Identity preference without the identity effect in Cochabamba Quechua
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The results of a repetition task show that speakers of Cochabamba Quechua (CQ) are sensitive to a cooccurrence restriction on ejectives, and further support a latent bias in favor of identical ejective pairs. While both identical and non-identical ejectives pairs are categorically absent in CQ, identical ejective pairs are preferred in many languages, a pattern known as the ‘identity effect’ (MacEachern 1999). CQ speakers thus reflect a typological pattern not directly supported by their native grammar.

**Ejective cooccurrence restrictions:** CQ contrasts three laryngeal categories of stops: ejective [p’ t’ tʃ’ k’ q’], aspirate [pʰ tʰ tʃʰ kʰ qʰ] and voiceless unaspirated [p t tʃ k q]. Among other restrictions, pairs of identical and non-identical ejectives are unattested within roots, which are primarily disyllabic (MacEachern 1999; Gallagher 2011).

(1) k’apij ‘to squeeze’ wirp’a ‘lip’ *k’ap’ij
k’anka ‘rooster’ rit’i ‘snow’ *t’ant’a

While CQ lacks both identical and non-identical ejectives, many languages distinguish identical and non-identical segments with respect to some phonotactic restriction. For example, in Bolivian Aymara, identical ejectives may co-occur in a root [t’ant’a] ‘bread’, but non-identical ejectives may not *[t’ank’a]. A preference for identical over non-identical ejectives is also found in Mayan languages, like Chol (Gallagher & Coon 2009) and Tz’utujil (MacEachern 1999), Hausa (Afro-Asiatic) and Gojri (Indo-Aryan) (MacEachern 1999), and the pattern is also found for aspirates, implosives and homorganic consonants.

If the cross-linguistic preference for identical ejectives is due to a cognitive or phonetic bias, we may expect to see this bias surfacing in individual speakers, even in the absence of direct support from their language experience. Individuals have been found to have latent preferences that mirror typological asymmetries in a variety of perception, production and rating studies (Scholes 1966; Broselow & Finer 1991; Broselow et al. 1998; Berent et al. 2007; Davidson 2010; Daland et al. 2011).

**Experiment 1:** Participants were presented auditorily with disyllabic nonce words, and were instructed to repeat what they heard as precisely as possible. Target items were 36 nonce words with medial ejectives, in three categories. Control items were phonotactically legal nonce words with an initial fricative or sonorant, e.g., [huk’a]. Items in the identical and non-identical categories were phonotactically illegal nonce words, with an initial ejective that was either identical to (e.g., [p’ap’u]) or distinct from (e.g., [p’ak’u]) the medial ejective. 16 native speakers of CQ completed the experiment, which took about 5 minutes.

Responses were coded as “correct” if the medial consonant was produced as an ejective (e.g., target [p’uk’a] repeated as [p’uk’a], and as “incorrect” if it was produced as a plain stop (e.g., target [p’uk’a] repeated as [p’uka]). Repetition of a target medial ejective as a plain stop made up the overwhelming majority of errors. The ejective/non-ejective status of a consonant was determined by careful examination of the spectrogram and waveform. A mixed logit model was run with “correct” as the dependent variable and two fixed effects of stimulus type: control vs. identical & non-identical, and identical vs. non-identical. Random intercepts were included for participant and item, and a random slope for each predictor by participant. Accuracy was higher on control items than on non-identical/identical items (p < .0001), and was higher on identical items than non-identical items (p < .02); results are in Figure 1.

**Experiment 2:** Acoustic analysis was done of all responses on the repetition task to explore whether the asymmetry between identical and non-identical ejective pairs could have an articulatory basis. Two types of acoustic measures were looked at. Duration of V₁ and closure duration of C₂ were measured to assess whether the temporal distance between two ejectives is...
lengthened (as is found at word boundaries in Gallagher & Whang (under review)). Burst amplitude and Voice Onset Time (VOT) were also measured, to assess whether the primary cues to ejection are affected by stimulus category. VOT was found to be significantly shorter in the second of two ejectives, as compared to the control category (e.g., VOT of [k’] is shorter in [p’uk’a] and [k’uk’a] than in [huk’a]). VOT appears to be reduced in illegal medial ejectives, but no distinction is found between identical and non-identical pairs. No other acoustic measures differed significantly between control, identical and non-identical categories.

**Experiment 3**: An ABX discrimination task was run to investigate the possibility of a perceptual asymmetry between identical and non-identical ejectives. All target items with medial ejectives from the repetition study were paired with an item with a medial plain stop (e.g., [p’uk’a]-[p’uka]). There were 15 participants, none of whom had completed Experiment 1. D-prime scores (MacMillan & Creeleman 2005) were computed and compared between three types of trials: control trials, comparing phonotactically legal nonce words (e.g., [huk’a] vs. [huka]), identical trials (e.g., [p’up’a] vs. [p’upa]) and non-identical trials (e.g., [p’uk’a] vs. [p’uka]), comparing a phonotactically illegal nonce word with a legal counterpart. Discrimination was better in the control trials than in the identical/nonidentical trials, but no difference was found between the identical and non-identical trials (Figure 2).

![Repetition results](image1.png) ![ABX results](image2.png)

**Figure 1**: Accuracy by category; error is SE. **Figure 2**: D-prime by category; error is SE.

**Discussion**: The asymmetry between control items and items with pairs of ejectives is found in the repetition task, in acoustic detail, and in discrimination, reflecting the grammatical distinction in CQ. The preference for identical ejectives is found only in the repetition task. The absence of acoustic/perceptual distinctions between identical and non-identical ejectives may reveal that the preference for identical ejectives is not phonetically based, or it may be that the current measures are not sensitive enough to pick up on an existing difference.

A possible non-phonetic source of the asymmetry is the size of the class of identical ejectives (5 pairs) compared to the non-identical class (20 pairs). If identical and non-identical ejectives are considered as separate classes in learning, the higher number of expected non-identical ejective pairs may result in a greater confidence in their ungrammaticality (Tenenbaum & Griffiths 2001; Albright & Hayes 2003), and thus a stronger restriction against them.