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**MAKING LIGHT OF TROUBLES:
EVIDENCE FOR THE ROLE OF LAUGHTER AS A PROSOCIAL
PRAGMATIC DEVICE IN CONVERSATION**

A dissertation submitted in partial satisfaction
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

PSYCHOLOGY

By

Charlotte Anne Zeamer

June 2014

The Dissertation of Charlotte Anne Zeamer is
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Tyrus Miller
Vice Provost and Dean of Graduate

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Abstract

Making Light of Troubles: Evidence for the Role of Laughter as a Prosocial

Pragmatic Device in Conversation

Charlotte Anne Zeamer

This dissertation describes a series of studies testing the role of laughter in spontaneous conversation. Though laughter has typically been considered a response to humorous stimuli, one proposed function of laughter in naturally occurring talk is as a communicative signal indicating and attending to a potential source of social discomfort. We argue that laughter in conversation is a paralinguistic response to the desire for maintenance and management of social relationships during conversation. Laughter sends a message that some potentially alarming event need not be taken seriously, and invites the sharing of relief and mirth with others. Three studies tested this proposal. In the first, laughter was found to affect tension levels in conversation, and affect them differently depending on the initial tension level and who is laughing. In the second, the nature of the language just preceding laughter was demonstrated to be surprising and to co-occur with perception of fault on someone's part. And in the third, laughter was found to virtually escape notice in conversation as compared with two other non-linguistic noises, a sine tone and a cough sound, even when preceding talk was surprising or indicative of fault, and regardless of who was laughing. These findings are discussed as supportive of a model of laughter as a pragmatic device in conversation used to attend to and affect the health of social relationships.

Keywords: laughter, emotion, social interaction, speech processing

Making Light of Troubles: Evidence for the Role of Laughter as a Prosocial

Pragmatic Device in Conversation

When we laugh together, we relieve tension, we play, and we initiate or

reaffirm social bonds. Laughter in conversation is a message that problematic features

of an interaction or in the environment are not to be taken seriously or feared. In

formal presentations such as speeches, plays, comedy routines or other performances

where laughter has been most often studied, language and other behavior is often

prepared specifically to induce laughter: to create a set of expectations and then

introduce an incongruity that, upon successful processing, leads to the discovery of a

shared, playful inference, and results (hopefully) in a release of tension and in

laughter. It has been theorized about and commented on anecdotally for thousands of

years as a partner to humor, and its occurrence in speech has been described in some

detail in linguistic and psycholinguistic corpus studies as a feature of contexts such as

troubles-telling, flirting, and mocking conversation (Glenn, 2008; Jefferson, 1985;

Partington, 2006). But laughter has less often been studied experimentally as a

communicative phenomenon that works in predictable ways in spontaneous

conversation. This dissertation will address laughter as the object of such study, and

attempt to extend what is known about the social function of laughter.

In this dissertation, I discuss (1) what is known about laughter, especially

laughter in interaction, (2) an argument for laughter's place in conversation as a

mechanism for attending to social bonds, including a review of the frame, schema,

and politeness theories that background this model, (3) a description of three studies

that examine the role of laughter as a pragmatic device related to social comfort and cohesion in conversation, and (4) a discussion of possible future directions for research on the relationship between social ties and linguistic communication.

What is Laughter?

Folk notions of laughter tend to attribute it to joking, joy, play and social connection. But the way that laughter functions in social interaction is not adequately described in terms of positive affect alone, nor as an aggressive move to exclude others by mocking, nor even as a response to funny stimuli. Laughter is a primal social signal that has evolved to be useful in the countless settings in which threat, appeasement, and affiliation can occur in a complex social world.

Laughter has been described in some detail in terms of its structure, its relation to emotion, and its place in linguistic interaction. The physiology of laughter is often described as a complement to its acoustic structure and as evidence for its primal roots (e.g. Brown, 1967; Darwin, 1872; Fry & Rader, 1977; Provine, 1996; Spencer, 1875) and as an effective tool for reducing stress and negative feeling in clinical settings (e.g. Berk, Tan, Fry, Napier, Lee, Hubbard, Lewis, & Eby, 1989). The evolution of laughter suggests how aggression management could have evolved into a more complex prosocial bonding behavior, and then a correlate of humor (Bekoff & Byers, 1998; Davila Ross, Owren, & Zimmermann, 2009; Ramachandran, 1998; Vettin & Todt, 2005). Laughter has also been examined in the context of social interaction and conversational speech, and its role as a response to humor has become

clear as just one of a number of bonding and threat management behaviors (Attardo, 2002; Glenn, 2008; Jefferson, 1985; Partington, 2006; Provine, 1993).

Physiology and Evolution of Laughter

In non-human primates, intent to appease is expressed by bared-teeth open-mouth displays and accompanying vocalizations (Vettin & Todt, 2005). Such behaviors may be derivatives of explicitly aggressive displays in primates and early humans, and are likely precursors of modern human laughter and smiling displays (Grammar & Eibl-Eibesfeldt, 1990; van Hooff, 1972). There is an ancient association between perception of certain kinds of threat and prosocial expressive responses in mammals, particularly higher primates, including humans.

Laughter is produced with an open-mouth display in primates, including humans, accompanied by rhythmic pulses of expelled breath, generally with a voiced vowel sound following the aspiration, producing a "ha" like call. A longer laugh will typically be composed of a string of similar "ha ha ha" sounds, rather than varying "ha hee ho" sounds, probably due to the affordances of the vocal chords (Provine, 1996). The rhythmic exhalations of laughter start from a higher amplitude and degrade quickly in loudness and regularity as the laugh continues over time, due to in large part to exhaustion of the breath.

Aside from the regularity of these aspirated pulses, the acoustics of laughter are highly variable both within an individual's laugh repertoire and among laughers (Bachorowski, Smoski & Owren, 2001; Vettin & Todt, 2004). This variability may be a function of the laugh as an attention-getting social expression (Provine, 2001). For

all its acoustic variability, the highly regular structure of spaced pulses of breath of this human vocalization may be why it is easily recognized as laughter anywhere in the world (Chafe, 2007; Provine, 1996). Laughter is both universally identifiable, then, and highly idiosyncratic acoustically.

The vocal expression of intense laughter, especially when shared, can be quite dramatic, accompanied by exaggerated gestures, aggressive-seeming facial expressions, sounds that are extreme both in amplitude and frequency, and sometimes violent whole-body movements (Bachorowski, Smoski, & Owren, 2001; Brown, 1967; Darwin, 1872; Spencer, 1875; Vettin & Todt, 2004). Physiologically, intense laughter is also associated with surges in heart rate and blood pressure, and unsustainable changes in breathing necessary to produce the laugh sound (Averill, 1969; Fry & Savin, 1988; Godkewitsch, 1977; Langevin & Day, 1972). But laughter is rarely so extreme an experience. In conversation, it can just as easily consist of one or two, soft aspirated "huh" noises, and it can even be uttered simultaneously with speech, with aspirations interspersed among syllables (Potter & Hepburn, 2010).

Laughter is not only a communicative expression. Its distinctive appeal and the mechanism of its effectiveness to diffuse tension come from the pleasurable, euphoric sensation behind it, or *mirth*. Mirth can be produced by electrical stimulation in several diverse regions of the brain, and it is accompanied by laughter when the stimulation reaches a certain threshold (Arroyo et al., 1993; Fried, Wilson, MacDonald, & Behnke, 1998; Krack et al., 2001; Satow, 2003). There is evidence that the limbic system, where the brain's "pleasure center", fight-or-flight

mechanisms and other emotion and motivation circuitry reside, plays a significant role in the processing and generation of laughter and mirth (Ramachandran, 1998). As with all emotions, mirth can occur as a result of stimuli at different cognitive processing levels (Panksepp, 1998). The medial prefrontal cortex, associated with the generation of ideas and predictive models that guide decision and action, is activated during laughter production, humor appreciation, acknowledgement of social transgressions, embarrassment, and the elicitation of other moral emotions (Adolphs, 2003; Krack et al., 2001). Laughter is clearly not as simple as an unconscious response to delight or fun; evidence suggests it is related to how we make sense of the world around us, and how we decide how to behave in that world.

The pulsed-breath expressive noise that is characteristic of the human laugh is similar to tickle- and play-induced breath (and sometimes vocalization) patterns of orangutans, chimpanzees, bonobos and gorillas (Davila Ross, et al., 2009; Vettin & Todt, 2005). Such play-related vocalizations have even been demonstrated in rats, suggesting that nonserious threat-like behavior and associated communicative practices exist among many mammals (Bekoff & Byers, 1998; Panksepp, 2007).

