

## Variation in cognitive processing style as a source of listener misperception-based sound change

**Introduction:** Linguists have long hypothesized that sound change occurs when listeners make mistakes: the listener misinterprets the effects of the speaker’s production system or the effects of his own perceptual system as being representative of the speaker’s internal computation (Ohala, 1993; Blevins, 2004). Errors in perception may lead to adjustments in perceptual and production norms. However, little is known about the mechanism through which such adjustments occur. In fact, mounting evidence to the contrary suggests that listeners are adept at compensating for contextual variation in speech perception and production. Listeners, for example, perceive more instances of [s] than [ʃ] in the context of [u] than in the context of [a] (Mann and Repp, 1980); they also perceive more instances of [s] when the talker is male than female (Strand, 1999). Under what circumstances would perceptual compensation (PC) fail to correct for such context-induced variation in speech and how do such failures lead to sound change? This paper provides evidence in support of the hypothesis that differences in individual cognitive processing style affect the magnitude of PC. PC failure thus occurs systematically within a speech community, which may explain why sound change is so prevalent in language.

**Background:** Previous research has established that people with Autism Spectrum Condition (ASC) have limited ability to process perceptual stimuli in reference to the broad contextual information of the percept. Crucially, this connection between nonholistic processing style and behavioral traits associated with ASC exists even within neurotypical population, albeit in a more subtle way. Stewart and Ota (2008), for example, found that total Autism-Spectrum Quotient (AQ) score correlates significantly negatively with the extent of identification shift associated with the ‘Ganong effect’. Using the AQ score as an indirect measure of individual cognitive processing style variation, the present study examined the relationship between total AQ score and the amount of identification shift associated with phonetic context as well as talker gender effects in PC.

**Methods:** Fifty subjects performed a 2-AFC task by listening to a series of CV syllables (C = a synthesized 7-step /s/-/ʃ/continuum; V = /a/ or /u/ in either a female or a male voice) and deciding whether the fricative was /s/ or /ʃ/. Subjects also took the Autism-Spectrum Quotient (AQ) test (Baron-Cohen et al., 2001).

**Results:** Subject responses were modeled using a mixed-effect logistic regression with STEP (1-7), VOWEL (/a/ vs. /u/), TALKER (M vs. F), and AQ (50-200) as independent variables and TRIAL and SUBJECT as random factors. In addition to expected main effects of STEP, VOWEL, and TALKER, a significant four-way interaction between STEP, VOWEL, TALKER, and AQ was observed. Post hoc analyses revealed that subjects with higher AQ scores perceptually compensated for vocalic context and talker gender more than those with lower AQ scores. In fact, subjects with low AQ scores (first quartile) show little to no identification shift, suggesting that they were not performing PC for coarticulatory and gender effects.

**Conclusion:** The present study shows that differences in listener cognitive processing style significantly affect the magnitude of PC. This result suggests an alternative interpretation of the Ohalian listener-misperception view of sound change: sound change-inducing listener misperception does not happen in an accidental and haphazard fashion; while the general population manages to compensate for phonetic and socio-indexical effects on speech perception, a sizable number of listeners (i.e. the low AQ scorers who apparently rely more on holistic processing and focus less on the effect of the immediate local environment) are systematically under-compensating in their perception. Thus, while the likelihood of a sound change propagating through the speech community must be determined by the social dynamics of the population, the seeds for sound change are always present at the population level because of intrinsic individual variation in cognitive processing style.