



Evidence for Categories of Laughter

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Abstract

A binary classification of laughter according to a functional dimension of venting mirth vs. moving discourse along is considered in relation to a three-way social classification of any instance of laughter as solo, ratifying or ratified (the latter two understood as shared laughter). Tests of these classifications with an extant dialogue data set are conducted in order to assess whether they interact: significant interaction is taken as evidence that the categorizations are informative. Interactions with other phenomena, like personality traits, are similarly assessed. Each cross-classification reveals significant interactions.

Index Terms: laughter; classification; dialogue; discourse laughter; ratified laughter; paralinguistics

1. Introduction

We focus on two potentially orthogonal distinctions in types of laughter in dialogue, one binary and the other three-way. The first distinction, which we think of as *functional*, is between mirthful and discourse laughter, and the second distinction, which we term *social*, is between solo, ratified and ratifying laughter. The first distinction is evidently more problematic than the second. The first distinction has been addressed as one between mirthful and polite laughter [1, 2, 3]. One dimension of the problem is in the choice of labels: “polite”, as a label for non-mirthful laughter, is somewhat disjoint from “polite” as used within the theory of (im)politeness [4, 5, 6, 7] – for example, “polite” is forced as a label for those non-mirthful laughs that are timed and structured to be insulting. The label “discourse” has been applied as a positive label to contrast mirthful laughter (characterized by vocal outbursts that are spontaneous expressions of amusement, and thus not perfectly constrained by the dynamic flow of discourse structure) with vocalizations that are contrived in several respects [8]. The amusement might be triggered by words or actions of an interlocutor, but there is no contract that requires anyone to find any words or deeds truly amusing. We see mirthful laughter as a spontaneous reaction. Another dimension of the problem is that more refined and compelling classification schemes are available [9, 10]. One may acknowledge the problems inherent with fitting two positive labels to a binary contrast and the attractions of incorporating more layers of classification into a conceptualization scheme without agreeing that the binary scheme fundamentally lacks value. We articulate an empirically based analytical argument that the binary distinction makes sense.¹

The second distinction, between solo, ratified and ratifying laughter, which easily reduces to a binary contrast between

laughing alone and finding that others laugh with one, we think is uncontentious. It is self-evident that sometimes a person laughs while none of their interlocutors do, and further that sometimes people laugh and interlocutors laugh, too, around the same time. Sometimes, it is appropriate to say that interlocutors are “infected” with amusement, and sometimes not. One might note that if interlocutors laugh in close succession in this manner, then while they manifestly *agree* they do not necessarily consciously *agree to agree*. The fact that they *agree*, even if the laughter for all is mirthful and therefore not consciously contrived, warrants describing such events as *ratification*.

We offer empirical evidence that the two distinctions are not orthogonal. This, we argue, provides empirically founded evidence for the analytical merit of the distinction between mirthful and discourse laughter. We introduce a method that automatically annotates instances of laughter as solo or shared, given prior identification of each interlocutor’s laughter events (but without reference to the laughter type as mirthful or discourse), using a threshold (500 milliseconds in the experiment we report) for proximity of laughs that might be deemed unified, as well as the “leader” of such shared bouts of laughter. The cross-classification supports a contingency table analysis of annotations of mirthful vs. discourse laughter and solo vs. shared laughter. Rejection of the null hypothesis (that there is no interaction between the two dimensions of laughter classification) adds conceptual strength to the claim that the binary classification of laughter as mirthful or discourse oriented is sound.

We also explore the interaction between the two ways of distinguishing laughter types and personality, with reference to Big-Five personality traits. Our rationale is similar to that in exploring the interaction between the two distinctions: if distinctions in being high or low in particular personality traits participate in significant interactions with the other laughter categories, then, this lends additional weight to the argument that the laughter categorization schemes carry information. We embark on this with expectations about what those interactions might be. We expect those high in Openness to be more likely to be struck by mirthful laughter, those high in Conscientiousness, Agreeableness and Neuroticism to be noteworthy in ratifying laughter, those high in Extraversion and Agreeableness to be marked in engaging in discourse laughter, and those high in Extraversion and Openness to be noteworthy in solo laughter.

