Audience Laughter Distribution in Live Stand-up Comedy

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ABSTRACT
Professional comedians are experts in the manipulation of group laughter, but how comedians manage group laughter across performances provides an opportunity to identify how performers design their content and delivery to control audience response, with possible applications to other interactive contexts. Using a novel stratified laughter representation, we describe the distribution of laughter types during 43 minutes of performance for an audience of approximately 150 people, then compare group laughter responses to the same comedy segment in five different performances. Frequent short bouts of laughter are present throughout the long-form performance. We found more big audience laughter at the beginning of a performance and more small group laughter towards the end, suggesting that a comedian may be eliciting particular laughter types. When engaging the audience directly and deviating from the content of other performances, the comedian used self-laughter more frequently. Our findings suggest that a comedian’s control of audience response is most visible in the relative timing of laughter. The same section of comedy material retained patterns in the gaps between laughter bouts across performances, showing that comedic timing may be as much about preventing laughter as eliciting it.

Keywords
Laughter; comedy; performance; timing; joke

1. INTRODUCTION
Stand-up comedians expertly deliver speech that makes their audiences laugh. Through an iterative process of rehearsal and performance, they have honed the craft of managing the responses of large groups of people. Performers repeat material show to show, offering a counterpart to research into laughter in spontaneous conversation or in response to recorded media. Unlike research using video or audio of comedy to induce laughter in participants, comparative studies of live stand-up comedy can provide insight into how comedians manage laughter—or lack thereof—in a live interactive context.

In 1940, two experimenters used stopwatches and pencils to count laughter instances of one second or more across 13 performances of the same show [9]. While the number of laughs and their duration varied considerably, they found that the number of laughs correlated with audience size. Whether the same sections of performance elicited laughs was not noted, though the author states that “[one] exceptionally long laugh in the show continued for 18.4 seconds on its best night and 9.0 on its worst” [9](p. 183).

Group laughter has been studied using the ICSI dataset, comprised of recordings of meetings of six people on average [6, 12]. In the recorded project meetings, laughter accounts for 9% of vocalisation time, overlapping with other people’s speech without the turn-taking associated with conversation [7]. In conversation, laughs most commonly come from the person who has just spoken, rather than as a response to humorous content [15], and most often not in response to formal attempts at humour [11]. Vettin and Todt found a median of 5.8 laugh bouts in 10 minute conversations, though the frequency and duration of laughter varied widely between participants [15]. In the ICSI corpus, laughter occurs on average once a minute [7]. For people watching comedy clips alone or with one other person, the average duration of a bout of laughter was under a second [1]. Studies of audience laughter have used its presence or absence in recordings (whether canned laughter or natural laughter) as a variable to examine how others’ laughter affects participant perceptions of the speaker or the content (eg. [5, 2]). The contagious nature of laughter itself is often discussed [10, 3, 13], but whether laughter is timed consistently in response to the same material is less examined. The one-to-one relationship between humorous content and laughter has been questioned in research that has found that content can be laughed at before, during, and some time after the content itself [14]. Laughter has different forms and timings in conversational interactions [8, 4] and is likely to show the same variety in performative interactions. Predicting and managing these complex responses to humorous content is part of the performer’s design process. Does an audience’s response to comedy material support the idea that laughter is triggered by punchlines?

This research proposes a novel laughter representation and method, based on the estimated number of laughter participants, to investigate how audience laughter and performance interact, stratifying audience response and focusing on its timing and distribution.

2. METHODOLOGY

2.1 Data

2.1.1 Performance Description
The laughter data was recorded during the first act of a
solo professional stand-up comedy performer who had been on tour for over nine months. The stand-up comedian, SP, consented for their show to be recorded for research purposes. SP is British and their comedy style is conversational rather than consisting of a series of short jokes. Five performances were recorded between April and May 2017. All performances took place close to London with audiences of over 150 people.

2.1.2 Recording

Two types of recording were made using a Zoom H4N recorder during SP’s performances to isolate the performer’s voice from the audience noise. The Zoom recorder has two on-board microphones, in an XY setting at 90 or 120 degrees of one another, as well as having inputs to record from external microphones. To capture the clearest audio possible of SP speaking, the performer’s microphone feed was recorded directly from the sound desk. The Zoom’s on-board microphones were placed on their widest stereo setting to record the ambient noise in the auditorium. The recordings analysed here are from the Zoom’s on-board microphones.

Because the Zoom recorder was connected to the sound desk to access the microphone feed, its placement was determined by the venue. In four of the five venues, the sound desk was placed at the back of the auditorium, and in one performance the sound desk was back stage. During Show 3 the sound desk was at the back of the auditorium in an open booth with no glass or obstruction between the audience and the back row.