The primal cause of laughter, then, is probably not joy, but a feeling that there is a potential for social tension along with the desire for social affiliation. Infant chimpanzees show accelerated cardiac responses and aggressive vocal and facial expressions in response to both threatening stimuli such as photographs of aggressive animals and chimpanzee threat barks, and the sound of chimpanzee laughter as well (Berntson, Boysen, Bauer, & Torello, 1989). In the first year of life, human infants

have been observed to respond to identical threatening stimuli both with laughter and with crying (Washburn, 1929). Human infant laughter has been demonstrated to be more relational than a response to physical or basic sensory stimuli, communicating a desire for the reinforcement of social bonds (Fogel, Dickson, Hsu, Messinger, Nelson-Goens, & Nwokah, 1997). Animal and child play includes a number of communicative signals, including laughter, that communicate a lack of serious threat in the presence of an otherwise potentially threatening or alarming stimulus (Bekoff & Byers, 1998; Costabile et al., 1991; Scott & Panksepp, 2003; Vettin & Todt, 2005). In human children, in rats and in higher primates, laughing or laugh-like behavior occurs during tickling and rough and tumble play, again suggesting a co-occurrence of potentially threatening actions and pro-social communicative acts (Scott & Panksepp, 2003; Vettin & Todt, 2005). Tickling, though very often causing laughter, usually first and often simultaneously results in attempts to escape being tickled and in defensive behaviors (Provine, 2004). Tickling is also reserved socially for intimates—friends, lovers, parents, or children. It may be one of the most primal examples of aggression-as-play and tension management in social relations, with laughter as the characteristic vocalization.

In order to create contexts that engender laughter, adult humans routinely "tickle" or "roughhouse" with words and other communicative signals instead of touch: we breach linguistic, social, and propositional norms in ways we think (or hope) will be safe. We also simply note and communicate perceived aspects of conversation where we or others may be at fault, even very subtly, and laugh to

convey a sense of apology or forgiveness. The laughter call is central to a continued sense of togetherness and sharing, allowing otherwise risky behavior to be safe and even entertaining. Conversely, laughter can exclude and devalue when it is used to index talk, behavior, or anything else that the laugher thinks but others do not agree is nonserious. Laughter's functions are therefore varied across conversational contexts, but the effect it is intended to have is consistent: to signal that something that just happened is not serious, and to enlist others in agreement and appreciation of that evaluation.

Certainly, as complex social experiences, mirth and laughter are the result of processing across a broad array of cognitive systems, but shared laughter is a sensory, a cognitive, and a social experience. It comprises the recognition of some incongruity in the environment, the decision to note it, usually with another person, a pleasurable sensation of mirth, and the infectious vocalization (Meyer, Baumann, Wildgruber, & Alter, 2007, Provine, 1993). Mirth and laughter are tools that we, as social animals, have evolved to collectively recognize and manage at least two things: first, the emotions that come from threat or social unease, and second, the implications of such emotional tension on the social order.

In sum, laughter in conversation is, in essence, not always about humor. It is more fundamentally a call to share and manage a moment of potential social tension, broadly defined. Further, laughter is not simply pro-social behavior, nor does it derive from any joyful or bonding situations. Intuitions about this may be mistaking the result for the cause. We don't generally laugh at a beautiful sunset, or laugh when we

embrace a loved one, or laugh when we are absorbed in a particularly fascinating part of our work. Laughter is about the management of feelings of potential discomfort with others. It signals a desire to communicate that a potential threat to social comfort is nonserious, and also to communicate an intention to bond in a moment of mirth and mutual understanding. Joy in this bonding certainly ensues in many situations, but it was not the cause of the laughter. We have reviewed the literature that demonstrates that laughter during social interaction in children and animals co-occurs with play behaviors that appear aggressive, such as play fighting or biting, or have the potential for aggression, such as tickling, as well as truly aggressive encounters that need de-escalating. The joy often associated with laughter, we believe, is a result of the confirmation that no harm was meant, we are all together, and we are all at ease.

Just as in animal or infant behavioral contexts, we believe that conversational laughter among adult humans is likewise a mechanism for transforming a potentially risky social situation into one of mutual understanding and shared enjoyment, and for establishing and strengthening social bonds in that otherwise potentially perilous moment. Studies of when laughter occurs suggest just this—laughter is rarely enjoyed alone; it is 30 times more likely to occur with others than when we are by ourselves (Provine, 2004).

The following section is a review of the literature that describes laughter in natural conversation. I will develop the case that, though the meanings of laughter in conversation may seem diverse, they can probably be subsumed under a common

function of taking notice of the unexpected or unconventional in talk and preempting feelings of tension that could result. I will lay out the rationale for testing, in natural conversation, 1) whether laughter has a positive effect on otherwise tense conversational contexts, 2) what kinds of talk it follows in conversation, and 3) whether it is like language in that its recognition is facilitated by its natural linguistic context.

Laughter in Interaction

Human social behavior is guided by mental models, preconceptions and expectations. Our interactions with each other are not a series of novel stimuli and responses. A sense of what is appropriate or not guide both what we do and how we evaluate what is done when we are with others. These preconceptions govern both the most common social encounters we have with others, and likewise the ways we use language within these encounters. Because there are certain rules to interactional conduct, there is the possibility for misstep.

According to Goffman (1974), a set of expectations about what is right, desirable, or conventional defines conduct conducive to social cohesion. These expectations are developed culturally and then learned individually from repeated interactions of a particular type or in a particular context. For example, there are conventions that help us operate when we meet a stranger, joke, flirt, fight, or enter or exit a conversation with a friend. Preconceptions about what is acceptable are formulated, in Goffman's words, as the "image of human guidedness" (Goffman, 1974, p. 38). This image determines what is judged as rightly conforming or

nonconforming. Misstep is not just noticed, but negatively evaluated accordingly, as "ineffectively guided behavior" (p. 39). There is a right way and a wrong way to go forward in interaction with others.

Garfinkel's breaching experiments demonstrate how serious it is when social conventions, even in the most banal daily behaviors, are violated: standing the wrong way in an elevator, inexplicably picking litter up when it's "not your job", or even asking a person to repeat themselves when there is no obvious ambiguity or communication problem are all enough to produce negative responses in bystanders (Garfinkel, 1984). We do not tolerate social misstep without immediate notice, and often act to repair a behavior or sanction the one who misstepped.

The conventions that govern common daily linguistic interactions have been called *scripts* (Clark, 1992; Schank & Abelson, 1977). Consider going to a restaurant: there are a set of roles such as the patron, the waiter, the cook, other patrons and the servers. There are linguistic and other behaviors that all in the interaction are expected to do (seating the patron, taking the food order, bringing water, chatting at a reasonable volume with our table-mates and only rarely with others, etc.) and they should do them in a particular order. Certain chunks of language are specified within scripts: "How many for dinner?" "There are two of us." "Come this way." "Can I get you something to drink?" The script will not govern every piece of language or behavior to come; rather, it will present a set of stable concepts that act like slots, into which a limited set of utterances and behaviors should be inserted. Failure to conform to behavioral and linguistic scripts like these can incur anxiety, social

sanction and potentially laughter. Put another way, there are rules, in a sense, as to how to behave with others or conduct a conversation, and these rules exist as a set of expectations that define rational, cooperative conversational behavior. Mutual monitoring and frequent sanction preserve the social order.

The scripts and norming that govern talk often exist on a minute scale, not obvious to intuitions about what violations of the social order might be. Paul Grice's (1975) conversational maxims describe in some detail what we do in conversation and, by extension, what behavior is predicted when we converse: be truthful; don't say too much or too little; say things that are relevant to the interaction; be clear. Violations of these maxims may be deliberate, indexing some shared reference that is not in the text of the conversation, and resulting in sarcasm, irony, hyperbole or other humorous inference: we violate the maxim of truth if we say "Bill is a genius with the copier", when he breaks it daily, and in doing so we are suggesting that he is the opposite; we violate the maxim of clarity when we say, "My goldfish has passed on to the great fishtank in the sky", when the goldfish has died and we want to make light of it; we violate the maxim of relevance when we say, "At least it was short" in sardonic response to the question "How did you like the guest speaker?" indicating we did not like her at all. Regardless of whether or not they are intentional, violations of conversational maxims present the possibility that a member of the social group either doesn't know or doesn't care about the linguistic or social rules in play. Breaches of social norms need to be addressed before they produce confusion, social discomfort, and the damage to one's social identity.

Face threatening events have the potential to endanger one's sense of self with a social group (Brown & Levinson, 1987). Face threat can occur in situations where a misstep is very subtle. When one accepts an apology, one infers that there was wrongdoing. When one promises, the expected act on the part of the other is to accept, and in doing so the recipient of the promise incurs a debt. When one interrupts, one violates the wish of the other to express a complete thought. When one speaks of controversial topics such as politics, religion, or personal details of life, one increases the probability of face threat to oneself and the hearer. Even minor mistakes such as briefly talking over someone, pronouncing a word wrong, or stumbling as we enter a room could constitute face threat if the event is not quickly addressed. Individuals need to be reassured that no serious breach was felt, no offense was taken, and social identities and relationships are intact. Attention to the health of our relationships in the presence of the unexpected during interaction is a continuous part of the flow of group behavior.

Laughter is one of the expressive tools we have developed to assist with the maintenance of comfortable, stable senses of self and bonds with others. Laughing with others in many contexts is an expression that we are in agreement that something is nonserious and we are celebrating that moment and that agreement (Chafe, 2007; Glenn, 2008; Platow et al., 2005). In some cases, the nonserious event can be an intentional breach of conventions: a joke of some kind. In others, we are noting a surprise or misstep in interaction and preempting any negative interpretation. In both cases, laughter is functioning as an affective commentary, expressing a shared

comprehension of the nonserious nature of the event and the feeling of bonding in that shared understanding.

