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Prosody in spontaneous humor

Evidence for encryption*

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The study of conversational humor has received relatively little empirical attention with almost no examinations of the role of vocal signals in spontaneous humor production. Here we report an analysis of spontaneous humorous speech in a rural Brazilian collective farm. The sample was collected over the course of ethnographic fieldwork in northeastern Brazil, and is drawn specifically from the monthly communal business meetings conducted in Portuguese. Our analyses focused on humorous utterances identified by the subsequent presence of laughter. Acoustic features of these utterances were compared to non-humorous utterances by the same speakers of similar length and immediately preceding them to look for prosodic contrasts. This corpus provided a unique opportunity for examining the way people mark their humorous productions in a non-humorous environment. Contrary to the notion that speakers must mark their production of humor in order to facilitate audience understanding, no significant marking of a joking "frame" was detected across a range of acoustic dimensions. The only consistent difference — that the set-up and punch line segments were louder than baseline speech before it — does not well support a marking hypothesis and more likely reflects speaker adjustments to the acoustic conditions of the meeting hall. We present these data from the perspective of the encryption theory of humor that predicts speakers will not generally mark spontaneous, conversational humor in most contexts.

Keywords: Brazil, encryption theory, humor, Portuguese, prosody, social assortment, spontaneous speech

1. Introduction

In most contexts of human social interaction people often behave in ways that can be broadly described as humorous. We tell jokes, make faces, and laugh with one another for an infinite number of reasons, many of them related to our folk understanding of what it means to be funny. But the incredible variety of circumstances

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in which this kind of behavior occurs makes the scientific study of humor theoretically and methodologically difficult. Recently, however, researchers have begun analyzing specific aspects of humor in an attempt to characterize this pervasive and complicated human behavior. In this Special Issue of *Pragmatics and Cognition*, a particular emphasis is placed on the underlying prosodic patterns associated with humorous speech — that is, what are the tonal and rhythmic properties of speech typically associated with verbal joking? How do people mark their attempts at being funny, and do they generally even mark them at all? Here we report an analysis of spontaneous humorous speech in a rural Brazilian collective farm, and we aim to show that, in fact, people often do not signal explicitly that they are being funny. We present this data in the context of a recently developed encryption theory of humor (Flamson and Barrett 2008). Rather than marking humorous utterances using explicit means such as speech prosody, speakers often rely on situational context and common knowledge in being understood. As described below, one likely function of humor is not merely to entertain an audience, but rather to signal encrypted knowledge and to communicate useful information in the context of recognizing and acknowledging social alliances. In this capacity, explicit marking should often be avoided, and in our sample, this is precisely what we found.

Most work on the pragmatics of conversational humor has focused primarily on the level of interaction between interlocutors (e.g., Kotthoff 2006a), or on performative aspects such as timing and framing (e.g., Norrick 2003), rather than on specific acoustic features. But the existing research on prosody and humor has uncovered some interesting results. For example, a study of conversational humor among brain-damaged patients found a significant correlation between stroke patients' ability to decode prosody and their appreciation of humor (Heath and Blonder 2005) suggesting that nonverbal vocal signals can be important for identifying humor. Other recent work has examined the specific acoustic features of joke telling, as one prevalent type of humor common in ordinary conversation (Pickering et al. 2009). In this study, undergraduate students told jokes and the punch lines were analyzed for distinctive pitch, loudness, and speech rate features. Contrary to suggestions in the literature (e.g., Norrick 2001), this work found that while punch lines did have lowered pitch and slowed speech rate relative to earlier portions of the jokes, these effects were not considered to be above and beyond what one would expect given the final position in a spoken monologue independent of humor. That is, speakers did not seem to provide distinctive prosodic signals that they were in fact ending a joke with a punch line. This result is especially interesting given the semi-scripted nature of the productions. Even with a stereotypical expectation of joke-telling behavior, people failed to produce highly stereotyped utterances to mark their humor.

These results, albeit limited, suggest that one-to-one mappings between speech characteristics and humor are not common in everyday talk. Research examining how people signal ironic intent in spontaneous conversation also shows that rather than using some stereotyped form to communicate irony (often a form of humorous speech), speakers rather tend to contrast prosodic features quite variably (Attardo 2001; Bryant and Fox Tree 2005; Bryant 2010, 2011). Vocal strategies for communicating subtle meanings likely depend on many complex social factors, and the acoustic form speakers choose to adopt will vary according to the pragmatic function in a given communicative context. From this perspective, speech acts are strategic signals in a context of cooperation and conflict (Pinker, Nowak, and Lee 2008).

The encryption theory of humor (Flamson and Barrett 2008) maintains that humor is produced by encrypting multiple implicatures within an utterance that can only be understood by audience members who share relevant background information (including attitudes, beliefs, and preferences, in addition to propositional knowledge). When an audience member has access to this background information, he or she is able to "decrypt" the hidden implicature(s) — that is, they "get" the joke. This hypothesis builds on a relevance theoretic model of inferential communication (Sperber and Wilson 1995), and predicts that the explicit marking of humor will depend largely on context and audience composition (see also Clark and Schaeffer 1987; Yus 2003). In contexts where people are particularly motivated to appeal to as many audience members as possible, they would be expected to mark their humor production in a variety of ways to facilitate the detection of encrypted content, and thereby enhance the breadth of audience members that would be able to detect their similarity with the speaker. Conversely, in contexts where speakers are motivated to solicit pre-existing ties, they would not be expected to mark humor, highlighting the depth of similarity with those audience members who manage to detect the encryption.

