text{control} : \mathbb{N} \end{array} \right]$$

As mentioned above, this leads to the postulation of a modified type for the dialogue gameboard, with a field for Mood:

$$(51) \quad \text{DGBType} \mapsto \left[\begin{array}{l} \text{spkr} : \text{Ind} \\ \text{addr} : \text{Ind} \\ \text{utt-time} : \text{Time} \\ \text{c-utt} : \text{addressing}(\text{spkr}, \text{addr}, \text{utt-time}) \\ \text{Facts} : \text{Set}(\text{Prop}) \\ \text{VisSit} : \left[\text{InAttention} : \text{Ind} \right] \\ \text{Pending} : \text{list}(\text{LocProp}) \\ \text{Moves} : \text{list}(\text{LocProp}) \\ \text{QUD} : \text{poset}(\text{Question}) \\ \text{Mood} : \text{Appraisal} \end{array} \right]$$

We do not offer here a general theory of how emotion categorisations/appraisals arise⁴⁷—we will restrict attention below to the effect laughter and other social signals

⁴⁷ Thus, we do not make explicit a key step in such processes—the relevance evaluation check, which could easily be incorporated given the detailed theory of relevance provided by KoS.

can have on the parameters of appraisal. Nonetheless, we make a number of assumptions concerning how Mood gets updated and introduce one abbreviation for two recurring operations. We assume that the most recent value of numerical components of Mood should be given a stronger weight than its current value, which itself represents some combination of the earlier ones. Therefore we postulate a weighting between the contribution of the new appraisal and the current value of a field of Mood. If this field also has a non-zero negative value, the weighting will attenuate it, otherwise it will have no effect.

Thus, an update rule that increments the positive pleasantness recorded in Mood to an extent given by the weight ε is given in (52a), whereas the converse operation of incrementing the negative pleasantness is given in (52b). We exemplify the application of positive pleasantness update for $\delta = 12$, $\varepsilon = .25$ in (52c):

$$(52) \quad \text{a. } \text{PositivePleasantnessIncr}(\delta, \varepsilon) =_{\text{def}} \left[\begin{array}{l} \text{preconditions: } [\text{LatestMove.cont} : \text{IllocProp}] \\ \text{effect : } \left[\begin{array}{l} \text{Mood.pleasant.affect.pve} = \\ \varepsilon(\text{preconds.Mood.pleasant.affect.pve}) + (1 - \varepsilon)\delta : \text{Real} \\ \text{Mood.pleasant.affect.nve} = \varepsilon(\text{preconds.Mood.pleasant.affect.nve}) : \text{Real} \end{array} \right] \end{array} \right]$$

$$\text{b. } \text{NegativePleasantnessIncr}(\delta, \varepsilon) =_{\text{def}} \left[\begin{array}{l} \text{preconditions: } [\text{LatestMove.cont} : \text{IllocProp}] \\ \text{effect : } \left[\begin{array}{l} \text{Mood.pleasant.affect.nve} = \\ \varepsilon(\text{preconds.Mood.pleasant.affect.nve}) + (1 - \varepsilon)\delta : \text{Real} \\ \text{Mood.pleasant.affect.pve} = \varepsilon(\text{preconds.Mood.pleasant.affect.pve}) : \text{Real} \end{array} \right] \end{array} \right]$$

$$\text{c. } \text{PositivePleasantnessIncr}(\delta = 12, \varepsilon = .25) \left(\left[\begin{array}{l} \text{pleasant} = \left\langle \text{pleasant}, \left[\begin{array}{l} \text{pve} = 4 \\ \text{nve} = 2 \end{array} \right] \right\rangle \\ \text{responsible} = [x = b] \\ \text{power} = \langle \text{powerful}, 2 \rangle \end{array} \right] \right)$$

$$= \left[\begin{array}{l} \text{pleasant} = \left\langle \text{Pleasant}, \left[\begin{array}{l} \text{pve} = 10 \\ \text{nve} = .5 \end{array} \right] \right\rangle \\ \text{responsible} = [x = b] \\ \text{power} = \langle \text{Powerful}, 2 \rangle \end{array} \right]$$

We will assume for simplicity that the weighting ε has a fixed value for any given agent and will not—as we formally should—specify it each time as a parameter of an agent's private cognitive state.