In brief, often in conversation, we laugh in the course of speech. Laughter punctuates or overlaps with our speech. It could be a more typical longer, ha-ha-ha laugh sound, or, more commonly in conversation, just one or two laugh *particles*, or "ha"-like exhalations (Potter & Hepburn, 2010). The cause of the laugh is often difficult to discern as a joke or even as lighthearted (Provine, 2001). We believe the laughs are functioning as a linguistic signal to refer to an unexpected or wrong-seeming event that is ongoing or immediately past. Laughter is an affective commentary on that event, signaling that it should not be taken seriously. These are events that are felt by the one laughing (significantly, most laughs are after a person's own utterance) to be understood as a social misstep or breach, and the laugh is a preemptive move to maintain social relations and good feeling (Provine, 2001). When and with whom laughter is used in conversation makes a difference in how it is perceived, but we argue that laughter has one main function in interaction: to direct a listener to evaluate preceding language in a nonserious way, revising an otherwise potentially negative or confusing meaning or intention. Put another way, laughter indexes a preceding moment in need of attention and interpretation as nonserious. We conducted three studies to test this role of laughter in conversation.

In the first study, we explored the differential effects of laughter in conversation. If laughter suggests that what was just said should be interpreted as nonserious, laughter's effect should vary depending on what interpretation as

nonserious means in that context. This experiment explored the hypothesis of laughter as a linguistic signal indexing an event in speech with a nonserious affective commentary, and specifically whether samples of conversation are variously affected by the presence of laughter. We tested whether what influences laughter's effects in context can include who instigated the reinterpretation (i.e., who laughed), and what the characteristics of the context were (i.e., Was the talk serious or playful?).

In the second study, we explored the hypothesis that particular kinds of talk, specifically breaches of expectation or convention, engender laughter. We tested what kind of speech—tense, surprising, or suggestive of fault—predict episodes of laughter in conversation.

In the third study, we explored the relationship between laughter and speech. If laughter is a tool for instructing a listener how to interpret preceding speech, is it a part of the speech stream, like words? Do we, as we do with words, expect laughter as a likely next utterance in speech? We hypothesize that certain segments of speech cause participants to anticipate laughter, and that they should respond more quickly to the sound of laughter in a speech stream as compared with other nonlinguistic sounds after the same speech. Alternately, if participants are slow to respond to laughter, it may suggest that laughter is not processed like words in a speech stream, but is nevertheless effective in helping listeners to interpret speech.

Experiment 1: Does it matter who laughs, and when?

If a person commits some obvious social breach in conversation, tension should ensue. However, if people in the conversation laugh it off, tension should not ensue.

Laughter from others in the conversation should have the greatest effect, signaling the relationally important message that no offense was taken because the preceding utterance was understood to be nonserious. In contrast, in low-tension settings where there is no obvious social breach, laughter should vary in its effects across contexts. Laughter from a speaker just after his or her own utterance should increase feelings of lightheartedness compared with the same speech without laughter, since the laughter will be indexing how a person intends his or her own utterance to be perceived: as nonserious, and, because there is no immediately apparent social breach, as play. However, laughter from others after an otherwise neutral utterance in a low-tension setting may have a different effect. A speaker can comment on her own utterance without threatening her own face. But an addressee cannot. An addressee's laughter allows the possibility that the addressee's interpretation was not in line with the speaker's intention.

In Experiment 1, we tested two hypotheses: (1) If speech is more tense, laughter should function to reduce the tense feeling of the interaction and the laughter produced by others should have the greatest effect on tension; (2) If speech is less tense, laughter from a speaker should have the greatest effect, suggesting an intended use of the nonserious as in play; the laughter of other should have a contrasting effect, increasing tension by indexing an unintentional breach on the part of a speaker. One alternate hypothesis is that laughter in conversation is interpretable as aggressive and exclusionary in either context, and in this case it should increase tension. Another

alternate hypothesis is that laughter in all cases is lighthearted and playful, and in this case it should always decrease tension.

Participants heard short audio clips from natural conversations that were selected from the Michigan Corpus of Academic English (MICASE), an audio corpus collected in a variety of settings on a University campus (Simpson, Briggs, Ovens, & Swales, 2002). The thirty clips used in this experiment were selected by the researcher and divided into equal groups of ten high-, ten mid-level and ten low-tension speeches. The clips were chosen by the researcher for a particular tension-level group based on criteria such as: the presence of explicit disagreement or contradiction between interlocutors with raised voices or lengthy and apparently awkward pauses, for high-tension; the presence of mild disagreement or misunderstanding between interlocutors without raised voices or lengthy pauses, for mid-level tension; and for no apparent disagreement or misunderstanding or a lighthearted joke on the part of interlocutors, for low-tension. The clips were then engineered to represent three categories within each of these three tension levels: where a person laughed immediately after their own utterance, where the laughter come from another person in the conversation, and where no one laughed. All laughs were voiced so that the laughs would be most likely to be perceived as having a positive valence (Cirillo & Todt, 2005; Devilleurs & Vidrascu, 2007; Bachorowski & Owren, 2001; Kipper & Todt, 2001). All laughs came from a single person participating in the conversation, rather than a group so that the identity of the person laughing would be clear to a listener. Where necessary, laughs were edited from

other parts in the same conversation and inserted into the segments of conversation we selected for use as stimuli so that we were always using the "real" laughs from the same speakers and interlocutors in our stimuli. These manipulations resulted in three laughter levels at three speech tension levels as described in Table 1, below:

Table 1

E1 Conditions and Predicted Tension Levels

	No Laughter	Self Laughter	Other Laughter
High Speech Tension	Higher perceived tension	Lower perceived tension	Lower perceived tension
Mid-level Speech Tension	Mid-level perceived tension	Lower perceived tension	Lower perceived tension
Low Speech Tension	Lower perceived tension	Little or no change in tension	Little or no change in tension

In these three speech tension contexts, laughter should have different effects, and the effects should be modulated by who laughs. First, in a conversation where the speech is already very tense, laughter from either a speaker themselves or an interlocutor should reduce tension in the conversation. In these otherwise high-tension settings, if laughter is an expression of social affiliation, laughter coming from an interlocutor in conversation—someone laughing after someone else's speech,

rather than laughing after their own—should have a stronger effect on tension than laughter coming from a speaker. Second, in a low- or no-tension conversation, the significance of laughter should be variable: the intended meaning could be either expression of intention to play, or an expression of teasing or mocking. Since the work intended by the laughter should be more difficult for an overhearer to discern than in a high-tension context, the effect of the laughter on tension ratings in these contexts should be "washed out" by a variety of responses, and so less dramatic overall in either direction than in the high tension context.

There are at least two alternative hypotheses. First, laughter could actually increase tension in some cases if the object of the laughter, whether the speaker or the speech, is perceived as being mocked rather than bonded with or appreciated. Second, laughter could decrease tension similarly in all cases, which would suggest that it is less context-dependent and more reliably mirthful regardless of the surrounding speech or the person laughing.

Method

Participants. Thirty-one native English-speaking University of California undergraduate students participated in exchange for course credit.

Materials and Procedure. Thirty audio clips of natural conversation were selected from the MICASE (Michigan Corpus of Academic Spoken English). All clips had a single naturally-occurring episode of laughter, and all clips were 20-60 seconds in duration. All clips were ended 1-2 seconds after the site of the laugh episode. After editing out the laughter, the clips were selected by the researcher for

suitability as a high- mid- or low tension segment of conversation. Three laughter conditions were created from each clip: no laughter, self-laughter, and other-laughter. First, the no-laughter condition for each clip was created by editing out the laughter in each clip. Then, the self- and other-laughter conditions were created. Since half of the clips in their original form already had self-laughter in them and the other half had other-laughter in them, the missing condition was created by replacing the naturally-occurring laughter by either the speaker or the interlocutor in the conversation with an episode of naturally-occurring laughter from elsewhere in the same conversation. This laughter was found and spliced in from elsewhere in the same conversation. This resulted in 90 total audio clips, with 10 clips each representing the three initial tension levels and each clip engineered in the three laughter conditions, and used in a within-subjects design. Care was taken during the editing of the audio so that the clips were as natural-sounding as possible. Manipulation check trials were run to ensure that clips were heard as intended. Ten of the 90 clips were removed for inconsistent ratings (4 low tension, 4 mid-level tension and 2 high tension). The experiment was run using these remaining 80 audio clips.

The clips were divided in to three groups and were played to three groups of participants, counterbalancing the audio stimuli so that no participant heard a version of a single audio clip in more than one laughter condition. Immediately after each clip, participants were asked to rate the tension they perceived in the conversation on a scale of 5 (very tense) to 1 (very relaxed), answering the question, "How tense do you think that conversation was, overall (not for individual people in the

conversation, but for the conversation as a whole)?" Five filler recall questions were included after the tension question to encourage participants to attend closely to the content of the conversations and the identity of the speakers and laughers.

Results

A 3 x 3 within subjects ANOVA was used to examine the ratings of perceived tension by initial conversational tension level (low, mid-level, and high) and laughter condition (no laughter, self-laughter and other-laughter). See Table 2 below for overall results for the 3 x 3 ANOVA, which includes Main Effects for the three IVs and the Interaction Effect for the three IVs.