Others have studied the interaction between personality traits and humour and laughter [11]. Particular traits, like openness, are explored [12]. Comedians compared with humour writers and college students have been seen to have greater levels of openness and lower of conscientiousness, extraversion and agreeableness [13]. Some found correlation between laughter and only conscientiousness of the big five traits, and that, negative [14]. In decoding, it has been found that observer

¹Extant evidence that acoustic properties separate mirthful and discourse laughter is already compelling to some.

judgements of traits converged on independent assessments for extraversion in laughing individuals, but not other traits [15]. Meta-analysis has identified effects of neuroticism and extraversion [16]. Here, we explore the interaction between personality traits and laughter categories; again we take significant interactions as evidence of relevance of the categoration schemes.

Below, we detail how we quantitatively assess the interactions and hypotheses. The core hypotheses are validated: interactions between classification schemes are best explained as non-random, and thus, the classification schemes carry information. Some anticipated relationships between personality traits and laughter categories were not evident; others were.

2. Method

We analyze data from the MULTISIMO corpus [17], a multimodal data-set of 18 conversations each involving a facilitator and two participants who communicate to resolve a joint task involving imagining what an independent group of 100 people take to be the best answers to questions about mundane issues (e.g. “what is something one can cut?”), based on the game *Family Feud*. The conversations are annotated for paralinguistic behaviours like gesture and laughter, with a binary distinction encoding whether laughter is expressive of mirth or has a discourse function [1]. The dataset includes results of Big-Five personality trait assessments of each participant. We constructed a binary categorical representation of traits as “high” or not depending on whether the score for the trait was at least the value of the third quartile. We developed an independent classification of each instance of laughter, noting whether it was an instance of only one person laughing (i.e. solo) or instead whether it was shared laughter (within, we note the first laugh in a sequence as “ratified laughter” and subsequent laughter as “ratifying”, using a 500 millisecond threshold from the end of the first to the start of any non-overlapping subsequent laughter) and noting the “leader” of shared laughter (see <https://multisimo.eu/papers/SharedLaughterAlgorithm.pdf>).

Descriptive statistics associated with contrasts explored here are given in Tables 1-5. Table 1 shows the counts of the instances of laughter in the cross-classification of laughter types. Table 2 indicates the mean and median durations (in milliseconds) of laughter in the cross-classification of categories. Table 3 shows the mean of the raw personality trait scores for laugh owners across all instances within the functional types, and Table 4 presents the mean of personality trait raw scores for laugh owners within the social types. Table 5 shows the counts of instances of each type of laughter according to the binary personality trait classification of the laugher as having a top quartile score for the trait. We test for significant effects using contingency table tests (χ^2) including inspection of standard residuals and using Wilcox tests (pairwise Wilcox tests with Bonferroni correction for the three-way social category).

3. Results and Discussion

3.1. Laughter categories in themselves

The χ^2 test of the cross-classification depicted in Table 1 is significant ($\chi^2 = 58.248, df = 2, p = 2.247e-13$). The standard residuals are shown in Table 6. With Bonferroni adjustment to $alpha = 0.05, \alpha' = 0.008$, and the critical point for significance is a residual magnitude of 2.64. Thus, relative to the null hypothesis of no interaction between the binary functional category and the three-way social classification of laughter, there is

a statistically significant abundance of solo discourse laughter and ratifying mirthful laughter, and significant dearth of ratifying discourse laughter and solo mirthful laughter. We interpret the rejection of the null hypothesis as evidence that there is an interaction between the functional and social categories – the binary functional distinction carries information. This does not argue that less coarse-grained categorization schemes are not also viable, but the claim we have encountered is that the binary distinction between mirthful and discourse laughter is not viable, which this effect appears to refute.

The difference in duration of mirthful and discourse laughter is significant (Wilcox $W = 63595, p = 0.01849$) – mirthful is longer. The differences in duration between both ratified and ratifying laughter and solo laughter are significant ($p = 6.2e-05$ and $p = 9.3e-06$, respectively) – solo laughter is shorter, but there is not significant a difference in the durations of ratified and ratifying laughter.

3.2. Laughter categories in interaction with personality

Differences in raw openness scores of the laugh owners are significant between discourse and mirthful laughs ($W = 28387, p = 0.01278$), as are the raw neuroticism scores ($W = 27111, p = 0.001136$) greater for mirthful in both cases. The differences are not significant for the other traits. In considering the counts of instances of mirthful and discourse laughter according to high or not high scores for each personality trait (see Table 5), none show significance, but the interaction for neuroticism approaches significance ($\chi^2 = 3.2442, df = 1, p = 0.07168$), with more instances of mirthful laughter and fewer of discourse laughter than would be expected with no interaction.

