Sonority projection effects: extra syllables without epenthetic vowels

Introduction. Native speakers make distinctions within the set of unattested consonant sequences (e.g., in English **nb* vs. **bn*), as shown by a variety of experimental tasks including acceptability judgment (e.g., Scholes, 1966; Daland et al., 2011), shadowing (e.g., Davidson, 2006), same-different judgment (e.g., Berent et al., 2007; Berent & Lennertz, 2010), and syllable counting (e.g., Berent et al., 2007). We focus on distinctions that arise from 'projecting' the sonority sequencing principle (Hooper, 1976; Selkirk, 1982), which prefers large sonority rises within onsets, to unattested word-initial clusters. Specifically, we investigate whether the fact that English speakers assign higher average syllable counts to spoken forms beginning with **sonority plateaus** (e.g., **bd*), in comparison to matched forms beginning with **small sonority rises** (e.g., **bn*), results from a difference in the application of perceptual vowel epenthesis (Berent et al., 2007; see Berent et al., 2008 and Berent et al., 2012 for cross-linguistic evidence).

Syllable counting. Two experiments were performed on Amazon's Mechanical Turk service, with care taken to ensure that participants heard the stimuli clearly. In Experiment 1, 90 participants heard critical CCáCV forms, produced by a Russian speaker, beginning with a variety of clusters that are unattested in English (SN: /pn bn tm dm km gm kn gn/, SS: /pt bd tp db kp gb kt gd/, FN: /vm vn zm zn/, FS: /vd vg zb zg/). Participants also heard matched filler items with a schwa before the cluster or between the first two consonants. For the critical SN and SS items of interest here, the initial stop burst was manipulated to be relatively short (approx. 20 ms) or long (approx. 50 ms), approximating non-contrastive variation in Russian. Participants responded to each item by clicking a button marked '2' or '3' according to their judgment of syllable count. Several examples of English two- and three- syllable words were presented at the beginning of the experiment to illustrate the distinction (e.g., *bravo*, *glory* vs. *casino*, *salami*).

Participants were highly accurate on filler items (> 96% '3' responses) and less likely to respond '3' to FN and FS items (~ 30%) than to SN and SS items (~ 42%). A mixed-effects logistic regression of responses to SN and SS (Fig. 1), with maximal random effect structure for participants and items, established that '3' responses were more probable for stimuli with longer burst durations ($\beta = 1.31$, $p < .05$). There was no main effect of sonority profile, but sonority and burst duration interacted: '3' responses were more likely for SS than for SN at the shorter burst duration ($\beta = 1.26$, $p < .05$). Therefore, short-burst stimuli showed a sonority projection effect.

Forced-choice transcription. In Experiment 2, 90 participants heard exactly the same stimulus recordings as above and, for each one, chose one of four possible transcriptions (e.g., for /bdázo/: bdazo, bedazo, ebdazo, dazo). Spelling conventions were similar to those of English and explained to the participants at the beginning of the task. Display of the choices was randomized across participants to mitigate response biases. Participants were again highly accurate (> 93%) on filler items and less likely to choose transcriptions with epenthetic vowels for FN and FS items (~ 36%) than for SN and SS items (~ 44%). An analysis parallel to that for Experiment 1 (see Fig. 2) revealed that epenthetic responses were more probable when burst duration was long ($\beta = 0.60$, $p < .05$); but there was no effect of sonority profile or interaction of profile with duration in this experiment. (Crucially, a combined analysis also established the positive effect of a significant interaction between experiment and sonority profile.)

Discussion. These results suggest that higher syllable counts do not systematically imply greater rates of vowel epenthesis, and specifically call into question the hypothesis that sonority projection affects the perceptual representation of the relevant clusters. Sonority plateaus and rises were perceived intact at similar rates, depending on burst duration, for the purposes of transcription. Differences in syllable count appear to reflect judgments of cluster cohesion: indeed, several participants in the syllable-counting task spontaneously commented on the difficulty of determining whether the first member of a cluster should 'count' as a syllable on its own. Plausibly sonority sequencing operates in syllable counting as in other metalinguistic tasks like acceptability judgment, affecting the well-formedness of sequences without repairing them.

Figure 1. Syllable counting results for SN and SS items.