Table 2

Initial Tension Level x Laughter Condition Factorial Analysis of Variance for Effect of Laughter on Tension

Source	Df	F	η^2	P
Initial Tension Level	2	44.65	.76	< .0001
Laughter Condition	2	7.35	.34	.003
Tension x Laughter	2	5.31	.44	.003
Error (Tension x Laughter)	30			

There was a significant interaction between tension level and laughter condition (Wilks' Λ = .56) and significant main effects for tension level (Wilks' Λ = .25) and

for laughter condition (Wilks' Λ = .66). The interaction is represented in Figure 1, below.
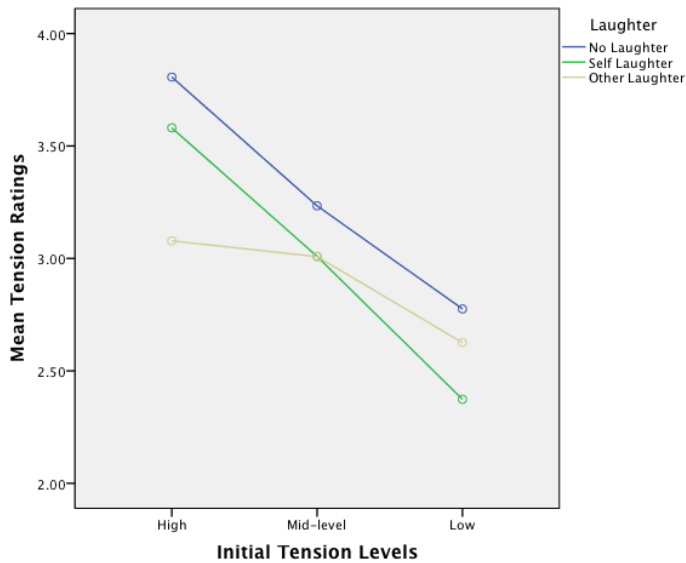
Figure 1

Interaction Effect of Laughter on Initial Conversational Tension Levels

Next, three one-way within-subjects ANOVAs and follow-up Bonferroni-corrected pairwise comparisons were run to compare the effects of laughter in high-tension, mid-level-tension, and low-tension conditions. In the high-tension condition there was a significant effect of laughter, Wilks' Λ = .54, F (2, 29) = 12.55, $p < .0001$. Bonferroni-corrected pairwise comparisons of the three laughter conditions in the high-tension clips indicate that only the laughter of others resulted in tension that as lower than in the no-laughter condition (M = 3.08, 95% CI [.35, 1.10]), $p < .0001$, and self-laughter had no effect (M = 3.58, 95% CI [-.18, .63]), $p = .51$. In the mid-level tension condition, there was no overall effect of laughter on the three tension

conditions Wilks' Λ = .94, F (2, 29) = .98, p = .39. In the low-tension condition,

there was again a significant effect of laughter on tension for the three laughter

conditions, Wilks' Λ = .75, F (2, 29) = 4.93, p = .014. Pairwise comparisons of the

three laughter conditions in the low-tension clips indicate that, in this context, only

self-laughter resulted in tension significantly less than in the no-laughter condition (M

= 2.37, 95% CI [.074, .73]), p = .012, and the laughter of others had no effect (M =

2.63, 95% CI [-.51, .21]), p = 1. The means and standard deviations for the three

levels of each IV are reported in Table 3, below.

Table 3

Mean Tension Scores for Laughter Conditions across Initial Tension Contexts

Laughter Conditions	Initial Tension Level		
	High Tension	Mid-level Tension	Low Tension
No Laughter	3.81 (.66)	3.23 (.81)	2.78 (.68)
Self Laughter	3.58 (.72)	3.01 (.65)	2.37 (.48)
Other Laughter	3.08 (.53)	3.01 (.66)	2.63 (.65)

Consistent with our hypotheses, the presence of laughter affected perceived tension

levels in conversation, and the source of laughter and the conversational context of

the laughter both contributed to the effects. Self-laughter was most effective when

tension was low, and other-laughter most effective when tension was high.

Discussion

These findings support the notion of laughter as a relationship-management tool in conversation used to attend to moments of potential tension (Glenn, 2008; Provine, 2004). First, in a conversation where the speech was already very tense, laughter reduced tension, but it only did so when it was coming from an interlocutor after an utterance, not the speaker of the preceding utterance. In this scenario, the effects support the work of laughter as a tool for attending to the health of a relationship in the event of a potentially problematic social interaction (Jefferson, 1985). The laughter of others in these cases constitutes positive attention to these social bonds: a person is indicating he or she has witnessed a possible breach committed by another in conversation, and is communicating a prosocial message that it has been perceived as nonserious, and therefore "no problem". This communication had the effect, in our study, of preempting or preventing the tension. Although a person laughing at his or her own utterance in a high-tension situation may communicate information about their own emotional state, such laughter would not necessarily speak to the health of the relationship. The opinion of another is necessary for that. Said another way, it is more to the point to say laughter is attending to the state of the relationship of the speakers rather than the content of the language or the event that preceded the laugh in and of itself.

Consistent with the hypothesis of laughter as a signal to reinterpret a preceding utterance as nonserious, in the low-tension situations, only laughter from a speaker just after his or her own utterance affected tension, again reducing it. If a positive change in the state of the relationship is the objective of laughter, our results

suggest that the low-tension contexts in this study may, in fact, be sites for similarly prosocial but less remedial uses of laughter. We believe that when tension is very low, laughter may be initiating or ratifying an intent to play, or joke around in conversation. If this is the case, then it makes sense why self-laughter may have been effective for influencing perceived tension in these contexts: declaring a preceding utterance as nonserious or playful is something that a speaker can safely and effectively do to his or her own utterance, but a listener laughing at an otherwise benign utterance may be suggesting an utterance is nonserious when it was not intended as a joke or seen by the speaker as in need of apology. Only a speaker can reliably tag the lighthearted intention of what he or she has just said. We did not find a negative effect of laughter on ratings of tension in any of the three contexts or laugh conditions, supporting the notion that, when listeners think about tension and hear laughter, the laughter is perceived as prosocial and not mocking.

We have proposed that there is an overarching function of laughter in conversation, to index a moment in conversation in need of revision as nonserious. Experiment 1 demonstrated that laughter changes how identical stretches of conversation are perceived, mitigating the effects of otherwise tense speech on perceived tension. Experiment 2 was designed to examine what kind of talk precedes laughter in conversation. If laughter is used and effective in both high-tension social situations and low-tension situations, is there a common characteristic to the speech that precedes it? Based on the theory that laughter is a mechanism for indexing moments in need of attention and revised interpretation, laughter should follow

speech that creates tension, violates expectations, or suggests a commission of fault. In Experiment 2, we tested this hypothesis.

Experiment 2: What are they laughing at?

The second study examined the nature of the talk preceding laughter in a spoken corpus of spontaneous conversation. The findings from Experiment 1 suggested that laughter is effective in changing how seemingly contrasting conversational contexts are perceived, but we believe it is nevertheless related to a common social and/or emotional experience in conversation: creation of the potential for tension through violation of expectation and commission of social fault. We wanted to test whether these general contexts predictably co-occur with laughter,

First, we tested whether speech immediately preceding laughter is more tense than speech not followed by laughter. In two follow-up experiments, we tested whether speech preceding laughter was more unexpected than other speech and then whether speech preceding laughter suggested some commission of fault more than other speech.

Experiment 2A: Does laughter follow tense speech?

Laughter has been characterized in the literature and demonstrated in Experiment 1 to be effective as an expression of how to nonseriously interpret otherwise potentially tense events. It is possible that, even in lighthearted settings, it is verbal rule-breaking or lighthearted conversational "roughhousing" that is causing the laughs. We wanted to test the theory that laughter is primarily a tool for managing

events that would otherwise produce social tension. If laughter is used as a tension-management tool the majority of the time in conversation, speech just before a laugh should be perceived as more tense than speech further away. Speech just following laughter should likewise be rated as less tense, as long as it does not engender further laughter.

Method

 Participants. Thirty-six native English-speaking University of California undergraduate students participated in exchange for course credit.

 Materials and Procedure. Transcripts of the MICASE corpus were used for the creation of stimuli for this experiment. Short segments of the text from these transcripts were selected: 35 instances of speech immediately preceding laughter and 70 instances of speech two or more utterances distant from a laughter episode, at a point where no laughter occurred. The transcribed laughter was removed from the text segments. The speech segments were presented in order and read by participants. The speech segments, taken together, made up three different conversations with two, five, and seven interlocutors respectively, and the design was within-subjects.

 The segments were presented to participants using a computer-based survey tool. Each segment was presented on the screen in the order they occurred in the conversation, and after each segment on the same screen as the segment text, the participants were asked to rate the tension they perceived in the conversation on a scale of 5 (very tense) to 1 (very relaxed), answering the question, "How do you think the person [or people] was [or were] feeling as they spoke?" Five filler recall

questions were included after the entire conversation to encourage participants to attend closely to the content of the conversations and the identity of the speakers. There was no time limit for reading and answering the ratings and other filler questions that followed.

Results

Data was analyzed using a paired-samples *t*-test of the tension ratings of speech that did and did not precede laughter. Speech that immediately preceded laughter ($M = 3.19$, $SD = .31$) and speech that was two or more turns distant from laughter or followed laughter ($M = 3.16$, $SD = .31$) did not differ significantly on tension ratings, $t(34) = 1.21$, $p = .23$.

Discussion

There was no difference between tension ratings of speech just before laughter and speech elsewhere in these conversational transcripts. This indicates that tension as it is perceived in the text of language from a conversation is not a predictor of when laughs appear.

