Speakers and listeners don't agree: Audience design in the production and comprehension of acoustic prominence

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EXPERIMENT 1

The Uniform Information Density (UID) hypothesis predicts that words which carry more information in a discourse will have longer duration. (Frank & Jaeger, 2008; Levy & Jaeger, 2007; see also Aylett & Turk, 2004)

Experiment 1 tests the prediction that speakers will produce durations that are related to amount of discourse change.

METHODS

Task

Speakers viewed objects moving in on a computer screen (Figure 1) and described these movements to an experimenter who replicated the movements on a separate computer.

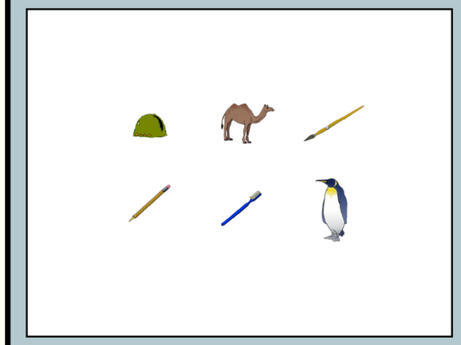

Figure 1. Example computer display for Experiment 1 at start of trial.

Design

3 conditions were defined by the context (first) utterance:
- Given condition: Critical item (camel) previously mentioned in the same syntactic position
- Shift condition: Critical item previously mentioned in a different syntactic position
- New condition: Critical items not previously mentioned

[1] Example utterances
1. Context utterance:
Given: The camel above the helmet.
Shift: The pencil goes above the camel.
New:The pencil goes above the helmet.
2. The camel goes to the right of the penguin.

METHODS CONT.

Participants

- 6 participants (3 males, 3 females)
- 5 items (5 items x 3 conditions = 15 trials per participant)
- chosen from larger set for audio clarity and consistent production of critical item.

RESULTS AND DISCUSSION

Measured several acoustic variables (Table 1) on each critical word ("camel").
-- Duration was significantly related to condition
-- No other significant findings

	Means by Condition			Model Comparison t values	
Acoustic Variable	Given	Shift	New	Given vs. Shift	Given vs. New
F0 Max (Hz)	161.9	163.0	163.7	0.25	0.42
F0 Min (Hz)	140.0	145.5	142.9	1.34	0.70
F0 Difference (Hz)	21.9	17.5	20.9	-0.69	0.27
F0 Mean (Hz)	148.4	153.0	151.6	1.29	0.88
F0 Slope	0.072	0.053	0.061	-1.24	-0.37
F0 Alignment	0.45	0.36	0.42	-1.35	-0.46
Intensity Mean (dB)	69.6	69.6	70.2	0.03	0.85
Duration (ms)	321.1	345.8	352.0	1.89†	2.36*

†p<.10 *p<.05

Table 1. Means of acoustic variables measured in Exp 1 for each condition and t values for models which predict each acoustic variable.

EXPERIMENT 2

Experiment 1 shows that duration is related to amount of disource change as predicted by UID.

Experiment 2 tests whether listeners alsp use this distinction.

METHODS

Task

Participants rated the prominence of the second (critical utterance from each trial in Experiment 1.

METHODS CONT.

Participants

- 44 Participants total
- 6 dropped from analysis (1 due to technical error; 5 for failure to complete the task as directed)

RESULTS AND DISCUSSION

Ratings by condition

Tested whether participants' ratings were significantly different in the 3 conditions (given, shift, new) (Figure 3)
- Given vs. Shift: t = -1.576, p > .10.
- Given vs. New: t = -1.83, p < .10

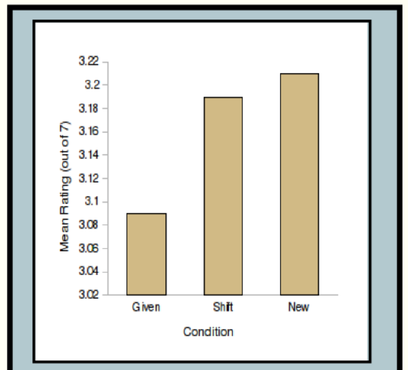

Figure 3. Mean rating (7 possible) for Experiment 2 in the Given, Shift, and New conditions.

Ratings by acoustic variable

Intensity Mean was the best predictor of listeners' ratings, t = -5.13, p < .001

Duration was not significantly related to listeners' ratings, t = -1.16, p>.05

CONCLUSION

UID predicts that speakers will optimize communication by varying the duration of a word with the amount of information carried by that word (Frank & Jaeger, 2008; Levy & Jaeger, 2007; see also Aylett & Turk, 2004).

-- In Exp 1, duration was significantly related to the amount of discourse change.
-- In Exp 2, listeners' ratings of prominence were not related to duration (Isaacs & Watson, 2008; Lam & Watson, 2008).

Thus, the relationship between duration and information density of words may be due to speaker-internal rather than to communicative processes.

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