

An integrated perspective on code-mixing patterns beyond doubling?

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Code-mixing (CM) is a striking example of how two languages are active simultaneously in bilingual production. Gradient Symbolic Computation (GSC) proposes a formalism to account for the systematicity of CM patterns by integrating psycholinguistic notions of bilingual co-activation with generativist accounts of grammar. We applaud the attempt to bridge research traditions and all efforts to capture the systematicity of variation, and the interaction between processing and grammatical constraints in bilingual production. However, the descriptive and predictive scope of the current proposal remains somewhat unclear, as does its connection to existing accounts.

GSC is built around and exemplified by the phenomenon of doubling which, by the authors' own words, is a rare type of CM. An obvious question is therefore whether and if so how the proposal can account for other and more frequent types of CM, such as mixing in noun phrases (NPs) between determiners (Det) and nouns (N), or between Det, N, and modifying adjectives (A). Where languages differ in word orders, such NPs constitute potential conflict sites where mixing may violate the surface grammar of both languages (Poplack, 1980). Nevertheless, such mixing is attested across several language pairs and bilingual communities (e.g., Cantone & MacSwan, 2009; Deuchar, 2005; Poplack, 1980). Examples (1–3) come from a corpus study of Welsh–English, Spanish–English, and Papiamentu–Dutch conversations (Parafita Couto & Gullberg, 2015).

- (1) *y* **Belgian** *loaf*
 Det^{Welsh} Belgian^{English} loaf^{English}
 (Robert5, LINE 150)
 'the Belgian loaf'
- (2) *los* **dry** *walls*
 Det^{Spanish} dry^{English} walls^{English}
 (Sastre1, *KEV)
 'the dry walls'
- (3) *un* **moeilijke** *keuze* (record 0369)
 Det^{Papiamentu} difficult^{Dutch} choice^{Dutch}
 'a difficult choice'

Although the languages differ in preferred N-A word order and presence/absence of gender, the mixing patterns are remarkably similar: Switches between Det and N dominate with Dets chiefly coming from one language regardless of gender (Welsh, Spanish [+gender], Papiamentu [-gender]), and N-As from the other language (English, Dutch) with preposed As.

How does the GSC deal with these consistent mixing patterns? The answer is not straightforward partly because the definition and status of the key notion of blend/blended representations seems specifically tailored to doubling. Co-activation (in psycholinguistic terms) is said to equal a blended representation present in a single position. This in turn suggests that a blend equals simultaneous overt manifestation of two languages – as in doubling, or in bimodal bilingual production where semantic content can be articulated simultaneously in speech and sign in code-blends (Emmorey, Borinstein, Thompson & Gollan, 2008). Under this definition, it is not clear how (1–3) should be handled since they do not simultaneously display equal content in two languages in one position. The QUANTIZATION constraint allows two heads from different languages to share one complement, thus avoiding the need to select one word order. However, in (1–3) the surface word order conflict is arguably resolved by switching language between Det and the lexical material, keeping the N-A word order language-internally consistent in well-formed constituents ('islands' in the Matrix Language Framework, Myers-Scotton, 2002). Adjectives are not doubled on either side of the N. If the QUANTIZATION constraint does not apply, the GSC seems to be left with very general constraints that do not necessarily account for mixing beyond discussing weights and activation levels.

Although crucial to the architecture and its predictive power, the proposal is vague about the source and status of weights and activation levels. Both notions draw on frequency information which is hard to find. Monolingual corpora do not necessarily provide pertinent frequency data for bilingual production, and even bilingual corpora may not, since they reflect community-specific rather than

general patterns (cf. Parafita Couto, Davies, Carter & Deuchar, 2014). Also, it is unclear whether the GSC can PREDICT the language-specific preferences in (1-3) or rather DESCRIBE them post hoc as the result of different weighting of constraints and activation levels of languages. These are challenges for all gradience-focused accounts of language use, but crucial to address.

In this and other respects, the family resemblance between the GSC and existing psycholinguistic and/or gradience accounts of CM could usefully have been discussed. For instance, the GSC purports to be psycholinguistically motivated but does not elaborate on the compatibility with any model of speech production. Similarly, its Optimality theoretical base relates it to emergentist proposals (e.g., MacDonald & Thornton, 2009), some of which even address CM (Valdés Kroff, *in press*), but no direct comparison is offered. A more explicit grounding relative to other proposals would increase the value of the contribution considerably.

In sum, the GSC offers an interesting approach through its formalisms, computational goals, and aim to build bridges between disciplines, but the construction work needs more scaffolding. We look forward to seeing it grow.

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