We examined spontaneous humor production in a community setting amongst individuals with long standing social ties. Based on the encryption theory of humor, we expected that there would be relatively little explicit marking of jokes in this specific context. The goals of most speakers revolved around official business of a cooperative work organization, and in this capacity, most speakers were highlighting depth of similarity with close social allies. When encrypting information, speakers should not provide disambiguating information to those without an ability to decrypt the information, and thus, laughter can honestly reveal possession of relevant implied information (i.e., a key). As described below, we explored the acoustic features of speech containing humor and looked for measurable changes in speech prosody (i.e., prosodic contrasts), and we expected that the amount and nature of prosodic contrasts between punch lines and set-up information would

be comparable to contrasts between set-up speech and speech immediately preceding it (baseline).

2. Method

2.1 Recordings

Field Site. The recordings were obtained during the course of ethnographic field work on the *Assentamento de Boa Ventura*, a collective farm in the state of Ceará, in northeastern Brazil. Until 1997, the *assentamento* was a traditional share-cropping plantation, and the site of prior ethnographic fieldwork (e.g., Johnson 1971). In 1997, the farm was collectivized as part of the government's agricultural reforms, and saw the arrival of an influx of new residents. The residents produce individual crops for use and sale, individual herds of livestock (cattle, goats, and pigs), and collective crops whose sales fund the *Assentamento*'s activities and provide monthly dividends to the residents.

Although approximately 200 individuals reside on the farm, the activities are organized around 64 *assentados* ("seat-holders") who each represent a household and jointly comprise the governing board. Sixty of these seat-holders are male, four female, and ages range from 29 to 66. The farm is managed via monthly meetings of these seat-holders, which typically run 2–3 hours. These meetings generally consist of extended, free-flowing discussion of problems confronting the farm, such as livestock overgrazing, or insufficient participation at weekly collective labor activities. As this context is oriented more towards serious discussion than casual socializing, conversational humor is a relatively infrequent occurrence, and typically appears as an aside in the course of a substantive discussion. All meetings are conducted in Portuguese.

Utterance identification and extraction. Examples of spontaneous humor were taken from two meetings of the governing body of the *assentamento* (January and May, 2007). The examples were selected based on the presence of laughter (audience or speaker) after the utterance. This method does not likely identify all instances of humor in the samples (see Attardo 1994). There are certainly instances of intentional humor that do not result in laughter, and bouts of laughter often occur that are not responses to intentional humor (e.g., Provine 2000). However, using laughter as a proxy for humor is useful for this analysis — that is, we are exploring successful instances of the "humor complex" that include both humorous utterances and laughter responses. Excluding cases of humor where no laughter is produced likely works against our acoustic predictions for at least two reasons. One reason laughter does not follow humor is because a joke fails, so analysis of

these cases might obfuscate cases of successful joking, the phenomenon of interest. Secondly, laughter might not occur when audience members do not want to reveal that a joke occurred to those who do not get it. These cases are highly likely to be free from disambiguation in their production as well (for the same reason), so their exclusion works against our predicted outcome. Also, there is the possibility that laughter was not in direct response to some of the speech we identified as humorous, but there is no reason to expect that these utterances would be systematically marked or not marked prosodically and thus confounding in our analysis. None of the speakers were observed to be surprised at the laughter response, provisionally indicating intentional humor.

Forty brief samples of humorous statements and immediate laughter were obtained from a total of 4.75 hours of recorded conversation. Eleven of the recordings had too much overlapping speech for reliable acoustic analysis, and so were removed. In four instances there was no discernible distinction between the set-up and the punch line (see below), so these recordings were also excluded. Finally, because only a single statement was produced by a female speaker, it was also excluded. This was done not only to simplify the acoustic analyses, but also to avoid analytical and theoretical complications related to known gender differences in humor production (see Kotthoff 2006b) beyond the scope of the current study. This left a sample of 24 recordings each of which included a non-humorous statement, a humorous statement, and laughter (Mean length = 11.05 sec., SD = 4.32 sec., Range = 3.62–19.38 sec.).

The recordings were made with an Edirol R-09 WAVE/MP3 Stereo Field Recorder as stereo mp3-format files (44.1 kHz, 16-bit, 320 kbps). After identifying and extracting the recordings, the amplitude of each was individually normalized (so the amplitudes are not constant across recordings). These recordings were then divided into three separate files: (1) non-humorous *baseline* sample, (2) *set-up* for the humorous sample, and (3) the *punch line* for the humorous sample. Laughter portions were removed from each recording. The files were then converted to mono wav-format files and resampled using an anti-aliasing filter (11.025 kHz, 16-bit). The full instances were transcribed by a native speaker of Portuguese (see Appendix B).