5.3 Pleasantness laughter

We can now formulate a lexical entry for pleasantness laughter, as in (53a): the content we posit is that the laughable is pleasant for the speaker to a contextually given degree δ . The *effect* of such laughter on the speaker is captured in terms of an update rule that increments the (positive) pleasantness recorded in Mood to an extent given by the weight ε , as described earlier. Note that this conversational rule is what we dubbed above *participant sensitive*: it can apply only to someone laughing; this ensures that in order to boost one’s Mood.pleasantness (which represents one’s *public* emotional state) one is actually required to laugh (or engage in other action, as we will see below).^{48,49,50}

- (53) a.
$$\left[\begin{array}{l} \text{phon : laughterphontype} \\ \\ \text{dgb-params : } \left[\begin{array}{l} \text{spkr : Ind} \\ \text{addr : Ind} \\ \text{t : TIME} \\ \text{c1 : addressing(spkr,addr,t)} \\ \delta : \text{Int} \\ \text{c2 : Arousal}(\delta, \textit{phon}) \\ \text{s : Rec} \\ \text{p = } \left[\begin{array}{l} \text{sit = 1} \\ \text{sit-type = L} \end{array} \right] : \text{prop} \end{array} \right] \\ \\ \text{content = } \left[\begin{array}{l} \text{sit = s} \\ \text{sit-type = } \left[\text{c4: Pleasant}(p, \delta, \textit{spkr}) \right] \end{array} \right] : \text{Prop} \end{array} \right]$$
- b.
$$\left[\begin{array}{l} \text{tcs = } \left[\begin{array}{l} \text{dgb : DGBType} \\ \text{private : Private} \end{array} \right] : \text{TCS} \\ \text{A = dgb.spkr : IND} \\ \text{A.pre: } \left[\text{LatestMove.cont = Assert(spkr, Pleasant}(p, \delta, \textit{spkr})) : \text{IllocProp} \right] \\ \text{A.effect : } \left[\text{PositivePleasantnessIncr}(\delta, \varepsilon) \right] \end{array} \right]$$

From pleasantness, we can derive three functions of laughter: affiliation, empathetic acknowledgement, and (with additional assumptions) superiority. We take these in turn.

⁴⁸ We thank an anonymous reviewer for *Glossa* for raising a question in this regard that led to a modification of our thinking on this score.

⁴⁹ The formulation of the update rule in (53) assumes that the force of pleasantness laughter is assertoric, justified in part by data on this score from section 3. This is more debatable for pleasantness laughter than laughter involving incongruity, since the former—on the content postulated here—represents a first person statement about her emotional state and so is less obviously up for discussion. Nothing very much rides on this decision, which could be modified if there is a clear motivation for postulating a distinct force.

⁵⁰ It is important to emphasize that the laughter arousal annotation cannot *in general* be *directly* informative about the degree of arousal shift experienced by interlocutors, though we are assuming this here in linking the arousal level in the laugh and the update to be effected. A low arousal laughter might signal a huge shift in arousal if the overall emotional state was very negative, while a high arousal laughter might actually signal a small shift in arousal if the laugher was already in a particularly excited and exhilarated state. In order to investigate carefully the shift in arousal experienced (or not) by participants we would need an experimental procedure that could establish a state baseline before the laughter occurs. This is certainly an interesting and important investigation that for the moment we defer for future work.

5.3.1 Affiliative laughter

Affiliative laughter arises by resolving the laughable as the state where the speaker and addressee are *co-present*. We abbreviate the laughable

$$\left[\begin{array}{l} \text{sit} = 1 \\ \text{sit-type} = \left[\begin{array}{l} \text{A:Ind} \\ \text{B:Ind} \\ \text{t: TIME} \\ \text{c1:addressing(A,B,t)} \\ \text{c2: CoPresence(\{A,B\},t)} \end{array} \right] \end{array} \right] \text{ as CoPresence(A,B).$$

Affiliation then involves the following sequence:

- i. A laughs at B; content: Pleasant (A, δ ,CoPresence (A,B)) bringing about an update: A's Mood.pleasant.arousal is positively incremented by δ .
- ii. This can give rise to a similar Mood update for B, signalled by laughter at A with content Pleasant (B, δ' ,CoPresence (B,A)).

This does not rule out the possibility one would like to distinguish the two “functions” (expressing pleasure and affiliation) if there were systematic reasons for so doing—say, a laugh incontrovertibly dedicated to the latter function and positing a “precompiled” lexical entry therefor. Nonetheless, absent such a demonstration, we need not assume affiliation *requires* a distinct laughter.

5.3.2 Empathetic laughter

Empathetic acknowledgement of A's utterance by B laughing requires the topos *If it's pleasant for me that you said that p, then I agree that p*—A's utterance is the event pleasant for B.

5.3.3 Superiority laughter

In similar fashion, we can explicate the source of “mocking” and/or “superiority” laughter: A observes an event *e* which affects B negatively. Laughter can then be taken to reflect A's appraisal of *e* as pleasant. If, in addition, A has control over the event, the added element of superiority or even sadism can emerge.