Findings from Experiment 1 suggest laughter can preempt feelings of tension in conversation, but the results of Experiment 2A demonstrate that tension is not evident in the text of speech preceding a site where a laugh occurs. We believe that there may be two explanations for these null results. First, they may indicate that tension, as an emotional reaction to speech, may be evident more in spoken conversation than in the transcripted text of a conversation. Hearing a spoken conversation provides a more complete picture of social dynamics and emotional

valence, with suggestive prosody, pauses, repetitions, speed of speech, overlap, and other paralinguistic indicators all in evidence. Second, conversational laughter may not be attending to serious breaches of social convention sufficient to cause alarm or offense that would be likely to be evident in the text of a transcript. Conversational laughter may be, as suggested in our review of the contexts in which face threat can occur, attending to subtle breaches of expectation in interaction. A more comprehensive notion of what needs attention and understanding as nonserious in conversation may be more general: segments of conversation that violate expectations. Experiment 2B tested whether speech that was surprising predictably precedes laughter.

Experiment 2B: Does laughter follow surprising speech?

Speech that violates linguistic conventions or expectations within interactional scripts should be evident in a transcript, and such speech should predict subsequent laughter if, by hypothesis, laughter is used to address the potential discomfort of surprising behavior in social interaction. In Experiment 2B, we used an identical design and procedure to Experiment 2A, but asked participants to rate how surprising they thought the speech segments were. We then compared the ratings of speech just preceding laughter to the ratings of speech two or more turns away from laughter.

Method

Participants. Twenty-eight native English-speaking University of California students participated in exchange for course credit.

Materials and Procedure. As with Experiment 2A, the same short segments of the text from naturally occurring speech from transcripts of the same MICASE spoken corpus were presented: 35 instances of speech immediately preceding laughter and 70 instances of speech two or more utterances distant from a laughter episode, at a point where no laughter occurred. The speech segments were again presented in order. After each segment, on the same screen as the segment text, the participants were asked to rate the amount of surprise they perceived in the conversation on a scale of 5 (very surprising) to 1 (not at all surprising), answering the question, "How surprising did what was just said seem to the people in the conversation?"

Results

Data was analyzed using a paired-samples t-test of the ratings of perceived surprisingness of speech that does and does not precede laughter. Speech that preceded laughter was more surprising ($M = 2.79$, $SD = .54$) than the than speech that occurred two or more turns away from laughter or followed laughter ($M = 2.72$, $SD = .49$), $t(26) = 2.17$, $p = .04$.

Discussion

Speech that came just before laughter in the corpus was found to be more surprising than speech in other places. These results support our hypothesis that laughter is associated with speech that violates expectations.

 Our overarching hypothesis connects laughter with the health of relationships and with the need to suggest an interpretation of some event or utterances as nonserious. Experiment 2C was designed to test the relationship between laughter and

the social implications of surprising behavior in interaction. We believe that surprising behavior in interaction should constitute a violation of social conventions, and be perceived as a misstep or fault.

Experiment 2C: Does laughter follow perceived fault?

Results from Experiment 2B suggest that laughter follows speech that is surprising in conversation. Whether laughter follows speech that would otherwise be perceived as a misstep or a social breach is key to our hypothesis about the function of laughter in interaction. In the following study, we used the same design as the previous two, but this time asked participants about perceived fault in conversation.

Method

Participants. Seventeen native English-speaking University of California students participated in exchange for course credit.

Materials and Procedure. As with Experiments 2A and 2B, short segments of the text from naturally occurring speech from transcripts of the same MICASE spoken corpus were presented: 35 instances of speech immediately preceding laughter and 70 instances of speech two or more utterances distant from a laughter episode, at a point where no laughter occurred. The speech segments were again presented in the order they occurred in the conversation. Participants were asked to answer the following question after each segment, "Is there a feeling that someone has said something wrong (made a mistake, or is feeling silly or self-conscious) in this line of conversation, and if so whom?" After this question, participants were given the following choices: a. Yes: the person speaking; b. Yes: the person listening; c. Yes:

someone who is not in the conversation; d. Yes: more than one of the people above (speaker, listener, other person); e. No.   These data were collapsed into two categories for each rating of a speech segment, either perceived fault or no perceived fault. We collected the data with this variety of possible responses so that we could preserve the identity of the one perceived to be at fault for future study.

Results

Data were analyzed using a paired-samples t-test of the proportion of fault ratings of speech that immediately preceded laughter as compared with the proportion of fault ratings of speech that was two or more turns away from laughter. The proportion of segments of speech that received a fault rating were significantly higher before a laugh site ($M = 54.91\%$, $SD = 23.86\%$) than the proportion of segments of speech that received a fault rating away from laughter ($M = 32.93\%$, $SD = 19.53\%$), $t(15) = 5.73$, $p < .001$. Speech that suggested fault to an overhearer predicted subsequent laughter.

Discussion

There was no difference in perceived tension of speech just before and speech further away from laughter. However, there was a difference in perceived surprise of language appearing just before and further away from laughter. Even more so than surprise, perception of fault by a person related to the conversation is higher just before laughter. These results suggest that laughter results from unexpected behavior that comes across as a mistake. These events are not tense, necessarily; surprises and

moments where someone appears to have made a mistake in interaction may be variously interpreted by listeners as tense or playful.

The findings from Experiments 1 and 2 together support the hypothesis that laughter in conversation is a tool for indexing a moment in speech that departs from conventions and could benefit from reinterpretation as nonserious. The preemption of potential tension demonstrated in Experiment 1 shows laughter's effect as a mitigator of otherwise negative feelings in conversation. Higher unexpected and fault ratings of speech just before laughter found in Experiments 2B and C suggest that violation of expectation in conversation and social breach precede laughter. Laughter allows that such breaches need not result in emotional distress, and the idea of laughter as related to violation of expectation and commission of social breaches across contexts is supported.

Results of the preceding studies suggest that laughter is a communicative device for managing the effects of unexpected social behavior or potential perceived fault. Laughter often occurs in a linguistic context, but it occurs outside of conversation as well, often in the absence of any language at all. Therefore, it is of interest whether laughter is an element of language, and whether it leads to the anticipation of certain next-utterances as words in speech do. We will consider the results of the trials that follow in the context of previous studies that measured response-times to linguistic targets in speech streams. Response-time latencies to exact (given as targets to participants in advance) phoneme-targets in sentence contexts are in the 450-500 millisecond range, and average response times to words

are around 400 milliseconds (e.g. Fox Tree, 1995; 2001; Fox Tree & Schrock, 1999; Marslen-Wilson & Tyler, 1980; Marslen-Wilson & Welsh, 1978; McNeill & Lindig, 1973; Morton & Long, 1976).

If laughter is a linguistic signal, it should, like words, be activated by laughter-relevant preceding talk and therefore be more accessible than other non-linguistic noise when primed by such talk, as frequently co-occurring words are. This prediction follows many in the literature where both lexical context and semantic meaning aid in the processing of language (e.g., Collins & Loftus, 1975; Morton & Chambers, 1973; Swinney, 1979; van Alphen & Van Berkum, 2010). Experiment 2 supports the idea that there are kinds of talk that may prime laughter in this way. However, if laughter is not linguistic in the sense that words are, it may be processed separately from speech and escape explicit notice when we are attending to the propositional content of language, as happens with gestures, ums and uhs, hesitations, and other paralinguistic elements of conversation (Christenfeld, 1995; Rosenfeld & Baer, 1969; Watts, 1989; Zeamer & Fox Tree, 2013).

In Experiment 3, we tested the hypothesis that naturally occurring laughter is primed by preceding language, resulting in a response to laughter that is easier and faster for a listener than other nonlinguistic sounds at the same site. Alternately, slower reaction times to laughter may suggest that comprehension of laughter is not like the comprehension of words in speech, activated and primed by preceding talk, but rather is an interactional move discrete from the speech stream.

Experiment 3: Is laughter primed by language?

Experiments 1 and 2 found that laughter affects tension levels, and follows unexpected talk and perceptions of fault in speech. The objective of Experiment 3 was to test the association of laughter with specific kinds of preceding talk. If, in natural conversation containing laughter, the laughter is more available to listeners than other non-linguistic sounds, this could indicate that there is a specific set of speech events that will activate laughter during interaction, and that laughter is therefore stored and retrieved like a word in linguistic context. Response times to the laugh should be similar to other meaningful elements of speech, in the 400-450 ms range.

In this study, the natural speech that preceded laughter was the predictor, and response time to three subsequent sounds, one being laughter, was the dependent variable. Using the same response time data, we conducted three analyses that examined three questions. First, following the overarching hypothesis for Experiment 3, we examined if speech before laughter in general causes listeners to anticipate the laughter and therefore respond to it more quickly as compared with two other non-linguistic noises. Second, we looked at subsets of response times to laughter according to the kind of laugh that followed (self- or other-laughter). And third, we looked at the kind of speech that preceded it respectively (surprising or suggestive of fault).

The second set of analyses extends the results of Experiment 1. We test whether speech preceding laughter from a speaker (speech preceding self-laughter),

or speech preceding laughter from another person in conversation (speech preceding other-laughter) is more likely to result in faster response times to laughter. If self-laughter is more associated with play and other-laughter with tension as results from Experiment one might suggest, different response times would indicate that one kind of context is more strongly associated with laughter than another. The third set of analyses follows the results of Experiment 2. We look at whether surprising speech and then speech where a speaker is perceived to be at fault causes listeners to anticipate laughter. In one scenario, if laughter is linguistic, hearing any of this speech should prime laughter since the stimuli are all speech contexts where laughter originally occurred. If only unexpected talk or only fault-suggestive talk primes laughter, it could suggest that laughter is more strongly associated with a play frame than a tension- or fault-related conversation, or vice versa. Lastly, null results on these three series of tests would suggest that laughter is not processed like speech but is a paralinguistic expressive and pragmatic device, related to speech perception and social relationships but processed differently than the surface features or propositional content of talk.

