Cognitive and genetic correlates of a single macro-parameter of crosslinguistic variation

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There is evidence suggesting that a correlation (and perhaps causation) exists between specific language features and societal features, in particular those relating to the 'exoteric' (open) and 'esoteric' (close-knit) society types, characterizable based on population size, mobility, communication across distances, literacy. Roughly speaking, languages associated with exoteric society types (Type A languages) typically exhibit a certain clustering of features, including less complex phonologies and morphologies, but more complex and more layered syntaxes, with more specialized (obligatory) grammaticalized distinctions, while languages associated with esoteric society types (Type B languages) exhibit a complementary clustering of features, including simpler (less layered) syntaxes, but more complex phonologies and morphologies, with richer sound inventories, and with more irregularity, and more formulaic/memorized language (e.g. Wray and Grace, 2007). Our first goal is to provide a more precise characterization of this distinction, and we are in the process of testing the proposed correlation between several specific linguistic and societal features (Table One and Table Two overleaf), with early results already providing preliminary support.

Next, we propose a novel hypothesis that this macro-parameter of crosslinguistic variation yields differential involvement of declarative versus procedural memory. Procedural memory subserves the acquisition of compositional, automated, rule-governed (grammatical) aspects of language, while declarative memory typically subserves vocabulary learning and irregular phenomena across domains, including memorized, opaque, formulaic language (e.g. idioms and proverbs) (Ullman, 2004; 2015; Heyselaar et al., 2017; Elyoseph et al., 2020, for impairments). While both memory systems are essential for language (with partly overlapping/redundant functions), and while both language types certainly rely on both memories, our hypothesis is that predominantly Type A languages rely more on procedural memory, while predominantly Type B languages, in comparison, rely more on declarative memory. Our second goal is to test this hypotheses, and we are in the process of performing cognitive experiments measuring the relative strengths of the two memory types with speakers of Type A and Type B languages.

Various genes have been found to play a role in declarative memory, e.g., *BDNF* and *APOE* (Ullman, 2015; Henke, 2010; Squire and Wixted, 2011; Eichenbaum, 2012), versus in procedural memory, e.g. *FOXP2*, *PPP1R1B* and *DRD2* (Packard, 2008; Doyon et al., 2009; Ashby et al., 2010; Eichenbaum, 2012). Because cognitive biases can be linked to (epi)genetic modifications, we hypothesize that any differential reliance concerning both types of memories will be detectable in differences in the allele frequencies of specific genes. Our third goal is to test this hypothesis, by seeking correlations between Type A/Type B linguistic dimension, and the frequency in the population of the candidate gene alleles.

The ultimate goal is to provide a tangible way to engage the neurobiological and genetic underpinnings of language variation, necessary to shed light on cognitive and genetic aspects of language evolution. As a bonus, our approach sheds novel light on the long-standing linguist's puzzle in characterizing crosslinguistic variation, where researchers often report trade-offs in complexity among different linguistic domains (see e.g. Sampson, Gil and Trudgill, 2009).

Table One (Linguistic parameters of variation)

a. Large consonant inventories (WALS) (expected to correlate with Type B)
b. Presence of uncommon consonants (WALS) (Type B)
c. Complex tone (WALS) (Type B)
d. Large number of genders (WALS) (Type B)
e. No Past Tense (less specialized marking) (WALS) (Type B)
f. Zero marking of A/P arguments (less specialized marking) (WALS) (Type B)
g. Case alignment (less specialized marking: neutral; ergative (WALS) (Type B)
h. Corelative relative clauses (less specialized marking) (WALS) (Type B)
i. Periphrastic causative (less specialized marking) (WALS) (Type B)
j. Non-specialized comparative/superlative (exceed or locative) (WALS) (Type B)

Table Two (Societal parameters of variation)

a. Smaller population size (Ethnologue; D-place) (esoteric feature)
b. Smaller language family size (Glottolog) (esoteric feature)
c. Lower degree of literacy (Ethnologue) (esoteric feature)
d. Lower polity complexity (Glottolog; D-place) (esoteric feature)
e. Lower language status (e.g. official/unofficial) (Ethnologue) (esoteric feature)
f. Lower mean size of local communities (D-place) (esoteric feature)
g. Lower density of population (D-place) (esoteric feature)
h. Shorter distance moved per year (D-place) (esoteric feature)
i. Higher fixity of residence (D-place) (esoteric feature)

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