5.4 Incongruity and pleasure

What of the pleasantness that occurs with much incongruous laughter? This can be captured by a simple refinement of (53)—adding as a disjunct that the trigger for the Mood update can also be an incongruity content, as in (42). This means that incongruous laughter will communicate (i) that the laughable p_i is incongruous relative to some topos τ and (ii) that the speaker is (momentarily) pleased.

This seems sufficient for cases like irony signalling (35) and scare quoting (39). In other cases, however, arguably the pleasure is actually incorporated in the incongruity. Thus, (54b) which denies the pleasure but not the incongruity seems a more natural reaction than (54c), which denies the latter:

- (54) a. (Strange scene: A tiger dressed in a soldier's uniform licks the hand of a military strongman). A: (laughs).
- b. B: What's funny? (It's weird, but not pleasure causing) \neg Pleasant(Incongr (p_i)): seeing a tiger dressed in a soldier's uniform licking the hand of a military strongman is not enjoyable.

- c. What's the big deal? (I don't see what's weird) $\neg \text{Incongr}(p_i)$: seeing a tiger dressed in a soldier's uniform licking the hand of a military strongman is not weird.

One way of capturing this additional inference is by positing a topos that finding an entity incongruous involves that fact itself being pleasant:

- (55) If p_i is incongruous and involves no threat to A, then l 's being incongruous is pleasant for A.

6 Scaling up to other non-verbal social signals

In previous sections we have argued that laughter is a signal that has propositional content, but also involves significant emotive content and have shown how to incorporate this in a dialogical semantics. In this section we suggest that our approach extends to other related signals such as smiling, sighing, and frowning—their meaning involving a combination of propositional and emotional content. We already noted in passing in section 3 that most of the phenomena we used to argue for propositional content for laughter—varying placement changes effect, conversational implicature, mock uses—all apply *mutatis mutandis* to other signals we consider here, with some minor exceptions. For laughter we have already noted Plessner (1970) as a pioneer in claiming that laughter has propositional content. Chovil (1992), following earlier work by Ekman (Ekman 1979), further systematized in (Bavelas & Chovil 2000; Bavelas et al. 2014), offers what remains a highly valuable study of spontaneous facial gestures categorized in terms of their semantic effects. Chovil documents the use facial gestures such as brow raising have in effecting emphasis or questioning for simultaneously uttered words, the use of gaze shifting in own communication management, and a variety of gestures as quotatives; Wierzbicka (2000) argues for an explicitly semantic approach to facial gestures (in contrast to an approach rooted in emotion, which she associates with Ekman in particular (Ekman et al. 1987)) and offers analyses of (certain uses) of brow raising and brow furrowing (“frowns”), further discussed below. In neither case is the account formalized or integrated into a dialogical semantics, though both authors clearly emphasize the intrinsically interactive nature of such gestures.

6.1 Smiling

The smile is characterized by the upward turn of the corners of the lips, which is produced by the contraction of the zygomaticus major muscle (Ekman et al. 1987). Ever since Darwin, the relationship between laughter and smiling has been a key question. Darwin's view was, essentially, that smiling is a low arousal version of laughter.⁵¹ One consideration in favour of this is the scalar relationship between laughter and smiling discussed earlier—when a laugh is expected, production of a smile implicates that laughter cannot be provided because the stimulus is insufficiently funny/pleasant. More generally, there is a large though not complete overlap in the effects that laughter and smiling can bring about: in addition to pleasant incongruity, these include affiliation and the expression of superiority or dominance over one's interlocutor (Niedenthal et al. 2010)—this latter can be viewed a “low arousal” version of the effect of *mockery* discussed above for laughter.

As with laughter, a definitive taxonomy of uses is still a matter of controversy. An extreme case is Ekman (2009), who identifies 18 types of smiles and suggests that there might be as many as 50 in all. A more minimalist view is that of Niedenthal et al. (2010),

⁵¹ *Smiling, as we shall see, graduates into laughter.* (Darwin 1877), chapter 8.

who suggest that many smiles are simply readouts of positive internal states such as happiness; this holds also for the “play-face” in primates, such as chimpanzees (for the latter, see discussion in section 7.) Such a meaning for a smile is analogous to our pleasantness meaning for laughter. However, Niedenthal et al. (2010) distinguish this from two other types—*affiliative* and *dominance* smiles. As we pointed out above for laughter, affiliation and mockery can actually be deduced from pleasantness uses. This does not rule out positing these as basic meanings for smiles, but leaves open the possibility that these, like many other effects of smiling noted inter alia by Ekman, are actually pragmatic inferences.