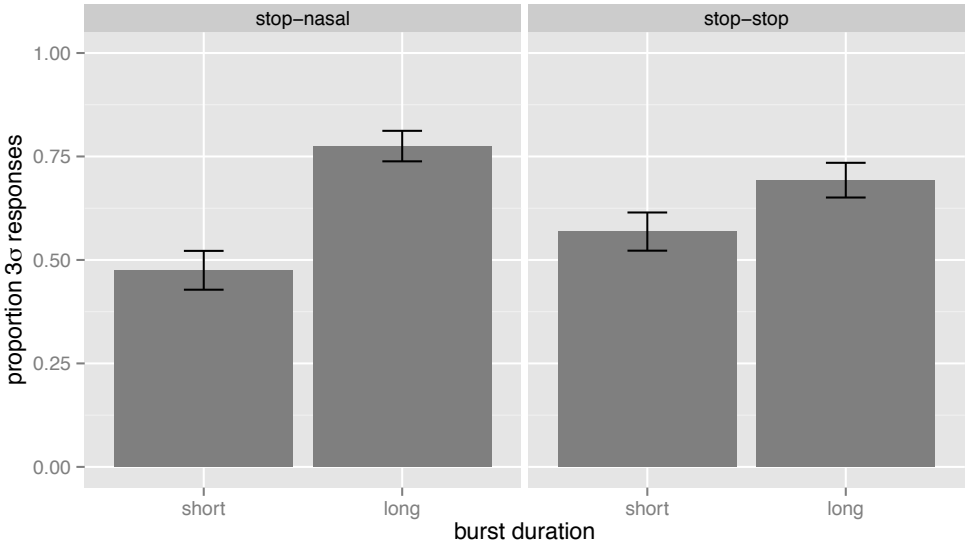
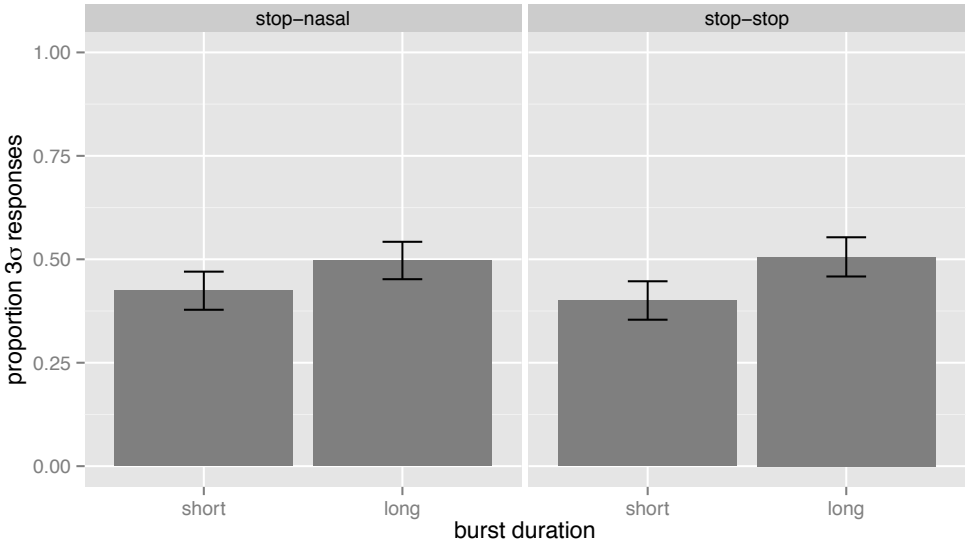


Figure 2. Transcription choice results for SN and SS items.



References

Berent, I., Steriade, D., Lennertz, T., & Vaknin, V. (2007). What we know about what we have never heard: Evidence from perceptual illusions. *Cognition*, *104*(3), 591-630. **Berent**, I., Lennertz, T., Jun, J., Moreno, M. A., & Smolensky, P. (2008). Language universals in human brains. *Proceedings of the National Academy of Sciences*, *105*(14), 5321-5325. **Berent**, I., Lennertz, T., & Rosselli, M. (2012). Universal phonological restrictions and language-specific repairs: Evidence from Spanish. *The Mental Lexicon*, *13*, 275-305. **Daland**, R., Hayes, B., White, J., Garellek, M., Davis, A., & Norrmann, I. (2011). Explaining sonority projection effects. *Phonology*, *28*(02), 197-234. **Davidson**, L. (2006). Phonology, phonetics, or frequency: Influences on the production of non-native sequences. *Journal of Phonetics*, *34*(1), 104-137. **Hooper**, Joan B. (1976). *An introduction to natural generative phonology*. New York: Academic Press. **Scholes**, R. J. (1966). *Phonotactic grammaticality*. Mouton. **Selkirk**, Elizabeth (1982). The syllable. In Harry van der Hulst & Norval Smith (eds.) *The structure of phonological representations*, Part 2. Dordrecht: Foris. 337–383.