Self-reported inner speech salience moderates implicit prosody effects

Mara Breen (Mount Holyoke College) and Evelina Fedorenko (MIT)

According to the Implicit Prosody Hypothesis (Fodor, 1998), readers generate imagined sound representations during silent reading which can influence comprehension. These representations are imagined, so cannot be measured directly. Inspired by prior work demonstrating that individuals' self-reported auditory imagery salience predicts memory for pitch contours (Hishitani, 2009), in the current pre-registered study, we investigated whether self-reported inner speech salience predicts the correlation between silent reading processes, as measured by eye-tracking, and overt reading behavior, as measured by spoken duration. The Varieties of Inner Speech Questionnaire (VISQ) predicts activation in brain areas associated with inner speech tasks (Alderson-Day et al., 2016) and self-reported imagery during silent reading (Alderson-Day, et al., 2017). If implicit prosodic representations are similar to explicit ones, participants with higher VISQ scores should exhibit stronger correlations between silent and aloud reading durations. We also assessed standardized measures shown to predict spoken durations, including the Peabody Picture Vocabulary Test (PPVT) (Spear-Swerling, 2006), Author Recognition Test (ART) (Moore & Gordon, 2015), Digit Span test (Naveh-Benjamin & Ayres, 1986), and Rapid Automatized Naming test (RAN) (Vukovic, et al., 2004), to determine whether they also predict silent reading durations. Finally, the Communication subscale of the Autism Quotient test (AQ-C) modulates implicit prosodic effects (Jun & Bishop, 2015). Therefore, participants with higher scores on the AQ-C should also exhibit stronger correlations between silent and aloud reading word durations.

Participants (N = 62) read 176 syntactically and semantically diverse English sentences twice – once silently and once aloud: 128 were 12-word naturalistic sentences with variable syntactic structure; 48 were syntactically controlled sentences. Twenty-four sentences were read silently and aloud twice, in order to assess the reliability of the reading measures. During silent reading, participants' eyes were tracked with an EyeLink 1000+. During overt reading, participants' voices were recorded with a head-mounted microphone. Participants read both silently and aloud on two separate days, at least a week apart, and completed standardized assessments on the second day. Order of list presentation and modality was counter-balanced.

Using linear mixed-effects regression, we predicted first pass reading time on each word in each sentence from spoken duration, with participant and sentence as random effects. We tested whether the standardized measures individually, and the interaction of the AQ-C and the VISQ with spoken duration, improved model fit by comparing models with and without each term using a likelihood ratio test. Effects which lead to significantly, or marginally, better fit were retained. The final model (Table 1) includes main effects of spoken duration, and the ART and RAN, demonstrating that shorter first pass times are predicted by faster spoken word duration, higher ART scores, and faster RAN times. In addition, the interactions of duration and AQ-C and duration and VISQ were significant, indicating that spoken durations are more predictive of silent reading times for speakers who report a) more salient inner speech, and b) less autistic-like communication skills (contrary to the prediction). In summary, these results demonstrate that the correspondence between silent and over reading processes is modulated by individual differences, providing support for the role of implicit prosody in sentence processing.

	First Pass Duration			
Fixed Effects	*Estimates*	*SE*	*t*	*p*
(Intercept)	208.81	27.13	7.70	**<0.001**
Spoken Duration	84.08	16.18	5.20	**<0.001**
ART	-0.86	0.53	-1.62	0.11
RAN	3.28	1.53	2.14	**0.04**
Spoken Duration x VISQ	0.58	0.21	2.74	**0.006**
Spoken Duration x AQ_C	-3.05	1.25	-2.44	**0.01**

Table 1: Fixed effects in the model predicting first pass duration during silent reading. ART = Author Recognition Test; RAN = Rapid Automatized Naming; VISQ = Varieties of Inner Speech Questionnaire; AQ-C = Autism Quotient, Communication subscale

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