These and the corresponding scalar implicatures could be captured by positing lexical entries for smiles that correspond to the ones we have posited for laughter; given our formulation, the pleasantness update rule will apply without further stipulation. There are two clear differences, however, signalled in (56) in bold. The first concerns form, which needs to be specified in terms of various parameters pertaining to facial shape/activity (the Zygomaticus major and orbicularis orbi muscles); as with laughter we abstract away from this using the label *smileshape*; the second difference concerns arousal—the range of arousal needs to be bounded so as to, roughly, be less than the arousal achieved by high arousal laughter; in other words, we assume that smiling is restricted to low and medium arousal.

(56) a.

$$\left[\begin{array}{l} \text{shape : smileshape} \\ \text{dgb-params : } \left[\begin{array}{l} \text{spkr : Ind} \\ \text{addr : Ind} \\ \text{t : TIME} \\ \text{c1 : addressing(spkr,addr,t)} \\ \delta : \text{Int} \\ \text{c2 : Arousal}(\delta, \textit{phon}) \\ \mathbf{c3 : \delta < HighArousal} \\ \text{s : Rec} \\ \text{p = } \left[\begin{array}{l} \text{sit = 1} \\ \text{sit-type = L} \end{array} \right] : \text{prop} \end{array} \right] \\ \text{content = } \left[\begin{array}{l} \text{sit = s} \\ \text{sit-type = } \left[\text{c4 : Pleasant}(p, \delta, \textit{spkr}) \right] \end{array} \right] : \text{Prop} \end{array} \right]$$

b.

$$\left[\begin{array}{l} \text{shape : smileshape} \\ \text{dgb-params : } \left[\begin{array}{l} \text{spkr : Ind} \\ \text{addr : Ind} \\ \text{t : TIME} \\ \text{c1 : addressing(spkr,addr,t)} \\ \delta : \text{Int} \\ \text{c2 : Arousal}(\delta, \textit{phon}) \\ \mathbf{c3 : \delta < HighArousal} \\ \text{s : Rec} \\ \text{p = } \left[\begin{array}{l} \text{sit = 1} \\ \text{sit-type = L} \end{array} \right] : \text{Prop} \\ \tau = \lambda r : (T1)T2 : (\text{Rec})\text{RecType} \\ \text{c2 : SubType}(L, T1) \end{array} \right] \\ \text{content = } \left[\begin{array}{l} \text{sit = s} \\ \text{sit-type = } \left[\text{c3 : Incongr}(p, \delta, \tau) \right] \end{array} \right] : \text{Prop} \end{array} \right]$$

6.2 Sighing

Sighs—breaths with a volume at least twice as large as the mean volume during a surrounding representative time interval (Vlemincx et al. 2017)—are ambiguous signals in conversation. They can be produced for purely physiological reasons to allow the respiratory system to return to a homeostatic state with respect to blood gas levels, but they can also be produced with communicative intent.

Teigen (2008) suggests that the prototypical sigh conveys *discrepancy* (something is wrong) accompanied by *acceptance* (there is nothing to be done). Such a meaning is straightforward to describe in the current set up, as we will see shortly. However, the most extensive corpus study of sighs we are aware of, the study by (Cash & Ginzburg 2019) of more than 100 sighs in the BNC, points to an additional class of sighs, *positively valenced* sighs, that are much more frequent than commonly believed. In the data of (Cash & Ginzburg 2019) they occur 46% of the time, and moreover seem to be partly correlated with whether the sigh is same/cross-turn with respect to the sighable: 29% of sighs in answers are positive, contrasting with 58% in queries. Sighs are typically low arousal (as noted also by Teigen and Vlemincx et al)—only 11% of the sample of (Cash & Ginzburg 2019) are high arousal. However, of the high arousal sighs a very large proportion—82%—are positively valenced.

A first approximation this suggests is to distinguish non-high arousal sighs from high arousal ones, associating the former with negative pleasantness and a sense of powerlessness, the latter with positive pleasantness and possibly relief. Respective lexical entries are (57a,c), whereas (57b) is an update rule associated with (57a), incrementing the negative pleasantness and setting the power arousal level to zero. The force of a positive sigh (57c) is postulated to be simply Pleasant, which makes it trigger the same update rule as for smiling and laughter, namely (57b).

(57) a.

$$\left[\begin{array}{l} \text{phon : sighphontype} \\ \\ \text{dgb-params : } \left[\begin{array}{l} \text{spkr : Ind} \\ \text{addr : Ind} \\ \text{t : TIME} \\ \text{c1 : addressing(spkr,addr,t)} \\ \delta : \text{Int} \\ \text{c2 : Arousal}(\delta, \textit{phon}) \\ \text{c3 : } \delta < \textit{HighArousal} \\ \text{s : Rec} \\ \text{p = } \left[\begin{array}{l} \text{sit = 1} \\ \text{sit-type = L} \end{array} \right] : \text{prop} \end{array} \right. \\ \\ \text{content = } \left[\begin{array}{l} \text{sit = s} \\ \text{sit-type = } \left[\text{c4 : Unpleasant-accept}(p, \delta, \textit{spkr}) \right] \end{array} \right] : \text{Prop} \end{array} \right.$$