Method

Participants. Thirty native English-speaking University of California undergraduate students participated in exchange for course credit.

Materials and Procedure. Participants were asked to listen to a series of audio clips of spontaneous speech that contained one of three sounds: the communicative and human generated sound of laughter; a human-generated but not

communicative cough sound; and one both non-communicative and non-human sound, a sine tone. The two non-laughter sounds were included so that potential effects of human-generated sound and non-human sound could be accounted for, if obtained. Participants were asked to respond with the press of a button as soon as they heard one of these sounds.

Twenty-four audio clips with naturally occurring laughter were selected from the MICASE corpus, 15-30 seconds long. Each clip was ended 1-2 seconds after the sound of laughter. This was the first set of stimuli. Then, two more groups of stimuli were created from each of these clips. The laughter was edited out, and into each clip 8 slightly different cough sounds were inserted, used three times each, and then 8 slightly different sine tones were inserted, used three times each. This produced three identical sets of 24 speech contexts, containing three different non-linguistic sounds. Then, so that each stimulus could be used without replication for a given participant, the stimuli were assembled into three groups, each group containing 8 of these audio clips. The result is that each participant was presented with 8 speech clips followed by laughter that naturally occurred in the original speech recording, 8 speech clips where the laughter was replaced by a cough, and 8 speech clips where the laughter was replaced by a sine tone, as well as 20 filler clips which had no laughter or other non-speech noises in them. These fillers were included to minimize expectation effects. Participants were instructed to respond with the press of a button when they heard a "laugh, a cough, or a beep" while listening to the speech clips, and were told that some speech clips may have none of these sounds in them. After each clip,

participants were instructed to press a button to continue to the next screen. On the next screen, each clip was followed by a single, multiple-choice comprehension question to ensure that participants were attending to the content of the speech in the audio and not solely the sounds that they were to respond to. After the comprehension question, participants were instructed to press a button to continue, and the subsequent clip would begin after a pause of 2000 ms. Participants completed four practice trials before completing the experiment. Clips were presented to participants in randomized order. It was not expected that participants would habituate to the task because they did not know which sound to expect at any time, and because almost half of the clips were fillers and contained no sound at all to respond to.

In order to ensure that the three different sounds were not responded to differently because of a difference in loudness characteristic of one group of sounds possibly producing a startle effect, inserted sounds were selected to be similar in amplitude to the laughs occurring in the original recording and to the surrounding language. Descriptive Statistics for these amplitudes are presented in Table 3, below.

Table 3

Descriptive Statistics for Sound Manipulations and Surrounding Language, in dB

Sound	Minimum	Maximum	Mean	Standard Deviation
Laughs	49.75	82.48	63	6.88
Coughs	52.72	73.53	64.22	6.06
Sine Tones	54.06	86.60	62.78	6.69

Surrounding Language	39.59	75.20	61.53	8.51

A one-way ANOVA was used to test for amplitude differences across the three sound manipulations and the amplitude of the surrounding speech in each of the manipulated clips. There was no significant difference in amplitude, $F(3, 92) = .55$, $p = .65$.

In preparation for the second analysis of the subset of response time data to the sound of laughter, we noted that the stimulus set included 9 speech clips originally containing self-laughter, 10 speech clips originally containing other-laughter and 5 speech clips originally containing group laughter. The group laughter clips were not included in the subset of clips for analysis because it would have been impossible to say if they included self- or other-laughter and interpret results accordingly. Last, in preparation for the third analysis, raters checked the stimuli for perception of surprisingness and fault. Raters heard the speech clips cut just before the laugh in each. Ratings were collected using the rating scales from Experiment 2. 16 raters provided ratings on how surprising they perceived the speech to be, and 22 provided ratings on perceived fault.

Results

A one-way repeated measures ANOVA was conducted to compare the effect of noise type on reaction time in laughter, cough, and sine tone conditions. There was a significant effect of the noise condition on reaction time, Wilks' $\Lambda = .44$, $F(2, 28) = 17.90$, $p < .001$. Bonferroni adjusted pairwise comparisons showed that there was

no significant difference between the reaction times to sine tones (M = 1242.71) and coughs (M = 1210.5, 95% CI [-296.53, 360.96]), p = 1. But there was a large difference between reaction times to laughter (M = 2810.64) as compared to both sine tones (95% CI [834.73, 2301.12]), p <.001) and coughs (95% CI [932.49, 2267.79]), p <.001). . Reaction times to laughter were much slower overall than reaction times to the other two non-linguistic sounds.

Reaction Times by Self-/Other-laughter. Next, a *t*-test was conducted to test whether mean reaction times were faster to laughter coming from another person in conversation (other-laughter) or from laughter coming from a speaker (self-laughter). Reaction times to group laughter were excluded from these analyses since it would have been unclear to a participant whether self- or other-laughter was present. There was no significant difference in the reaction times to self-laughter (M=2719.82, SD=1509.18) versus other-laughter (M=3419.77, SD=1585.17) conditions; t(17)=.91, p = .38.

Surprisingness and Fault Analyses. Last, correlations were conducted to test whether there was a relationship between higher mean ratings of surprisingness and proportion of ratings of fault for each clip, and faster mean responses to subsequent noises when that clip was heard. Ratings of fault were transformed from categorical (fault or no fault) to continuous (proportion of participants that responded that a particular clip had fault ratings versus no fault ratings). Participants responses were not related to ratings of the speech for laughs (Surprising speech, r = .169, n = 19, p = .49; Fault rated speech, r = .146, n = 19, p = .55) or coughs (Surprising speech, r =

.114, *n* = 19, *p* = .64; Fault rated speech, *r* = .053, *n* = 19, *p* = .829). Unexpectedly, however, higher ratings of surprisingness and fault were associated with faster responses to sine tones (Surprising speech, *r* = -.497, *n* = 17, *p* = .043; Fault rated speech, *r* = -.509, *n* = 17, *p* = .037).

Discussion

Participants were much slower to respond to the sound of laughter than other, non-communicative noises, and response times to all of sound targets in this experiment were much slower than to speech or phoneme targets (typically about 400-450 ms). Participants took nearly three seconds, on average, to register their perception of the sound of laughter after the onset of the laugh. In contrast, sounds that were no different in amplitude but neither speech-related nor necessarily to be expected in a speech context were responded to much more quickly (but still relatively slowly compared to response times either to speech or phoneme), over one second after onset.

One explanation for the slow response times to all of these the non-speech, communicative and non-communicative sounds is that they are distinct acoustically from the speech stream, and not recognized the same way that speech is. Words in language are used in ways that form associations over time as a result both of their semantic and syntactic characteristics. Both top-down and bottom-up processing are enlisted in the recognition and processing of speech sounds. None of the target sounds in this response-time experiment were speech sounds, operating as part of a symbolic system with semantic and syntactic associations, so the ways that they were

recognized and processed in the service of the response task would be different. In cases where a speech stream is interrupted and that interrupting noise needs to be processed for some response, the top-down linguistic processing may actually interfere with the participant's ability to recognize it and produce a response. That is, if she is expecting a next speech sound within a set of likely next-speech-sounds, she may need to redirect efforts to identify and respond to a cough or a sine tone, neither of which would have been in her preselected list of likely next linguistic options.

The laugh sound may be again a different kind of non-speech sound. It is meaningful and timed with speech but different from words or phonemes. It is produced both in pauses between utterances and simultaneous with speech, and related to concern for social relationships (Potter & Hepburn, 2010). It also occurs in the absence of any speech. As we have said, laughter occurs not necessarily because of the linguistic content of what is said, but because of how what precedes or accompanies the laugh is desired to be interpreted by the person laughing: as nonserious. The interpretation of an event during interaction is what causes someone to laugh. Such a personal thing, a social and emotional interpretation of ongoing events, would be difficult to anticipate or associate with any particular part of language without fairly intimate knowledge of the character of the speakers, their history together, and their feelings during the exchange. Therefore, information sufficient to anticipate a laugh may not be present in the short speech clips we prepared for listeners in our experiment.

Our case is that laughter in conversational context is not typically an involuntary emission related to the feeling of mirth, but rather it is both an insert and a modification that is used deliberately to instruct a listener that something that could otherwise come across as serious should not be interpreted so. An identical utterance could be interpreted a variety of ways across social contexts, such contexts defined by different personalities, different emotions in a given moment, and a person's varying and dynamic perceptions of others' dispositions and feelings as interaction unfolds. Only a few of the possible contexts where a given utterance may occur will suggest to someone in the conversation that a laugh is warranted to indicate that interpretation of the utterance should be nonserious.

This model of laughter offers one explanation as to why responses to laughter are slower than beeps and coughs. Laughter may stimulate an interpretive process as a listener works to figure out the nature of the fault, surprise, tension or other event in need of nonserious interpretation that warranted a laugh. This process of figuring out the cause of the laughter could make it difficult for a participant to focus on the procedural experimental task of identifying the sound of the laugh and pressing a button in response to the sound.