Acoustic analyses. For all sound files the following acoustic measurements were made using Praat (Version 5.1.07): overall mean fundamental frequency (F0), F0 variability (F0 SD), overall mean amplitude (dB), amplitude variability (dB SD), and speech rate measured by mean syllable duration (MSD). MSD was calculated manually by dividing the total time of all present acoustic energy corresponding to an utterance (identified through waveform and spectrograph displays) by the number of actual spoken syllables (as opposed to underlying syllable structure).

Changes greater than 30ms were considered significant, which is well above just-noticeable-differences in speech rate (Quene, 2007). Once all measurements were obtained, within-speaker comparisons were performed using t-tests for independent groups with Bonferroni-corrected probability values (.05/24 tests = .002) between (1) baseline and set-up utterances, (2) baseline and punch line utterances, and (3) set-up and punch line utterances. A between-speaker analysis was also performed using MANOVA with utterance condition (i.e., baseline, set-up, and punch line) as the independent variable and the six acoustic dimensions as dependent variables. Basic systematic prosodic production in conjunction with conversational humor should be revealed by measuring these global dimensions.

3. Results

The F0 and dB means and standard deviations, as well as mean syllable duration (MSD) values for all utterances can be found in Appendix A. Overall, aggregating across all six acoustic dimensions, punch line speech contrasted with set-up speech (73%) slightly more than set-up speech contrasted from baseline speech (68%) but the difference was not significant, $z = 0.99$, $\varphi = 0.06$, $p =$ ns. Figure 1 shows the percentage of significant contrasts in utterance pairs for all acoustic dimensions. On average, punch line speech had slightly more prosodic contrasts (i.e., co-occurring) from set-up speech ($M = 3.67$, $SD = 0.92$) than the set-up speech had from baseline speech immediately preceding it ($M = 3.38$, $SD = 1.13$) but this was also not significant, $t(24) = 1.07$, $p =$ ns. Figure 2 shows percentages of utterance pairs having co-occurring contrasts.

To check for systematic differences between utterance types on the prosodic measurements, means on the six acoustic dimensions across 24 utterances in each category (baseline, set-up, and punch-line) were calculated (see Table 1). To correct for between–speaker variability issues in F0 measurement, all F0 values were converted to semitones (relative to 50Hz) but actual F0 values are reported in the table.

A Repeated Measures MANOVA was used with utterance type as the within-subjects factor, and the six acoustic dimensions as dependent variables, and the overall model was significant, $F(12, 84) = 1.99$, $p < .05$, $\eta^2 = 0.22$. Univariate tests showed that only dB (i.e., loudness) was significantly different across all utterances pairs, $F(2, 23) = 5.91$, $p < .01$, $\eta^2 = 0.20$. Planned comparisons with least-significant-difference tests revealed that the baseline dB was significantly lower than the set-up dB ($p < .01$) and punch line dB ($p < .05$), but set-up dB and punch line dB were not significantly different ($p =$ ns.). F0 range was marginally significant, $F(2, 23) = 2.94$, $p = .06$, $\eta^2 = 0.11$. Planned comparisons revealed that punch line

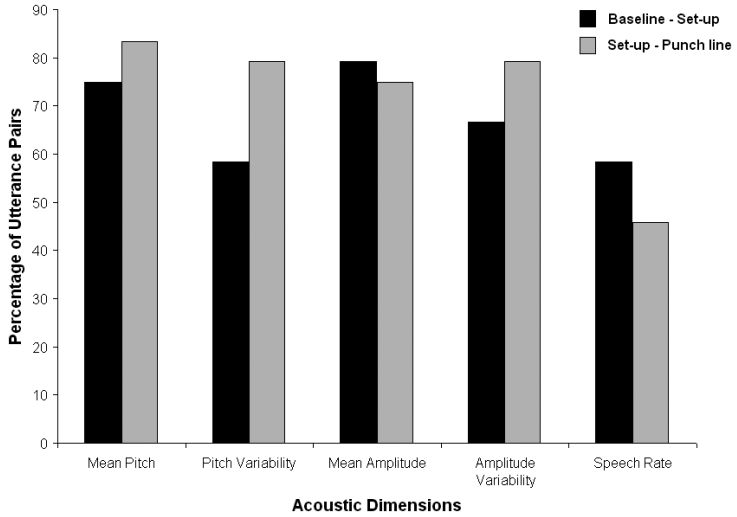

Figure 1. Percentage of utterance pairs with significant contrasts across six acoustic dimensions: Baseline versus Set-up speech and Set-up versus Punch lines.