$$\text{b. } \left[\begin{array}{l} \text{tcs} = \left[\begin{array}{l} \text{dgb} : \text{DGBType} \\ \text{private} : \text{Private} \end{array} \right] : \text{TCS} \\ \text{A} = \text{dgb.spkr} : \text{IND} \\ \text{A.pre} : \left[\text{LatestMove.cont} = \text{Assert}(\text{spkr}, \text{Unpleasant-accept}(p, \delta, \text{spkr})) : \text{IllocProp} \right] \\ \text{A.effect} : \left[\begin{array}{l} \text{NegativePleasantnessIncr}(\delta, \varepsilon).\text{effect} \\ \text{Mood.Power.arousal} = 0 \end{array} \right] \end{array} \right]$$

$$\text{c. } \left[\begin{array}{l} \text{phon} : \text{sighphontype} \\ \text{dgb-params} : \left[\begin{array}{l} \text{spkr} : \text{Ind} \\ \text{addr} : \text{Ind} \\ \text{t} : \text{TIME} \\ \text{c1} : \text{addressing}(\text{spkr}, \text{addr}, \text{t}) \\ \delta : \text{Int} \\ \text{c2} : \text{Arousal}(\delta, \text{phon}) \\ \text{c3} : \delta \geq \text{HighArousal} \\ \text{s} : \text{Rec} \\ \text{p} = \left[\begin{array}{l} \text{sit} = 1 \\ \text{sit-type} = \text{L} \end{array} \right] : \text{prop} \end{array} \right] \\ \text{content} = \left[\begin{array}{l} \text{sit} = \text{s} \\ \text{sit-type} = \left[\text{c4} : \text{Pleasant}(p, \delta, \text{spkr}) \right] \end{array} \right] : \text{Prop} \end{array} \right]$$

6.3 Eye rolling

By comparison with other non-verbal signals mentioned here, eye rolling has not been much studied and we are not aware of a major corpus study, though see (Goodwin & Alim 2010) for some discussion.

We mention here three attested examples:

- (58)
- a. Context: person delivering a racist rant in a cafe; author and sitter at bar exchange eye rolls.
 - b. Context: silly announcement in plane; author and passenger exchange eye rolls
 - c. Emily Matlis: What Brexit vision will be on your manifesto then? Barry Gardiner: To negotiate the deal that we have set out. Emily Maitlis: That's going to be on the leaflet? Barry Gardiner: We will decide what our manifesto position is as we normally do. Emily Matlis: (rolls eyes). <https://inews.co.uk/news/uk/emily-maitlis-barry-gardiner-bbc-newsnight-labour-brexit/>

This suggest the following basic description: the eye roller views the *eye-rollable* as *ridiculous*; this effects a decrease in the eye roller's mood for which some person or organization

R is responsible. Here the notion of *ridiculous* is akin to, but distinct from incongruity, and thereby relative to a topos. Hence the following lexical entry:

- (59) a.
$$\left[\begin{array}{l} \text{shape : eyerolltype} \\ \text{dgb-params : } \left[\begin{array}{l} \text{spkr : Ind} \\ \text{addr : Ind} \\ \text{t : TIME} \\ \text{c1 : addressing(spkr,addr,t)} \\ \delta : \text{Int} \\ \text{c2 : Arousal}(\delta, \textit{phon}) \\ \text{s : Rec} \\ \text{p = } \left[\begin{array}{l} \text{sit = I} \\ \text{sit-type = L} \end{array} \right] : \text{Prop} \\ \tau = \lambda r : (T1)T2 : (\text{Rec})\text{RecType} \\ \text{c2 : SubType(L, T1)} \end{array} \right] \\ \text{content = } \left[\begin{array}{l} \text{sit = s} \\ \text{sit-type = } \left[\text{c3 : Ridiculous(p, \delta, \tau)} \right] \end{array} \right] : \text{Prop} \end{array} \right]$$
- b.
$$\left[\begin{array}{l} \text{tcs = } \left[\begin{array}{l} \text{dgb : DGBType} \\ \text{private : Private} \end{array} \right] : \text{TCS} \\ \text{A = dgb.spkr : IND} \\ \text{A.pre : } \left[\text{LatestMove.cont = Assert(spkr, Ridiculous(p, \delta, \tau)) : IllocProp} \right] \\ \text{A.effect : } \left[\begin{array}{l} \text{NegativePleasantnessIncr}(\delta, \varepsilon).\text{effect} \\ \text{R : Ind} \\ \text{Mood.Responsible = } \left[\text{c : } \langle \text{Responsible, R} \rangle : \text{RecType} \right] \end{array} \right] \end{array} \right]$$