Alternately, laughter may be responded to more slowly than coughs or sine tones in Experiment 3 because the laughter is not at an incongruous place, but the sounds are at incongruous places. It has been demonstrated that incongruous laughter and noises impede recall, but congruous laughter and other sounds do not (Zeamer & Fox Tree, 2013). This is because incongruous sounds, or sounds that don't fit

expectations for a given auditory context, produce difficulty during auditory processing as a listener works to sort certain sounds for attention and others for inhibition. Incongruous sounds do not immediately or easily fit into the category of context-relevant items to stream for attention or inhibition. These two sounds, fitting poorly into the preceding conversation, may have caused listeners to be suddenly distracted from the ongoing talk and may have directed their attention to the sound. By this account, laughs wouldn't distract, as they were decisively part of the communicative stream, and therefore harder to immediately identify for a procedural response.

If the language does not activate subsequent laughter, it will also follow that there should not be a relationship between the identity of the one laughing and response times to laughter, and likewise that there is no a correlation between surprising speech, speech suggestive of fault and the speed with which participants respond to laughter.

The finding on sine tones—that preceding speech that is surprising or suggestive of fault speeds reaction times to this sound—is difficult to explain in the context of the present study. One possibility is that surprising or fault-suggestive talk eases the recognition of a similarly surprising sine tone appearing in recorded conversation. For our purposes, the fact that a difference can be observed for some sound demonstrates that the task is theoretically able to tap into how much attention people pay to surprising and fault-suggestive talk versus non-surprising and non-fault-suggestive talk.

General Discussion

Provine (2001) found that 46% more laughter in conversation is produced by a speaker after his or her own speech rather than their conversation partner, demonstrating that laughter is not, as intuition would have us believe, necessarily or even primarily a response to humorous or other external stimuli. The findings from this set of studies extend these findings and suggest that, although the interpretation of laughter is highly context dependent, laughter is a paralinguistic social signal related to breaches of expectation in interaction. Our findings also support the complementary idea that laughter in conversation is a signal that a preceding event is in need of attention and reinterpretation as nonserious.

Findings from Experiment 1 suggest that, when tension is high, laughter is more easily interpretable as a sign of the health of a relationship when it comes from others in conversation. When there is some source of discomfort in a social setting, a laugh after one's own utterance may be a sign of internal discomfort and a desire that others revise their interpretation of a misstep as nonserious, but a laugh from someone else in conversation is a sign of how that behavior has, in fact, been perceived by others as nonserious. We found that laughter in these cases helps the situation, decreasing tension when it is high. When tension is low, however, self-laughter has the strongest effect, suggesting that in lower-stakes situations, one's own laughter after an utterance may be most reliably interpretable as a call to feel at ease and together.

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Experiment 2 extended these findings by providing more detailed information about the type of conversation that may engender laughter. The behaviors that require such attention will be those that depart from convention, which our findings suggest are the same behaviors that are sometimes interpretable as mistakes by hearers or observers. It is not tension *per se*, then, that precedes laughter, but the perception of the unconventional or the misstep, broadly defined. Laughter may follow breaches of convention that are mistakes or jokes, or simply the perception on the part of any person that there was the potential for such a thing. The laugh, we argue, is the sign that preceding talk is desired not to be taken at face value, but should be reevaluated as less serious than it may otherwise come across.

The results from Experiment 3 suggest that laughter is not perceived in the same way that words in a speech stream are. It escapes quick detection, and is likely processed less like surrounding words and more like other paralinguistic backchannels that assist in the interpretation of speech such as um, uh, like, you know, etc. These markers are used not to convey propositional content, but rather to indicate how to understand an utterance in context or plan future conversational behavior. In the case of laughter, the nonseriousness of what came before is indicated, and the suggestion is conveyed to interpret it as harmless or playful.

Future Directions. The indexing and reinterpretation model of the function of laughter in interaction allows at least one other effect, not tested here: When tension levels are not high and lightheartedness or play is anticipated, conversational laughter in the absence of an obvious tense or playful utterance could, counterintuitively,

increase tension. Follow-up studies will examine this question more specifically, and examine the possibility of laughter as a source of negative affect in conversation.

Other studies will look more broadly at how social interaction proceeds in contexts where there is potential for social risk, for example in group work and learning settings. The results here and the literature on laughter more broadly strongly suggest that it may be an adaptive mechanism that increases our tolerance for novelty and threat when we are with others. Laughter is a tool for affirming the health of our relationships with certain individuals, creating in-groups where conventions of social behavior are defined and certain breaches are tolerated. Laughter allows for the creation and preservation of a dynamic social structure by means of unique and flexible expressions of monitoring and regulation (e.g., Bänniger-Huber & Gruber, 2010; Glenn, 2010; Platow et al., 2005; Provine, 1993; Trouvain & Truong, 2012). We believe that laughter and other prosocial behavior such as smiling, compliments, humorous self-effacement, and politeness should be abundant in risky situations shared with others. This may be counterintuitive: Do we seem unusually happy and interested in others when work we do with others is difficult, when relationships are at risk, or when there are concerns about social status? The mirth and bonding experienced when things get hard or uncomfortable should facilitate difficult or awkward tasks, resulting in a robust social group that can tolerate difficulty by framing mistakes as shared play and affirming social bonds when problems arise. We believe laughter may be a key to groups persevering and succeeding at tasks that would otherwise feel frustrating or challenging.

If laughter assists perseverance and facilitates bonding when group undertakings are hard, then we can say with more specificity than before what we already know to be true about the human species: that it is hyper-social, and that its members rely on each other, and that a strong social order relies both on rules and flexibility to last. We need each other not only for the good feelings that come from bonding, but for help constructing a shared, dynamic, unpredictable world, and for persistent reassurance about our identity and belonging in that world.

References

Adolphs, R. (2003). Cognitive neuroscience of human social behaviour. *Nature Reviews Neuroscience*, *4*(3), 165–178.

Arroyo, S., Lesser, R. P., Gordon, B., Uematsu, S., Hart, J., Schwerdt, P., Andreasson, K., et al. (1993). Mirth, laughter and gelastic seizures. *Brain*, *116*(4), 757–780.

Attardo, S. (2002). Humor and irony in interaction: From mode adoption to failure of detection. *Emerging Communication*, *3*, 159-180.

Averill, J. R. (1969). Autonomic response patterns during sadness and mirth. *Psychophysiology*, *5*(4), 399–414.

Bachorowski, J.A., & Owren, M. J. (2001). Not all laughs are alike: Voiced but not unvoiced laughter readily elicits positive affect. *Psychological Science*, *12*(3), 252–257.

Bachorowski, J.A., Smoski, M. J., & Owren, M. J. (2001). The acoustic features of human laughter. *The Journal of the Acoustical Society of America*, *110*(3), 1581-1597.

Bänniger-Huber, E., & Gruber, V. (2010). *Laughter as a means of emotion regulation in dyadic interactions*. Porto, Portugal: Edições Universidade Fernando Pessoa, Porto. Retrieved from http://search.proquest.com/docview/816389382?accountid=14523

Bekoff, M., & Byers, J. A. (Eds.). (1998). *Animal play: Evolutionary, comparative and ecological perspectives*. Cambridge: Cambridge University Press.

Retrieved from

http://www.sscnet.ucla.edu/comm/steen/cogweb/Abstracts/Bekoff_Byers_98.

html

Berk, L., Tan, S., Fry, W., Napier, B., Lee, J., Hubbard, R., Lewis, J. & Eby, W.C.

(1989). Neuroendocrine and stress hormone changes during mirthful laughter.

American Journal of Medical Science, *298*(6), 390–396.

Berntson, G. G., Boysen, S. T., Bauer, H. R., & Torello, M. S. (1989). Conspecific

screams and laughter: Cardiac and behavioral reactions of infant chimpanzees.

Developmental Psychobiology, *22*(8), 771–787.

Brown, J. W. (1967). Physiology and phylogenesis of emotional expression. *Brain

Research*, *5*(1), 1–14.

Brown, P., & Levinson, S. C. (1987). *Politeness: Some universals in language usage.*

Studies in interactional sociolinguistics, 4. New York, NY,: Cambridge

University Press.

Chafe, W. L. (2007). *The importance of not being earnest: The feeling behind

laughter and humor*. Amsterdam; Philadelphia: J. Benjamins Publishing Co.

Christenfeld, N. (1995). Does it hurt to say um?. *Journal of Nonverbal Behavior*,

19(3), 171-186.

Cirillo, J., & Todt, D. (2005). Perception and judgement of whispered vocalisations.

Behaviour, *142*(1), 113–129.

Clark, H. H. (1992). *Arenas of language use.* Chicago, IL, US: University of

Chicago Press.

Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic

    processing. *Psychological Review*, *82*(6), 407.

Costabile, A., Smith, P. K., Matheson, L., Aston, J., Hunter, T., & Boulton, M.

    (1991). Cross-national comparison of how children distinguish serious and

    playful fighting. *Developmental Psychology*, *27*(5), 881–887.

Darwin, C. (1872). *The expression of emotions in man and animals*. Chicago:

    University Of Chicago Press.

Davila Ross, M., J Owren, M., & Zimmermann, E. (2009). Reconstructing the

    evolution of laughter in great apes and humans. *Current Biology*, *19*(13),

    1106–1111.