Personality trait scores do not differ significantly between the three social categories for any of the five traits. In relation to the counts of each sort of social laughter and high or not-high scores for each trait, the interaction for neuroticism is significant ($\chi^2 = 9.9471, df = 2, p = 0.006919$), with significant residuals: an abundance of ratifying laughter ($p < 0.003$) and dearth of solo laughter ($p < 0.008$) for third-quartile neuroticism (and complementary dearth of ratifying laughter, abundance of solo laughter for not-high neuroticism).

4. Conclusion

The interactions for both dimensions of laughter classification is evidence of their viability. There were significantly many observations of solo discourse laughter and of ratifying mirthful laughter, more than would be expected with only random interactions in cross-classification. Mirthful laughter exhibited longer duration than discourse laughter, and solo laughter was shorter than ratified or ratifying laughter. The personality traits also interact with both dimensions of laughter classification. Openness and neuroticism scores were higher among the mirthful laugh owners (as expected for openness, but not neuroticism). Ratifying laughter was observed more for high-neuroticism and solo laughter rather less for high-neuroticism than would have been expected with no interaction between the personality traits and social laughter categories. We expected this, but other anticipated trait interactions were not evident. Nonetheless, the observed interactions provide evidence that the social and functional categories of laughter are meaningful.

5. Acknowledgements

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Table 1: *Cross classification of laughter instance counts according to the functional and social dimensions. Bold counts indicate that standard adjusted residuals (with Bonferroni correction) indicate significant abundance, and underlined values indicate significant dearth (and analogously, in each table).*

| Functional | Social | | |
|------------|----------|------------|------------|
| | ratified | ratifying | solo |
| Discourse | 101 | <u>157</u> | 204 |
| Mirthful | 79 | 171 | <u>56</u> |

Table 2: *Laughter duration millisecond means (median) according to cross classification of laughter instances*

| Functional | Social | | |
|------------|-------------|-------------|-------------|
| | ratified | ratifying | solo |
| Discourse | 1.08 (0.94) | 1.08 (0.99) | 0.88 (0.78) |
| Mirthful | 1.16 (1.08) | 1.17 (0.96) | 0.90 (0.86) |

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Table 3: *Mean of big five personality trait raw-scores for the laugh owner of each functional type.*

| Trait | Functional Category | |
|-------------------|---------------------|--------------|
| | Discourse | Mirthful |
| Openness | 44.64 | 52.29 |
| Conscientiousness | 48.72 | 46.38 |
| Extraversion | 44.53 | 47.00 |
| Agreeableness | 42.13 | 38.54 |
| Neuroticism | 51.69 | 60.99 |

Table 4: *Mean of big five personality trait raw-scores for the laugh owner of each social type*

| Trait | Social Category | | |
|-------------------|-----------------|-----------|-------|
| | ratified | ratifying | solo |
| Openness | 45.54 | 49.48 | 47.20 |
| Conscientiousness | 51.57 | 46.93 | 46.15 |
| Extraversion | 45.04 | 46.24 | 44.98 |
| Agreeableness | 41.47 | 39.13 | 42.15 |
| Neuroticism | 55.80 | 55.76 | 55.21 |

Table 5: *Counts of laughter types by high or not-high values for each personality trait.*

| Trait Category | Functional | | Social | | |
|----------------|------------|--------|--------|------------|------------|
| | Disc. | Mirth. | Rat'ed | Rat'ing | Solo |
| High Open | 76 | 63 | 30 | 63 | 46 |
| ¬ High Open | 224 | 154 | 88 | 171 | 119 |
| High Consc. | 86 | 55 | 37 | 57 | 47 |
| ¬ High Consc. | 214 | 162 | 81 | 177 | 118 |
| High Extra. | 85 | 53 | 37 | 55 | 46 |
| ¬ High Extra. | 215 | 164 | 81 | 179 | 119 |
| High Agree. | 99 | 61 | 40 | 71 | 49 |
| ¬ High Agree. | 201 | 156 | 78 | 163 | 116 |
| High Neur. | 83 | 77 | 34 | <u>88</u> | 38 |
| ¬ High Neur. | 217 | 140 | 84 | 146 | <u>127</u> |

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Table 6: *Standardized residuals of cross classification of laughter instance counts.*

| Functional | Social | | |
|------------|----------|--------------|--------------|
| | ratified | ratifying | solo |
| Discourse | -1.27 | -6.01 | 7.41 |
| Mirthful | 1.27 | 6.01 | -7.41 |