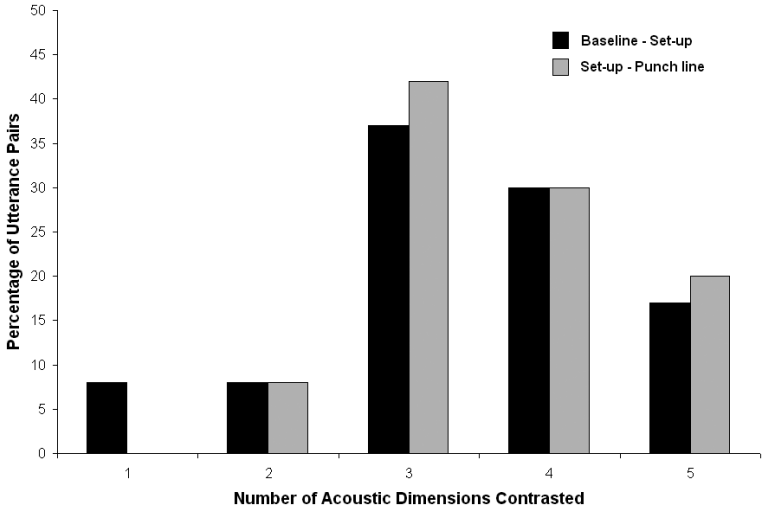

Figure 2. Co-occurrence of individual prosodic contrasts: Baseline versus Set-up speech and Set-up versus Punch lines.

F0 range was significantly lower than baseline F0 range ($p < .05$), and marginally lower than set-up F0 range ($p = .10$).

Absolute changes in all prosodic dimensions were measured between baseline and set-up pairs, and between set-up and punch line pairs, and these changes were compared. No differences in absolute changes were observed (all ps $> .05$). We also examined the direction of change across all dimensions. While no absolute

Table 1. Means and standard deviations for six acoustic dimensions across 24 baseline, set-up, and punch line utterances.

Acoustic Dimension	Baseline		Set-up		Punch line	
	Mean	SD	Mean	SD	Mean	SD
F0	197.6	36.0	203.4	38.2	206.7	31.2
F0 SD	32.7	15.6	33.1	17.2	31.7	22.9
F0 Range	165.1	82.1	157.4	87.2	126.5	75.7
dB	71.3 *	0.8	73.8	0.6	73.6	0.7
dB SD	5.0	0.3	5.3	0.3	4.9	0.3
Syllable Duration	175	8.1	185	14.8	168	8.3

Note: * = $p < .05$.

differences occurred in the comparison between baseline and set-up contrasts nor between set-up and punch line contrasts, and only one acoustic dimension (mean dB) was different across all speakers, there could be a pattern in the direction of prosodic changes. But for all acoustic dimensions in both analysis pairs (baseline — set-up and set-up — punch line) directions of change were mixed, and only one was significantly biased. Loudness contrasts (mean dB) between baseline and set-up speech were more often due to amplitude increases, not decreases (12 contrasts louder, 7 softer), $z = 1.62$, $\varphi = 0.26$, $p = .05$.

4. Discussion

We examined the acoustic characteristics of Portuguese spoken humor in the context of a collective work farm in rural Brazil. There has been only very limited work examining how speakers mark humor explicitly using vocal signals, and cognitive theories make few predictions of how vocal correlates will manifest themselves in various types of humor production. The encryption hypothesis predicts that in situations where speakers seek to reinforce established social ties, speakers should enhance the signal value of their conversational humor by *not* marking, limiting the number of audience members capable of detecting the humor. As expected, we found little evidence of prosodic signaling of humor — speakers failed to change their voices in any systematic way either when they were setting up a humorous statement, or delivering a punch line.

We did find that speakers increased the loudness of their voices during the set-up of a joke (and the subsequent punch line) relative to baseline speech immediately preceding it. However, in many of the samples, audience laughter actually began before the speaker had completed the punch line, likely necessitating

an increase in loudness in order to be heard. This suggests that speakers were not marking humor per se, but instead were ensuring they were audible. This pattern of loudness change would not likely provide either a reliable cue or signal of humor, because there are many reasons why speakers increase the loudness of their voices to be heard. Moreover, we found that speakers tended to narrow the pitch range of their voices when producing punch lines — another possible strategy to penetrate a noisy environment.

By not presenting the audience with an ostensive marker of "this is a joke now", this kind of conversational humor limits its detection to those audience members with sufficiently high common ground to detect the presence of encryption more or less spontaneously, without actively searching for a humorous interpretation. These kinds of jokes can be an effective means of reminding your allies that they share a similar cognitive environment with you. Highlighting the depth of pre-existing relationships can prove an effective means of soliciting support from co-operation partners. This contrasts with the potential consequences of ostensively marking humorous utterances with framing devices and specialized paralinguistic signals. By drawing attention to the presence of a humorous stance and inviting the audience to seek out a humorous interpretation, one broadens the appeal of a claim to similarity at the expense of its depth. Those more overt sorts of strategies are more likely to be found in the initial stages of alliance-building, when individuals are attempting to discover new potential allies that merit pursuing.

In a context such as the collective board meeting where these recordings were obtained, pursuing new alliances through overtly marked humor might be both risky and counter-productive, as the risks of publicly failing to be humorous would reduce one's ability to recruit more allies in an argument, and not serve as a particularly effective enhancer of pre-existing relationships. Here, mostly brief and unmarked humor would be effective for pursuing communicative goals — something that serves as a quick reminder to friends that they like you and share your interests especially in relation to the context at hand.