6.4 Frowning

Wierzbicka (2000) attempts to find a general meaning for *drawing one’s eyebrows together* and plumps for an earlier intuition of Scherer (1992), who speaks of the perception of some type of discrepancy between one’s needs or goals and one’s actual circumstances. Wierzbicka tries to explicate this as *I want to do something, but I know I’m not doing it now*. Kaukomaa et al. (2014) suggest with respect to turn-opening frowns that they are related to the emergence of a problem, relate to negative assessment and lack of affiliation across participants. The constructed example (60a) indicates the possibility of a frown as part of clarification interaction, whereas (60b) exemplifies a frown in self-repair:

- (60) a. A (while frowning): You’re suggesting we need to redo the calculations?
(What is B suggesting? unclear to A)
- b. A (while frowning): What’s the first name of Gesualdo?

We refine these proposals by viewing discrepancy and problem emergence as involving the frownable giving rise to a question, which can indeed be explicitly posed, as in (60); this is associated with a Mood update in which power is non-zero and pleasantness is decreased.

- (61) a.
$$\left[\begin{array}{l} \text{shape : frownbrowtype} \\ \\ \text{dgb-params : } \left[\begin{array}{l} \text{spkr : Ind} \\ \text{addr : Ind} \\ \text{t : TIME} \\ \text{c1 : addressing(spkr,addr,t)} \\ \delta : \text{Int} \\ \text{c2 : Arousal}(\delta, \text{phon}) \\ \text{c3 : } \delta < \text{HighArousal} \\ \text{s : Rec} \\ \text{q : question} \\ \text{p = } \left[\begin{array}{l} \text{sit = 1} \\ \text{sit-type = L} \end{array} \right] : \text{prop} \end{array} \right] \\ \\ \text{content = } \left[\begin{array}{l} \text{sit = s} \\ \text{sit-type = } \left[\text{c4 : NegRaise}(p, q, \delta, \text{spkr}) \right] \end{array} \right] : \text{Prop} \end{array} \right]$$
- b.
$$\left[\begin{array}{l} \text{preconditions: } \left[\text{LatestMove.cont = Assert}(\text{spkr}, \text{NegRaise}(p, q, \delta, \text{spkr})) : \text{IllocProp} \right] \\ \text{effect : } \left[\begin{array}{l} \text{NegativePleasantnessIncr}(\delta, \epsilon) \\ \text{Mood.Power.arousal} > 0 \end{array} \right] \end{array} \right]$$

7 Conclusions

7.1 Main points

In this paper we have refuted a view that has dominated research on formal grammar since the influential typology of Trager (1961) that views laughter as *paralinguistic*, hence lacking meaning akin to what words and phrases possess and not contributing to the compositional construction of meaning. We have shown that, in fact, laughter has propositional content: we show that it involves reference to external real world events, quite analogously to event anaphors and in contradistinction to bodily signals like sneezing and hiccuping, a view that can be traced back to Plessner (1970). We suggest that laughter has stand alone meanings and that it participates in semantic and pragmatic processes like repair, implicature, and irony.

We have shown how to develop a formal semantic and pragmatic account of laughter embedded in a general theory of conversational interaction. This novel view of laughter enables us to capture in a unified and rigorous manner previous insights concerning laughter, including those from Conversation Analysis and those emanating from linguists working on humour. From CA, in particular Gail Jefferson, we take the assumption that laughter can be and often is an intentionally produced signal included in the range of responses an utterance generates.

Echoing a parable of Milan Kundera's, our account, couched within the framework KoS, posits two distinct meanings for laughter, one based on incongruity exhibited by the laughable, the other based on pleasure the laughable causes to the laugher. Building on Raskin's work in humour theory, we explicate incongruity as a notion that relates a contextually salient entity l with a defeasible rule (a *topos*) in case there exists a contextually salient characterization of l that is incompatible with τ . With this view of incongruity, which is closely related to the TTR notion of *negation* (Cooper & Ginzburg 2015), we show how a wide range of functions of laughter can be deduced. These include signalling irony, dismissing the seriousness of an assertion, question, or suggestion, and scare quotation. This view of laughter also captures straightforwardly the potential for misunderstanding/repair associated with laughter, given the need to resolve in context both laughable and *topos*. It also captures the "hyper-intensional" nature of humor that does not e.g., survive translation or synonymous paraphrase, in exactly the same way as the hyper-intensionality of repair processes. This requires adopting independently motivated assumptions about the nature of the input to semantics/pragmatics, namely rich, multi-dimensional representations of utterances. This assumption is not generally assumed in most other semantic/pragmatic frameworks.

