Corrigendum to Tic Tac TOE: Effects of predictability and importance on acoustic prominence in language production

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Watson, Arnold & Tanenhaus (2008) used the game of Tic Tac Toe to investigate the link between predictability, importance, and acoustic prominence. We reported that in moves that were unpredictable (and unimportant) the target word, which was the number of a cell in a 3 by 3 grid, was produced with longer duration and a higher F0 than the target word in moves that were predictable (and important). We also reported that the target word in moves that were predictable (and important) was produced with greater intensity. We concluded that importance and predictability were independent factors in acoustic prominence. We found evidence that predictability was linked to speaker-centered processes while importance may be linked to marking important information for the listener.

After publication, we found an error in the scripts used to extract acoustic information from the target number. The data reported in Watson, Arnold and Tanenhaus did not just contain information from the cell number, but also from segments preceding it (usually the entire utterance, although not always). Here we report the correct intensity, F0, and duration for the cell number as well as the entire utterance.

Table 1 presents the means of the acoustic measures of the entire utterance. In an analysis of the entire utterance, predictable moves were reliably shorter than unpredictable moves, $F1(1,19)=51.39$, $p <.001$; $F2(1,8)=157.74$, $p <.001$. In contrast, important moves were produced with greater intensity than unimportant moves, $F(1,19)=20.20$, $p < .001$; $F2(1,8)=12.67$, $p<.01$. There was a numerical trend for F0 to have a higher minimum and lower maximum over the entire utterance in the predictable

condition, but the differences by condition were not consistently reliable by both subjects and items.[1]

In an analysis of just the cell number (Table 2), unpredictable moves were still reliably longer than unpredictable moves, $F1(1,19)=30.25$, $p < .001$; $F2(1,8)=50.06$, $p <.001$. Unpredictable moves had greater intensity then predictable moves although this was only reliable by subjects and not items, $F1(1,19)=6.17$, $p < .05$; $F2<1$. There were no differences in F0.

Thus, the corrected results still support our original conclusion that importance and predictability independently influence acoustic realization. However, this is true only when we consider the utterance as a whole. For the cell number itself, we only found an effect of predictability.

From these data, we can conclude two things. The first is that effects of predictability are not necessarily localized to individual words: both the unpredictable cell number and the words that preceded it were lengthened. This may reflect effects of planning processes being engaged during the production of the words that preceded the target, supported by the fact that the rate of disfluency in these moves was greater. In fact, several models of speech production attribute the reduction associated with predictable material with speaker-centered production processes (e.g. Bell et al., 2009, Bard et al., 2001). Because these words are less difficult to access, they are produced with less prominence. Second, these data suggest that factors that correlate with prominence, such as duration and intensity, can fractionate at the utterance level, and that intensity might play a special role in marking importance information. Although we do

[1]For maximum F0, $F1<1$; $F2(1,8)=8.01$, $p <.05$. For minimum F0, $F1(1,19)=6.41$, $p <.05$; $F2(1,8)=1.57$.

not find evidence for this divergence at the word level in this dataset, more recent work suggests that this is also possible. Lam, Watson and Arnold (2008, 2009) independently manipulated repetition and predictability. They found that repeated words (which are easy to access) are reduced regardless of predictability, and words that are unexpected tend to be uttered with greater intensity, regardless of repetition.

Overall, these data suggest that both predictability and importance can influence the acoustic properties of an utterance but in different ways.

References

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Table 1. The duration, intensity, and F0 of the entire move.

	Important/Predictable	Unimportant/Unpredictable
Duration (ms)	1688 (59)	2732 (173)
Intensity (db)	67.71 (0.84)	67.08 (0.79)
Minimum F0 (Hz)	107 (9)	106 (9)
Maximum F0 (Hz)	188 (15)	189 (15)
Average F0 (Hz)	144 (11)	144 (10)

Table 2. The duration, intensity and F0 of the cell numbers.

	Important/Predictable	Unimportant/Unpredictable
Duration (ms)	479 (23)	537 (22)
Intensity (db)	62.83 (.75)	63.25 (.74)
Minimum F0 (Hz)	115 (7)	112 (7)
Maximum F0 (Hz)	159 (11)	161 (11)
Average F0 (Hz)	135 (9)	134 (8)