It is important to note that the communicative function of encryption in humor is not primarily the exclusion of out-group members (although that facet may be exploited in certain contexts), but rather the verification of claims to similarity being made by speaker and audience. While other researchers have investigated how speakers can use encrypted "keys" to conceal their meaning from overhearers (Clark and Schaefer 1987), the encryption theory of humor derives its explanation of the structure of humor from the utility of honestly indexing the overlap in cognitive environments. Because successful humor relies on a non-random fit between otherwise obtuse speech and information implicitly available to some audience members, it serves as an honest signal (in the game theoretical sense, see Maynard Smith and Harper 2003) of the fact that the speaker possesses the same

implicit knowledge that the audience members rely on to successfully detect the presence of the joke. Those audience members who do not get the joke are ancillary to the process — in some cases, the fact that there was a joke they did not get may go completely unnoticed, while in other cases this feature may be intentionally exploited to make their out-group status manifest.

Nevertheless, the vocal strategies employed in such complicated communicative contexts are likely to be highly varied. Not only are there a variety of ways to accomplish the same goal, but the incredible diversity in situational contexts will call for many different kinds of disambiguation. The trade-offs between depth and breadth involved in the process of encryption in humor can be understood in an error management framework (Haselton and Nettle 2006; Haselton et al. 2009). Strategies employed for encrypting information in everyday talk can be construed as more or less costly to implement — the cost of potential target misunderstanding must be weighed against the cost of reducing the signal value of the utterance. Obscuring meaning in an obtuse joke might risk confusing target listeners as well as out-group audience members, but making jokes too obvious risks making the necessary keys so widely available that the discriminating function of broadcasting and detecting greater or lesser similarity is impossible. Depending on the context, speakers can move in either direction on this axis of being understood by all versus being understood by none. Although the extremes are both useless for assortment activities, some cases (such as people attempting to recruit new allies) call for casting a broad net, while other contexts (such as reinforcing existing ties with close allies) call for directing a precise strike.

Future work should explore the subtle dynamics of humor production in spontaneous contexts especially when groups are mixed and alliance dynamics are at play. Speakers use a variety of devices to achieve communicative goals through humor, and most of these do not likely involve explicit marking. Conversely, when speakers are attempting to appeal to a wide audience and be sure to broadcast that a joke is being made, explicit marking should occur. These are but a few predictions about the nature of humor production that can be generated from the encryption theory of humor.

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References

Attardo, S. 1994. *Linguistic Theories of Humor*. Berlin: Mouton de Gruyter.

Attardo, S. 2001. "Humor and irony in interaction: From mode adoption to failure of detection". In Anolli, L., R. Ciceri, and G. Riva (eds), *Say Not to Say: New Perspectives on Miscommunication.* Amsterdam: IOS Press, 166–185.

Bryant, G.A. 2010. "Prosodic contrasts in ironic speech". *Discourse Processes* 47(7): 1–22.

Bryant, G.A. 2011. "Verbal irony in the wild". *Pragmatics & Cognition* 19(2): 291–309.

Bryant, G.A. and Fox Tree, J.E. 2005. "Is there an ironic tone of voice?". *Language and Speech* 48(3): 257–277.

Clark, H.H., and Schaeffer, E.F. 1987. "Concealing one's meaning from overhearers". *Journal of Memory and Language* 26(2): 209–225.

Flamson, T. and Barrett, H.C. 2008. "The encryption theory of humor: A knowledge-based mechanism of honest signaling". *Journal of Evolutionary Psychology* 6(4): 261–281.

Haselton, M.G., Bryant, G.A., Wilke, A., Frederick, D.A., Galperin, A., Frankenhuis, W.E., and Moore, T. 2009. "Adaptive rationality: An evolutionary perspective on cognitive bias". *Social Cognition* 27(5): 732–762.

Haselton, M.G. and Nettle, D. 2006. "The paranoid optimist: An integrative evolutionary model of cognitive biases". *Personality and Social Psychology Review* 10: 47–66.

Heath, R. and Blonder, L. 2005. "Spontaneous humor among right hemisphere stroke survivors". *Brain and Language* 93(3): 267–276.

Johnson, A.W. 1971. *Sharecroppers of the Sertão: Economics and Dependence on a Brazilian Plantation.* Stanford, CA: Stanford University Press.

Kotthoff, H. 2006a. "Pragmatics of performance and the analysis of conversational humor". *HUMOR: International Journal of Humor Research* 19(3): 271–304.

Kotthoff, H. 2006b. "Gender and humor: The state of the art". *Journal of Pragmatics* 38: 4–25.

Maynard Smith, J. and Harper, D. 2003. *Animal Signals*. New York: Oxford University Press.

Norrick, N. 2001. "On the conversational performance of narrative jokes: Toward an account of timing". *HUMOR: International Journal of Humor Research* 14(3): 255–274.

Norrick, N. 2003. "Issues in conversational joking". *Journal of Pragmatics* 35(9): 1333–1359.