In order to explicate the requisite notion of *pleasantness* whose importance for laughter has been emphasized by Morreall, we build on existing work in cognitive psychology and artificial intelligence. We extend the representations of KoS so that they incorporate the outputs of appraisal reasoning/emotion construction. This allows us both to capture the incrementation of a laugher's public level of pleasure, as well as deduce functions of laughter such as affiliation, empathetic feedback, and superiority. Using this extension of KoS, we have sketched in broad terms how our approach extends to other non-verbal social signals such as smiling, sighing, and frowning for which the arguments we offer about the content-fulness of laughter extend straightforwardly.

Given that these signals are considered intentionally produced alternatives to each other (and to verbal signals), we can also capture their potential to give rise to conversational implicatures.

We have mentioned that the current approach can deduce various potential functions that laughter has. In fact, our view of laughter meaning means that we do not assume the existence of a limited set of discrete functions that are associated with laughter; in principle, distinct laughter episodes can give rise to an unbounded number of distinct inferences, as assumed, in both constructionist and appraisal views of emotional episodes. We have not addressed *attested* functions here, but Mazzocconi et al. (2020) have developed a taxonomy for the functions of laughter building on the two basic meanings here. They utilize a taxonomy with four subtypes: *pleasant incongruity* (cases in which a clash between the laughable and certain background information is perceived as witty, rewarding and/or somehow pleasant), *social incongruity* (situations involving a clash between social norms and/or comfort and the laughable), *pragmatic incongruity* (cases when there is a clash between what is said and what is intended), and *pleasantness* (cases lacking incongruity where a sense of pleasantness/affiliation is either felt or displayed towards the interlocutor.). A corpus study using this taxonomy based on examination of 1072 laughs (289 instances in English (drawn from the British National Corpus (BNC)), 562 instances in French, and 221 in Chinese (the latter two drawn from the multilingual DUEL corpus (Hough et al. 2016)) achieves very high coverage (> 99%).

7.2 Implications for the grammar

At this point, a natural question to ask is: have we shown that laughter (and its close relatives smiling, frowning, sighing etc) belong to the grammar? We do not assume that this is a question that can be answered straightforwardly, not least because of potential disagree-

ments about what constitutes *the grammar*. Over the last few years, several works have appeared detailing the view that grammars should be viewed as systems that classify an utterance as it occurs in conversation see e.g., (Ginzburg 2012; Ginzburg & Poesio 2016; Kempson et al. 2016; Cooper 2020). Thus, Ginzburg & Poesio (2016). argue that phenomena such as disfluencies, non-sentential utterances, quotation, and co-speech gestures are as rule-governed as binding, control, and dislocation—traditional sentence-level phenomena captured in formal grammars. Given the existence of formal accounts for all these conversational phenomena within frameworks such as KoS (Ginzburg 2012), PTT (Poesio & Rieser 2010), SDRT (Asher & Lascarides 2003), Dynamic Syntax (Kempson et al. 2016), and other related frameworks, this suggests the need for a new view wherein grammar is a means for directly characterizing speech events, abolishing the performance/competence distinction (though recasting this in a way that allows maintaining a distinction between the task of describing the linguistic phenomena from the task of describing how they get processed.).

In considering whether laughter and its non-verbal cousins merit inclusion in the grammar in the above sense, one would presumably consider criteria such as the following, all of which all the above phenomena such as disfluencies, non-sentential utterances, quotation, and co-speech gestures pass:⁵²

- (62) a. enters into content calculation
- b. participates in pragmatic processes
- c. manifest form/function cross-linguistic variation
- d. neural, onto/phylo-genetic considerations

With respect to placement, one very influential view due to Provine (1993) has been that laughter always follows the laughable and only occurs *between* spoken utterances; Vettin & Todt (2004) offer a more nuanced account, but assume adjacency between laughter and laughable and exclude laughs that occur in the middle of or overlap with an utterance. Mazzocconi et al. (2020) demonstrate (for French and Chinese in the DUEL corpus and English in the BNC) that only 72% of laughs immediately follow their referents. Instead, the laugh can occur before, during or after the laughable with wide time ranges. Strikingly, they demonstrate statistically significant differences between the three languages regarding the positioning of laughter in relation to its laughable. An earlier result though on a smaller scale is due to Gavioli (1995), who found that laughter used to remedy social incongruity—where a bookseller had to provide a dispreferred response to a client—occurred by and large turn initially for English (n = 16, 75%) whereas turn finally in Italian (n = 20, 90%). To this one can add work that describes carefully the positioning of a variety of non-verbal signals such as sighs (Hoey 2014) and sniffs (Mondada 2020). At the same time, it is clear that a detailed formal account of placement and form/meaning/function correlations is still very open for laughter and other conversational facial gestures, in particular on the extent of cross-linguistic variation in this respect and its basis.⁵³

The neuroscientific study of laughter is very active: including locating multiple sites in the brain of activation for laughter and smiling (Szameitat et al. 2010), and the

⁵² See (Ginzburg & Poesio 2016) for exemplification.