Devillers, L., & Vidrascu, L. (2007). Positive and negative emotional states behind

    the laughs in spontaneous spoken dialogs. In J. Trouvain & N. Campbell

    (Eds.), *Proceedings of the Interdisciplinary Workshop on The Phonetics of

    Laughter* (pp. 37–40). Presented at the Interdisciplinary Workshop on The

    Phonetics of Laughter, Saarland University, Saarbrücken, Germany.

Fogel, A., Dickson, K. L., Hsu, H. C., Messinger, D., Nelson-Goens, G. C. &

    Nwokah, E. (1997). Communication of smiling and laughter in mother-infant

    play: Research on emotion from a dynamic systems perspective. *New

    Directions for Child and Adolescent Development*, 1997: 5–24.

Fox Tree, J. E. (1995). The effects of false starts and repetitions on the processing of

    subsequent words in spontaneous speech. *Journal of memory and language*,

    34(6), 709-738.

Fox Tree, J. E. (2001). Listeners' uses of um and uh in speech comprehension. *Memory & cognition*, *29*(2), 320-326.

Fox Tree, J. E., & Schrock, J. C. (1999). Discourse markers in spontaneous speech: Oh what a difference an oh makes. *Journal of Memory and Language*, *40*(2), 280–295.

Fried, I., Wilson, C. L., MacDonald, K., & Behnke, E. (1998). Electric current stimulates laughter. *Nature*, *391*(6668), 650.

Fry, W. F., & Rader, C. (1977). The respiratory components of mirthful laughter. *Journal of Biological Psychology*, *19*(2), 39–50.

Fry, W. F., & Savin, W. M. (1988). Mirthful laughter and blood pressure. *Humor - International Journal of Humor Research*, *1*(1), 49-62.

Garfinkel, H. (1984). *Studies in ethnomethodology*. Cambridge, UK: Polity Press.

Glenn, P. (2008). *Laughter in interaction.* Cambridge: Cambridge University Press.

Glenn, P. (2010). Interviewer laughs: Shared laughter and asymmetries in employment interviews. *Journal of Pragmatics*, *42*(6), 1485–1498. doi:10.1016/j.pragma.2010.01.009

Godkewitsch, M. (1977). *Verbal, exploratory and physiological responses to stimulus properties underlying humour.* (Doctoral Dissertation, ProQuest Information & Learning, US).

Goffman, E. (1974). *Frame analysis: An essay on the organization of experience.* Cambridge: Cambridge University Press.

Grammar, K., & Eibl-Eibesfeldt, I. (1990). The ritualization of laughter. In W. A. Koch (Ed.), *Naturlichtkeit der Sprache und der Kulture. Bochumer Beitrage zur Semiotik* (pp. 192–214). Bochum, Germany: Brockmeyer.

Grice, H. P. (1975). Logic and conversation. In P. Cole & J. Morgan (Eds.), *Speech Acts*, Syntax and Semantics (Vol. 3, pp. 41–58). New York: Academic Press.

Jefferson, G. (1985). An exercise in the transcription and analysis of laughter. In T. A. van Dijk (Ed.), *Handbook of Discourse Analysis, Vol. 3: Discourse and Dialogue* (pp. 25–34). London: Academic Press.

Kipper, S., & Todt, D. (2001). Variation of sound parameters affects the evaluation of human laughter. *Behaviour*, *138*(9), 1161–1178.

Krack, P., Kumar, R., Ardouin, C., Dowsey, P. L., McVicker, J. M., Benabid, A.L., & Pollak, P. (2001). Mirthful laughter induced by subthalamic nucleus stimulation. *Movement Disorders*, *16*(5), 867–875.

Langevin, R. L., & Day, H. I. (1972). Physiological correlates of humor. In J. H. Goldstein & P. E. McGhee (Eds.), *The psychology of humor: Theoretical perspectives and empirical issues*. New York: Academic Press.

Marslen-Wilson, W., & Tyler, L. K. (1980). The temporal structure of spoken language understanding. *Cognition*, *8*(1), 1-71.

Marslen-Wilson, W. D., & Welsh, A. (1978). Processing interactions and lexical access during word recognition in continuous speech. *Cognitive Psychology*, *10*(1), 29–63.

McNeill, D., & Lindig, K. (1973). The perceptual reality of phonemes, syllables, words, and sentences. *Journal of Verbal Learning and Verbal Behavior*, *12*(4), 419-430.

Meyer, M., Baumann, S., Wildgruber, D., & Alter, K. (2007). How the brain laughs. *Behavioural Brain Research*, *182*(2), 245–260.

Morton, J., & Chambers, S. M. (1973). Selective attention to words and colours. *The Quarterly Journal of Experimental Psychology*, *25*(3), 387–397.

Morton, J., & Long, J. (1976). Effect of word transitional probability on phoneme identification. *Journal of Verbal Learning and Verbal Behavior*, *15*(1), 43-51.

Panksepp, J. (2007). Neuroevolutionary sources of laughter and social joy: Modeling primal human laughter in laboratory rats. *Behavioural Brain Research*, *182*(2), 231–244.

Partington, A. (2006). *The linguistics of laughter: A corpus-assisted study of laughter-talk.* London; New York: Routledge.

Platow, M. J., Haslam, S. A., Both, A., Chew, I., Cuddon, M., Goharpey, N., Maurer, J., Rosinia, S.,Tsekourasa, A. & Grace, D. (2005). "It's not funny if they're laughing": Self-categorization, social influence, and responses to canned laughter. *Journal of Experimental Social Psychology*, *41*(5), 542–550.

Potter, J., & Hepburn, A. (2010). Putting aspiration into words: "Laugh particles", managing descriptive trouble and modulating action. *Journal of Pragmatics*, *42*(6), 1543–1555.

Provine, R. R. (1993). Laughter punctuates speech: Linguistic, social and gender

    contexts of laughter. *Ethology*, *95*(4), 291–298.

Provine, R. R. (1996). Laughter. *American Scientist*, *84*(1), 38–45.

Provine, R. R. (2001). *Laughter: A scientific investigation.* New York, NY, US:

    Penguin Press.

Provine, R. R. (2004). Laughing, tickling, and the evolution of speech and self.

    Current Directions in Psychological Science, *13*(6), 215–218.

Ramachandran, V. S. (1998). The neurology and evolution of humor, laughter, and

    smiling: The false alarm theory. *Medical Hypotheses*, *51*(4), 351–354.

Rosenfeld, H. M., & Baer, D. M. (1969). Unnoticed verbal conditioning of an aware

    experimenter by a more aware subject: The double-agent effect. *Psychological

    Review*, *76*(4), 425–432. doi:10.1037/h0027451

Satow, T. (2003). Mirth and laughter arising from human temporal cortex. *Journal of

    Neurology, Neurosurgery & Psychiatry*, *74*(7), 1004–1005.

Schank, R. C., & Abelson, R. P. (1977). *Scripts, plans, goals and understanding: An

    inquiry into human knowledge structures.* Oxford, England: Lawrence

    Erlbaum.

Scott, E., & Panksepp, J. (2003). Rough-and-tumble play in human children.

    Aggressive Behavior, *29*(6), 539–551.

Simpson, R. C., Briggs, S. L., Ovens, J., & Swales, J. M. (2002). *The Michigan

    Corpus of Academic Spoken English*. Ann Arbor, MI: The Regents of the

    University of Michigan.

Spencer, H. (1875). The physiology of laughter. *Illustrations of universal progress: A series of discussions* (pp. 194–209). New York, NY: D. Appleton & Company.

Swinney, D. A. (1979). Lexical access during sentence comprehension:(Re) consideration of context effects. *Journal of verbal learning and verbal behavior, 18*(6), 645-659.

Trouvain, J., & Truong, K. P. (2012). Convergence of laughter in conversational speech: Effects of quantity, temporal alignment and imitation (p. 2). Presented at the International Symposium on Imitation and Convergence in Speech, ISICS 2012, Laboratoire Parole et Langage, CNRS. Retrieved from http://isics2012.sciencesconf.org/conference/isics2012/pages/booklet_2.pdf

Van Alphen, P. M., & Van Berkum, J. J. (2010). Is there pain in champagne? Semantic involvement of words within words during sense-making. *Journal of Cognitive Neuroscience, 22*(11), 2618–2626.

van Hooff, J. A. (1972). A comparative approach to the phylogeny of laughter and smiling. *Non-verbal communication* (p. xiii, 443). Oxford, England: Cambridge University Press.

Vettin, J., & Todt, D. (2004). Laughter in conversation: Features of occurrence and acoustic structure. *Journal of Nonverbal Behavior, 28*(2), 93–115.

Vettin, J., & Todt, D. (2005). Human laughter, social play, and play vocalizations of non-human primates: An evolutionary approach. *Behaviour, 142*(2), 217–240.

Washburn, R. W. (1929). A study of the smiling and laughing of infants in the first

    year of life. *Genetic Psychology Monographs*, *6*, 403–537.

Watts, R. J. (1989). Taking the pitcher to the "well": Native speakers' perception of

    their use of discourse markers in conversation. *Journal of Pragmatics*, *13*(2),

    203–237.

Zeamer, C., & Fox Tree, J. E. (2013). The process of auditory distraction: Disrupted

    attention and impaired recall in a simulated lecture environment. *Journal of

    Experimental Psychology: Learning, Memory, and Cognition*, *39*(5), 1463–

    1472. doi:10.1037/a0032190