Pickering, L., Corduas, M., Eisterhold, J., Seifried, B., Eggleston, A., and Attardo, S. 2009. "Prosodic markers of saliency in humorous narratives". *Discourse Processes* 46: 517–540.

Pinker, S., Nowak, M.A., and Lee, J.J. 2008. "The logic of indirect speech". *Proceedings of the National Academy of Sciences of the United States of America* 105(3): 833–838.

Provine, R.R. 2000. *Laughter: A Scientific Investigation*. New York: Viking.

Quene, H. 2007. "On the just noticeable difference for tempo in speech". *Journal of Phonetics* 35(3): 353–362.

Sperber, D. and Wilson, D. 1995. *Relevance: Communication and Cognition*, 2nd ed. Cambridge, MA: Blackwell.

Yus, F. 2003. "Humor and the search for relevance". *Journal of Pragmatics* 35(9): 1295–1331.

Appendix A

Means for acoustic measurements of baseline, set-up, and punch line speech. Comparisons were between 1) Baseline — Set-up, and 2) Set-up — Punch line.

Sample	Type	F0	F0 SD	dB	dB SD	MSD
01	Baseline	199	30.3	71	3.6	183.8
01	Set-up	183*	29.7	71	5.2*	147.8+
01	Punch line	183	22.1*	71	6.2	176.1
02	Baseline	154	28.5	61	5.6	256.0
02	Set-up	150	38.7	66*	5.9	150.2+
02	Punch line	152	15.8	69*	4.9	141.5
03	Baseline	207	30.4	75	3.8	108.3
03	Set-up	222*	31.2	74*	6.4*	173.0+
03	Punch line	210*	23.2*	72*	6.0	161.8
04	Baseline	135	30.2	65	6.7	199.2
04	Set-up	160*	25.6	71*	6.2*	210.3
04	Punch line	199*	35.4*	76*	4.1*	165.2+
05	Baseline	192	32.2	72	4.9	140.4
05	Set-up	206*	15.8*	74*	5.4	158.0
05	Punch line	200	34.0*	71*	3.3*	138.7
06	Baseline	147	19.7	68	5.1	208.2
06	Set-up	147	32.5*	66*	4.6	291.5+
06	Punch line	156*	16.2*	71*	6.8*	267.9
07	Baseline	203	34.7	75	4.2	118.8
07	Set-up	227*	40.6	72*	5.1*	141.3
07	Punch line	202*	33.9	73*	3.4*	180.9+
08	Baseline	159	15.2	67	4.4	199.4
08	Set-up	175*	16.4	68	5.9*	241.6+
08	Punch line	190*	20.6*	68	4.8	251.3
09	Baseline	191	20.3	72	5.9	170.2
09	Set-up	232*	85.0*	79*	4.6*	192.4

Note. * $p < .002$ (Bonferroni corrected α); + MSD diff > 30 ms. F0 = fundamental frequency (pitch); F0 SD = fundamental frequency standard deviation (pitch variability); dB = decibels (loudness); dB SD = decibel standard deviation (loudness variability); MSD = mean syllable duration (speech rate).

Appendix A. (continued)

Sample	Type	F0	F0 SD	dB	dB SD	MSD
09	Punch line	189*	15.7*	74*	5.9	149.9+
10	Baseline	233	40.3	72	8.9	201.4
10	Set-up	215*	70.9*	69*	7.1*	216.1
10	Punch line	211	10.4*	64*	6.1	156.1+
11	Baseline	209	39.6	74	5.8	172.0
11	Set-up	178*	15.2*	67*	5.3	142.0
11	Punch line	185	28.2*	68	6.3	241.2+
12	Baseline	180	39.3	75	4.6	211.7
12	Set-up	148*	17.0*	73	5.8*	145.5+
12	Punch line	246*	94.7*	71*	7.5*	213.5+
13	Baseline	151	9.4	77	3.9	204.0
13	Set-up	215*	24.1*	79*	1.5*	168.2+
13	Punch line	152*	18.6	74*	3.4*	146.8
14	Baseline	196	85.9	72	5.7	195.8
14	Set-up	226*	30.7*	67*	6.0	222.3
14	Punch line	207*	17.6*	71*	4.3*	196.2
15	Baseline	208	22.1	78	3.8	145.4
15	Set-up	159*	19.4	71*	3.8	89.5+
15	Punch line	181*	23.3	72	3.8	141.6+
16	Baseline	201	17.8	71	3.5	158.6
16	Set-up	205	27.8*	70	4.0	202.8+
16	Punch line	173*	17.5*	70	5.1*	187.8+
17	Baseline	201	34.6	74	6.0	161.4
17	Set-up	207	47.0	73	4.6	178.1
17	Punch line	216	32.5*	71*	3.5*	108.7+
18	Baseline	272	50.7	73	5.3	136.6
18	Set-up	225*	44.4*	70*	5.5	151.5
18	Punch line	318*	106.5*	69	3.6*	142.0
19	Baseline	218	34.0	73	4.4	125.6
19	Set-up	218	36.0	72*	4.8	117.4

Appendix A. (continued)