2.2 Annotation Labels

The initial goal of the annotation process was to identify how often laughter occurred during SP’s performance to account for gaps in the timing of spoken material. However, it quickly became apparent that a large proportion of audience laughter overlapped with the comedian’s onstage speech. Focus shifted to the number of people involved in any given laughter bout to prepare for future work on how group laughter interacts with the performer’s speech timing.

ELAN [16] was used to annotate the recording of audience laughter. The performer’s voice can be heard in the background. The annotation labels used were:

- **Solo Laughter**: Only one person laughing.
- **Babble Laughter**: Between two and five people distinctly laughing.
- **Audience Laughter**: More than five people laughing, or several people laughing in a manner that makes it hard to distinguish their number.
- **Self-laughter**: The performer themselves laughing.

Applause or Cheers: Parts of performance where the audience clapped, whooped or responded with “oooo”.

Audience, Babble and Solo Laughter are mutually exclusive categories.

3. RESULTS

To examine laughter distribution across performances, laughter types were first annotated for the entirety of one recording to select a section to examine in more detail across different performances. The first act of Show 3 was selected as it is the median performance; if the show is continually evolving at a similar rate, Show 3 is theoretically as different from the first recording as it is to the last.

3.1 Laughter Durations in Show 3

Table 1: Laughter Type Descriptions (Show 3)

<table>
<thead>
<tr>
<th></th>
<th>Audience</th>
<th>Babble</th>
<th>Solo</th>
<th>Self</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instances</strong></td>
<td>158</td>
<td>166</td>
<td>86</td>
<td>10</td>
<td>420</td>
</tr>
<tr>
<td><strong>Max. (s)</strong></td>
<td>8.78</td>
<td>12.78</td>
<td>5.07</td>
<td>1.35</td>
<td>12.78</td>
</tr>
<tr>
<td><strong>Min. (s)</strong></td>
<td>0.73</td>
<td>0.50</td>
<td>0.29</td>
<td>0.32</td>
<td>0.29</td>
</tr>
<tr>
<td><strong>Mean (s)</strong></td>
<td>2.32</td>
<td>1.65</td>
<td>1.05</td>
<td>0.66</td>
<td>1.75</td>
</tr>
<tr>
<td><strong>Total (s)</strong></td>
<td>366.63</td>
<td>274.61</td>
<td>90.91</td>
<td>6.60</td>
<td>738.77</td>
</tr>
</tbody>
</table>

In Show 3, laughter of some kind was present for 27.5% of performance time. Audience Laughter accounts for slightly over half of total laughter time (Table 1). A similar amount of audience laughs and babble laughs were identified (158 and 166 respectively), but Babble Laughter was shorter on average, at 1.65 seconds compared to 2.32 seconds. Only 10 instances of self-laughter were identified. Laughter bouts lasted 1.80 seconds on average, reaching a maximum of 16.02 seconds.

3.2 Laughter Distribution in Show 3

Fig. 1 shows the gaps between laughter of each type. The longest gap with no laughter is 44.50 seconds and the average gap between laughs is 5.09 seconds. The distribution in performance time of each laughter instance shows that Audience and Babble Laughter are both frequent, but appear at different densities at different points in the performance. Audience Laughter is more frequent at the beginning of the show (on the left), while there is a greater density of Babble Laughter towards the end (on the right). Comedians often begin a show with jokes about the venue or the audience itself, so this distribution may be showing the comedian using jokes that appeal to the audience as a whole.
to win the audience over, gaining the goodwill necessary to build towards more complex jokes later in performance.

Considered alone, the average gap between laughs for Audience Laughter is 14.03 seconds and 14.13 seconds for Babble Laughter in Show 3. As expected, these gaps are more than double the average gap when all laughs are considered together. The gap between laughs drops when Audience and Babble Laughter are considered together, suggesting that Babble Laughter often occurs between instances of larger-scale audience laughter or vice versa.

Plotting the gaps between instances of Audience Laughter and Babble Laughter separately provides a more nuanced picture of how types of laughter are ebbing and flowing throughout the performance. A gap in laughter is measured as the duration between the end of one laughter bout and the beginning of the next, plotted at the point at which the second laughter bout began. Blank space followed by a low gap duration indicates that the blank space contained laughter, while blank space followed by a high gap duration indicates audience silence.

After the first 500 seconds (or roughly 8 minutes of performance time) frequent Audience Laughter, visible as a cluster of small gaps between laughs, gives way to a more even scattering of audience laughter. Babble Laughter becomes more frequent, particularly after the halfway mark. Examining the gaps between all audience laughter types together highlights parts of the performance where laughter was less frequent, visible as spikes in gaps between laughs.

### 3.3 Cross-performance Laughter Distribution

A short segment of material that contained the longest gap between group laughter in Show 3 (around 1250 seconds, see Fig. 1) was annotated in four other performances to see if the same material received a similar pattern of Audience Laughter. The roughly six-minute segment contained material around three themes: underwear, Brexit and Uber.