⁵³ An anonymous reviewer for *Glossa* suggests we need to show some caution and indicate that the meanings (*incongruity*, *pleasantness*) we associate with laughter might not be universal and that other uses might exist. We cannot of course disagree with this sentiment. As far as we know there have not been many controlled studies about cross-linguistic or cross-cultural variation in the basic meanings associated with laughter. We mention two studies here, which provide tentative support for universality:

- i. Mazzocconi et al. (2020), discussed above, compared French, German, and Chinese interlocutors engaged in similar tasks and found all uses of laughter to be describable using the taxonomy developed in that paper, based on the basic meanings of (*incongruity*, *pleasantness*).

demonstration that there is different brain activity underlying subjects' ability to distinguish "genuine"/spontaneous' from "fake"/"strategic" laughter (Lavan & McGettigan 2016). However, for the moment, there has been little work on laughter processing in spontaneous conversation which would indicate how this processing relates to other elements of conversation viewed as grammar internal.

The fact that apes possess laughter-like calls (Ross et al. 2009) raises various questions about the cognitive and semantic relationship between such calls and human laughter (and smiling). These include: (i) Does chimpanzee laugh face anticipate illocutionary act seriousness cancellation laughter with humans, as already suggested by the highly prescient Bateson (1955)? More generally, (ii) do apes have incongruity laughter? This is suggested, for instance, by observation of laughter during play (tickling and rough-and-tumble) (Van Hooff & Preuschoft 2003; Davila-Ross et al. 2011), and by anecdotal data such as <https://www.youtube.com/watch?v=OLrYzY3jVPY>, where an orangutan apparently laughs at a magic trick. Given the semantic complexity of incongruity, as discussed here extensively, this would potentially require rethinking existing views of non-human cognitive capacities, whether in the wild or for non-humans living in close contact with humans (Griebel et al. 2016).

List of Abbreviations

BNC = British National Corpus, CA = Conversation Analysis, EMA = EMotion and Adaptation, SSTH = Semantic-Script Theory of Humor, TTR = Type Theory with Records

Acknowledgements

We wish to thank three anonymous reviewers for *Glossa* and Johan Rooryck for their very useful comments on earlier versions. For discussion and comments we also wish to thank Ellen Breitholtz, Greg Bryant, Heather Burnett, Robin Cooper, Justine Cassell, Penny Eckert, Judit Gervain, Eleni Gregoromichelaki, Pat Healey, Julian Hough, Chris Howes, Ruth Kempson, Dimitra Kolliakou, Dan Lassiter, Andy Lücking, Vlad Maraev, Ira Noveck, Peter Pagin, Catherine Pelachaud, Béatrice Priego-Valverde, Frank Richter, Manfred Sailer, and Wendy Sandler. We also thank Andy Lücking for help with LaTeX. Portions of this paper have been presented at: the 2nd Conference on Interactional Linguistics and Chinese Language Studies, Shanghai; SemDial 2016 (JerSem) at Rutgers; the Institute for Logic, Language, and Cognition, Hebrew University, Jerusalem; Institut des Sciences Cognitives-Marc Jeannerod, Lyon; Cognitive Structures 2018, Düsseldorf; the Workshop on Visual Components of Language, Haifa; ESSLLI 2018, Sofia; Logic and Algorithms in Computational Linguistics 2018, Stockholm. We thank participants in these fora for their comments.

Funding information

This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the program "Investissements d'Avenir" (reference: ANR-10-LABX-0083). It contributes to the IdEx Université de Paris - ANR-18-IDEX-0001. We also acknowledge a senior fellowship from the Institut Universitaire de France to the first author.

ii Bryant et al. (2016), using a sample of 966 participants from 24 societies, showed that the subjects detected affiliation (an instance of *pleasantness*, as described above) at above chance rates when hearing clips of laughter by American interlocutors.

It is also worth emphasising that both notions of incongruity and pleasantness clearly accommodate cross-cultural relativity. Nonetheless, obviously we cannot at this stage rule out the existence of cultures/languages in which distinct basic meanings for laughter exist.

Competing Interests

The authors have no competing interests to declare.

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How to cite this article: Ginzburg, Jonathan, Chiara Mazzocconi and Ye Tian. 2020. Laughter as language. *Glossa: a journal of general linguistics* 5(1): 104. 1–51. DOI: <https://doi.org/10.5334/gjgl.1152>

Submitted: 01 November 2019 **Accepted:** 08 July 2020 **Published:** 03 November 2020

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