Sample	Type	F0	F0 SD	dB	dB SD	MSD
19	Punch line	215	28.0*	76*	4.0*	131.3
20	Baseline	241	35.0	75	4.5	113.1
20	Set-up	240	33.4	75	4.7	149.1+
20	Punch line	256*	29.1*	75	5.4	121.4
21	Baseline	241	55.4	66	8.1	154.7
21	Set-up	314*	38.9	71*	5.1*	227.9+
21	Punch line	288*	46.0	68*	4.7	159.2+
22	Baseline	196	21.0	71	3.9	198.4
22	Set-up	214*	33.1*	68*	8.4*	452.0+
22	Punch line	196*	37.6	69	3.1*	174.9+
23	Baseline	151	33.3	65	3.2	197.8
23	Set-up	179*	7.5*	66	5.1*	120.1+
23	Punch line	175	22.4*	64*	5.9	152.8+
24	Baseline	260	24.7	71	4.9	244.7
24	Set-up	238*	33.7*	71	5.8	154.1+
24	Punch line	258*	32.3	74*	4.7*	132.4

Appendix B

Transcript of baseline, set-up, and punch line speech

#X: = Sample ID
A) Baseline, B) Set-up, C) Punch line
{xxxx} = Non-focal speaker
Bold = Translation
[?] = Unintelligible

1A: Quem botou o rapaz pra fora foi você.
You were the one who kicked the guy out.

{Por que?}
{Why?}

1B: Eu disse, Olha, voce não tem direito de contar dinheiro não.
I said, Look, you don't have the right to count money.

1C: Quem queria a contar, tem um contador, quem queria um [?] pra contar [?] com o contador, ai, vergonha

Who would want to count, there's an accountant, who would want a [?] to count [?] with the accountant, jeez, for shame.

2A: Quem, minha mulher? Não…
Who, my wife? No…

{Aí Reginaldo, senta…será que [a Carol] não pode escrever não?}
{Hey, Reginaldo, sit…why couldn't Carol write?}

2B: Tsk, tsk, tsk. De jeito nenhum. Da minha familia 'tô lhe disendo que a,
Tsk, tsk, tsk. No way. As far as my family goes, I am telling you that

2C: A minha familia até eu 'to com vontade de, de abondonar as terras nossa tambem.
For my family, even I feel like abandoning our lands, too

3A: Aonde eu um dia se apagando o dinheiro 'ta com…eu vou tirar a manga.
Where I one day was going out for the money was with…I'm going to take off the shirt-sleeves.

3B: Por que a Zete vai pra lá por um papo, quando Zete chega lá, que a ponta é
Because Zete goes over there for a chat, when Zete gets there, the point is

3C: Eles viram pra traz e vem que — vem com tudo.
They turn around and come — they come with everything.
Part A came after parts B & C

4A: Todo mundo trabalhando e o cara falando engonhado discutindo umas coisas [?] trabalho,[?] né? Compra um macaco* [?] e disse oi!
Everybody's working and the guy blabbing away discussing something [?] work [?], right? Buy a monkey* [?] and say "hey"!
** Strictly translated; "macaco" could also mean "overalls" or "ugly face" or "old hand", depending on the context, which is unintelligible.*

4B: O assunto pessoal só é quem 'tá [?] igual o assunto pensando.
The personal thing is only who is [?] equal to the thing we're thinking about.

4C: [?]
Unintelligible

5A: O que é pobre é bicho feliz. Pobre não fica de resto com a roupa [?]
A poor guy is a happy guy. A poor guy doesn't stay apart from that with his clothes [?]

5B: é ficar satisfeito
He ends up satisfied

5C: Fica em cima de ruim, sabe
He ends up above the bad stuff, you know

6A: Queria acertar que chega lá às sete e meia, oito horas,
I wanted to make sure that we're arriving there at 7:30, 8 o'clock.

6B: O cara vai e você sem soco na mata.
The guy goes and you without a punch in the forest

6C: Quando é {laughter, other speaker} preguiça [?]

When it is {laughter} laziness [?]

7A: Não pode ser assim com o Leonardo, agora só [?] trabalha e se eu empurrar um filho [?] eu não encontro trabalho [?] de jeito nenhum não. Eu gosto de começar de casa.
It can't be this way with Leonardo, only now [?] work and if I push a son [?] I won't find work [?] in any way. I like to start at home.

7B: Agora só vou pagar o meu amigo com dinheiro
Now I'm only going to pay my friend with money

7C: e o jeito é aceitar é problema {laughter} não é meu, né
And the only thing I can do is accept it {laughter} it's not my problem, right?.

8A: [?] voce andou num cabo de lança.* O cabo 'tava sentado de uma vez, é isso.
[?] you went with the end of a spear*. The thing is the end was sitting for a time.
**Strictly translated, this refers to the sharpened sticks the farmers generally carry with them for protection from snakes when working in the fields. There is also a widely-recognized phallic connotation.*

8B: Me juraram de
They swore to me that

8C: me pegar.
they would get me

9A: Eu tinha um dinheiro pra cana que foi discontado. O.
I had some money for sugar cane that was discounted/disallowed/deducted. Hey.

