The Information Value of Some Hesitation Phenomena: Filled Pauses, Lengthenings, and Entropy Reduction

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Abstract: Such hesitation phenomena as filled pauses (e.g., *uh*, *um*) have been argued to serve a pragmatic role as markers of impending hesitation on the part of the speaker (Smith and Clark, 1993; Clark and Fox Tree, 2002). Lengthenings (e.g., *a:nd*, *we:ll*)—also hesitation phenomena—are arguably similar. In short, these hesitation markers constitute information from which listeners make inferences. The present research reports on an effort to use entropy reduction (Shannon, 1948) in a corpus analysis to investigate the relationship between hesitation markers and subsequent delay in spontaneous speech. Results show filled pauses and lengthenings are similar in the way that they mark impending delay.

Background

Such hesitation markers as filled pauses (FPs: *uh*, *um*) have seen increased study recently as overt markers of speech repair processes (cf., Levelt, 1983). Consistent with this, Clark and Fox Tree (2002) argue that FPs serve a pragmatic role as giving an account of an impending delay in communication on the part of the speaker. They present corpus evidence that closed FPs (*um*) signal longer impending delays than open FPs (*uh*) (though see O'Connell and Kowal, 2005 for non-corroborative evidence).

1. and uh I went to . parochial school _
2. but if it was because of the negligence of somebody driving . um _ of course that person would be responsible .

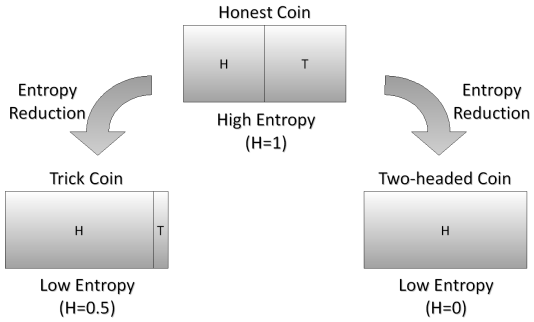
Another hesitation marker is lengthenings (e.g., *a:nd*, *we:ll*).

3. it eventually turned into a: teachers' exchange

Jaeger and Kidd (2008) argue that lengthening of function words is similar to closed FPs in signaling delays. The present research seeks to confirm this claim using an information-theoretic approach.

Information Theory

A given probability space has a certain entropy, H, which is based on the number of outcomes and the relative likelihood of those outcomes—the more balanced the probability of the outcomes, the higher the entropy. Learning some information may cause the relative likelihood of outcomes to change, resulting in a change in the entropy of the probability space.



Information theory (Shannon, 1948) gives a useful way of quantifying the value of this information (called estimated information value or EIV) based on how much entropy reduction is obtained by learning that information. EIV is based on a weighted sum of the entropy reductions for different outcomes.

> Assuming a 1 in 10 chance of a trick or two-headed coin:
> - EIV(*Is it a trick coin?*) = 0.05
> - EIV(*Is it a two-headed coin?*) = 0.10
>
> Thus, *Is it a two-headed coin?* is a more informative question.

The Corpus

The study uses a small, specialized corpus of spontaneous speech (Rose, 1998) which consists of 8,200 spoken words from four different native speakers of English. Various hesitation phenomena

have been marked for type of vocalized hesitation (FPs, lengthenings, as well as false starts, restarts, and repeats) and length of silent pause (short, normal, long).

Study

In spontaneous speech, there is a lot of information being communicated from the speaker to the hearer. The present study focuses on the information about what kind of hesitation marker is being used—open FPs, closed FPs, or lengthenings—and how that relates to the probability of a certain outcome—whether or not the speaker will delay by pausing.

Results

Results from the corpus are as follows. Only function word lengthenings are used in the lengthening analysis.

	No following pause	Following pause
Open FP (*uh*)	97	36
Closed FP (*um*)	42	25
Lengthening (*a:nd*)	67	36

Given a hesitation marker in the form of a FP or lengthening, the entropy, H, of a subsequent pause is as follows.

$$H(pause?) = 0.82$$

Then, the entropy and EIV values for the three different hesitation markers is as follows.

	No following pause	Following pause
Open FP (*uh*)	0.84	0.0005
Closed FP (*um*)	0.95	0.0103
Lengthening (*a:nd*)	0.93	0.0117

In terms of Information Theory, the results reveal high information value for open FPs and lengthenings. Thus, the following conclusions can be drawn from the data.

Conclusion 1: Closed FPs are far more informative than Open FPs about following pauses, indicating a higher chance of a pause.

Conclusion 2: Lengthenings are (slightly) more informative than Open FPs about following pauses, indicating a higher chance of a pause.

Discussion

Results give independent corroboration of Clark and Fox Tree's (2002) theory about open and closed FPs and stand in contrast to O'Connell and Kowal (2005). Furthermore, results are consistent with that of Jaeger and Kidd (2008), showing that lengthenings can also be a signal of impending delay.

This research therefore suggests that FPs and lengthenings may be closely related phenomena in spite of the fact that they are overtly very different.

References

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