Across the performances the longest gap varied between 33.21 seconds (Show 2) and 50.09 seconds (Show 5), but it is still visible as significant, illustrating the importance of considering patterns in timing rather than absolute values. The average gap between laughs varied between 3.69 (Show 4) and 5.29 seconds (Show 4), though the standard deviation was more similar (between 6.92 in Show 1 and 8.78 in Show 5). Despite differences in statistical measures, long gaps between laughter instances appear at similar positions in performance time (Fig. 2). In some performances silences and frequent laughter alternate more clearly in linear patterns, such as in Show 1, whereas in other performances laughter gaps are more varied, such as in Show 5 where laughter gaps crest and drop. Rather than a punchline triggering a laughter type consistently, reliable audience response to content appears in gaps between sections of laughter, suggesting that performer control may be as much in holding back as in inducing audience response.

However, there is more variability in the duration of sections that contain many short burst of laughter. The long gaps between laughter instances contain very similar performance material, whereas there is more variability in the material eliciting short, frequent laughter. In Show 5, SP deviated from the material to engage the audience specifically about someone re-entering the room and to comment on their show. This new material is between the 1423 and 1455, visible in Fig. 2 as a section of short frequent laughter not present in other performances. Show 5’s segment had 14 instances of self-laughter within this segment, more than the entirety of self-laughs identified in Show 3.

Here the comedian may be trying to spark audience laughter with their own laughter and additional material, trying to create a connection before moving on with the performance.

### 4. LIMITATIONS

Relying on only one microphone placement restricts the sources from which sound can be captured. The recorder was at the back of the room and audience members faced the front. The audio captured during the performance favouring those sitting at the back of the room and may have missed quiet or solo laughter further away. Because of the potential to miss laughter, even faint or hard to make out solo laughter was counted to help redress the conservative laughter estimates this methodology produces. Microphone placement contributed to the decision not to use loudness of the laughter as one of the features to categorise laughter types.

The short duration of laughter bouts is partly due to the separation of laughter types. Babble Laughter often occurred close to Audience Laughter, while Solo Laughter occurred immediately before and after other laughter types as well as in isolation. Had they been annotated together,
laughter bouts might be considered longer and less frequent. The distinct acoustics and differing distributions of laughter types suggest that combining all group laughter may miss subtle distinctions in group laughter dynamics.

5. DISCUSSION

Despite the conversational style of SP’s comedy, it seems that they have some control of when the audience responds in this one-to-many interaction. The frequency of laughter overall suggests that sections with infrequent laughter may be significant. Parts of a mature show in which the audience is consistently quiet are likely to be purposefully placed, sculpting audience attention by offering a counterpoint of comparatively serious silence. Orchestrated group silence may be as powerful an indicator of performer planning as group laughter.

Future work on the dynamics of group laughter in audiences, and the performer’s control or reaction to it, will require a fine-grained approach to timing given the frequency and short durations of laughter bouts. Our annotation schema does not capture the differences in laughter texture that influenced interactions: some audience laughter was muted, underscoring the performer’s speech, while other audience laughter was loud and synchronous and occurred in pauses in speech. It would be interesting to explore whether the performer is also controlling the type of laugh, encouraging supportive underscoring laughter or disruptive responses from the audience as part of their performance’s design. In Show 5 self-laughter was used alongside extra material that seemed aimed to stimulate audience engagement between signature laughter gaps, suggesting that the performer may have been trying to get the audience in a particular state before beginning the next section of prepared material.

This case-study of audience laughter types will be extended to examine a section of material from a stand-up comedy routine performed to 10 different audiences. Comparing patterns of audience laughter, and whether they coincide with the same pieces of prepared material, would illuminate the extent to which the performer controls audience laughter through the design of their material or spontaneously in their delivery. Particular attention will be given to patterns in audience response, joke consistency and the introduction of new material.

6. CONCLUSION

Stand-up comedy audiences laughed during 27.5% of a 43 minute performance with frequent, short laughter bouts. The frequency of laughter makes gaps in laughter of interest. Comparing laughter distribution in a segment of material present in five comedy performances showed that gaps between audience laughter were maintained across performances, even as the frequency and duration of laughter varied. The performer’s self-laughter appeared alongside new material aimed at audience engagement, suggesting that the performer is actively manipulating how their audience laughs. Despite the fact that laughter was found before, during and after punchlines, there were consistent sections of performance with no laughter at all.

7. ACKNOWLEDGMENTS

The authors would like to thank comedian SP for their participation. This research was supported in part by the Media and Arts Technology Centre for Doctoral Training, funded by EPSRC and AHRC (ref EP/L01632X/1).

8. REFERENCES