9B: O que eu não avisei
What I didn't mention / What I warned against

9C: Logo aviso é meu
I'm saying is mine / The warning was soon mine

Lots of ambiguity in exactly what each of these bits mean. Also, part A came after B & C.

10A: Mês pasado, eu trabalhei e não sobrou um dia
I worked all last month and didn't miss a day

10B: E esse mês eu não paguei ninguem, aí
And this month I didn't pay anyone, so

10C: Porque diz que tem o dinheiro por o peixe.
Because they say that there would be money for the fish

11A: E oito pra cá e os outros ficaram de [?] de baixo dos pés de pau lá
And from eight on the others stood around below the trees over there

11B: E eu quando terminei eu tava que eu não aguentava andar.
And when I finished I couldn't even walk

11C: Só dois nós riscámos
Just the two of us lined it up*

** Referring to marking off the area to be cleared in a field, while the others stood around the trees doing nothing.*

12A: O resto não vem, os outros não não não
The rest don't come, the others no, no, no

12B: Se escondem com medo porque com medo da falar dos…
They get scared and hide because they're afraid to speak of…

12C: [?].{laughter} Não tem aí, por causa de nada, não.
[?]. {Laughter} There's no reason, because of nothing, no.

13A: [?]
Unintelligible

13B: [?]
Unintelligible

13C: [?]
Unintelligible

14A: Pedro da Silva
Pedro da Silva

14B: Rapaz, nem passou aqui
Man, he didn't even come by here

14C: [?] presença aqui.
[?] presence here

15A: Beba [?] não
Drink [?] no

15B: Faze o milho e eu faço o gado
He does the corn and I do the livestock

15C: Não porque tá {laughter} acabando com nossa [?].
No, because it's {laughter} ruining our [?].

16A: Mesmo que nós não tinhamos um pedaço [?] não dá pra fazer
Even if we didn't have a piece, [?] it wouldn't work

16B: Os dois me deixou a casa
The two of them left me at home

16C: E já 'tô dizendo, cara.
And that's what I'm saying, man
Part A came after parts B & C

17A: Falta ouro que não tinha pra vende. Só pra ir a Fortaleza, e ficou todo o dia lá em casa
Didn't have anything to sell. Only option was to go to Fortaleza, and spent the whole day at home there

17B: Rapaz, vamos cortar minha terra, vamos cortar minha terra,
Man, let's cut up my land, let's cut up my land

17C: E agora não posso cortar não que todo mundo 'tá grande.
And now I can't cut it because everything's big

18A: Meu primo aqui — rapaz 'cê foi pra cá [?].
My cousin here — man you went over there [?].

18B: Rapaz, foi uma pintura mais média do mundo e lá todo mundo dezoito é da sistema.
Man, it was one of the most average paintings in the world and there everyone 18 is in the system.

18C: Fazendo não sei o que, né? {laughter} [?] para a mesma coisa me dá um real e meia.
Doing I don't know what {laughter} [?] for the same thing I get BR$1.50.

19A: Tudo no aberto. Nós 'tamos com tudo bem dizer no aberto. Esse assentamento tá todo no aberto.
Everything in the open. We're talking about everything in the open. This entire settlement is all in the open.

19B: Todo no aberto que eu digo é, no extremo, porque vendo esse assentamento aqui,
All in the open that what I'm talking about is, in the extreme, because if I sell this settlement here,

19C: se nós for tirar dá p'ra certa o assentamento em redor oito vezes
if we were to pull it off, we could definitely get around eight times for the settlement.

20A: Se um cara foi expulso do coletivo, o que ele tem do coletivo ele perde tudo.
If one guy is expelled from the Collective, then what he has from the Collective he loses everything.

20B: Porque se, é, se você expulsa eu do coletivo só do servico
Because if, if you expel me from the Collective, just from the labor,

20C: mas eu tenho o resto das coisas, tudo mundo vai querer isso.
but I have everything else, everyone would want this.

21A: Foi ou não foi seu João? [?] disse a noite?
Was it or wasn't it, João? [?] said that night?

21B: Aí ele foi e disse, ele disse, não sei
Then he went and said, he said, I don't know

21C: Se um disse que anda pra aqui pra qualquer merda aqui dentro. Eles não batem nem na minha porta.
If someone said that he was going around here for some crap or another inside here. They wouldn't even knock on my door.

22A: Não é só nois não.
It's not just us.

22B: Quem faz favor de
Who could do the favor of

22C: não é, não é de conta [?] {laughter}
No it's, it's nobody's business [?] {laughter}

23A: Poluicão, era poluicão, né?
Pollution, it was pollution, right?

23B: Aí se outro acende um fogo
Then, if someone else starts a fire

23C: eu posso acusar ele, né?
I can accuse him, right?

24A: É porque os sem-terra [?] não tem não [?]
It's because the MST [?] don't have no [?]

24B: Estava com três [?] pago no mês [?] desse tamanho
There were three [?] paid for the month [?] this size

24C: [?] vai passar três, não sei as penas
[?] going to pass three, I don't know what the penalties are

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