Quantifying bilingual language experience as a complex, socially dynamic spectrum

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Bilingualism is a multifaceted experience comprised of several continuous constructs indexing language usage, exposure, and fluency in multiple languages[1,2]. Yet bilinguals are often dichotomized into ostensibly homogeneous groups. The timing of exposure (i.e., age of acquisition; AoA) to a second language (L2) is one well-studied construct known to impact language processing[3], cognitive processing[4], and brain organization[5], but recent work shows that current language exposure is also a crucial determinant in these domains[6,7]. Critically, most indices of bilingual experience are inherently subjective, collected through self-report questionnaires. Such measures have been scrutinized in favor of objective measures of language ability[8]. Here, we build on prior findings to show that bilingual language experience can be estimated jointly and continuously as a function of multiple aspects of language experience.

We assessed the language experiences of 87 young adult French-English bilinguals (M_{age} = 23.79 years, SD_{age} = 4.06 years) who varied in their language experiences. We measured L2 AoA to provide an index of timing of exposure. Participants early exposure to the L2 (M = 3.76 years, SD = 3.24 years). We also measured sheer L2 exposure and language entropy (a measure of multilingual language balance, described in detail elsewhere[9]) across 16 communicative contexts to provide indices of current language exposure (e.g., usage in social settings such as with family, friends, and colleagues; usage for internal purposes such as thinking and dreaming; and usage for reading and writing). Overall, participants reported using the L2 35% of the time during a typical day (SD = 24%). Finally, we measured self-report language fluency via a questionnaire and objective fluency via category and letter fluency tasks. On average, participants rated themselves highly in both languages on 7-point Likert scales (M_{L1} = 6.78, SD_{L1} = 0.53, M_{L2} = 5.75, SD_{L2} = 1.08) and exhibited comparable performance between languages across the two fluency tasks (M_{L1} = 16.76, SD_{L1} = 4.92, M_{L2} = 12.77, SD_{L2} = 4.11).

We conducted oblique factor analyses on sheer L2 exposure, language entropy, and fluency measures to identify the latent factors driving the observed variables. Analysis of sheer L2 exposure measures revealed two factors related to L2 usage (1) for internal purposes / with friends and family and (2) for externally directed / professional purposes (Figure 1). Analysis of language entropy scores revealed a similar structure with an additional factor related to media consumption (Figure 2). Analysis of the fluency data revealed three factors: (1) general L2 fluency (objective and subjective), (2) subjective L1 fluency, and (3) objective L1 fluency (Figure 3). Results are consistent with work showing that language use and exposure exhibit distinct but interrelated patterns depending on the communicative context, with a particular dichotomy between internal vs. external usage purposes[10,11]. They also suggest that, counterintuitively, our sample may be able to more accurately self-assess L2 fluency than L1 fluency.

We then extracted individual factor scores, and we predicted fluency scores as a joint function of L2 AoA, L2 exposure scores, and language entropy scores. L2 fluency scores were positively associated with Factor 1 for L2 exposure (i.e., internal purposes / with friends and family) and Factor 2 for language entropy (i.e., externally directed / professional purposes). In contrast, the self-report L1 fluency scores were negatively associated with Factor 2 for L2 exposure (i.e., externally directed / professional purposes), but there were no significant associations for objective L1 fluency scores. These results are consistent with the idea that language proficiency is not a unitary construct: people become proficiently bilingual by distributing language use through various communicative contexts to achieve various communicative goals[10]. Together, these results show that bilingualism is a complex and socially dynamic construct.

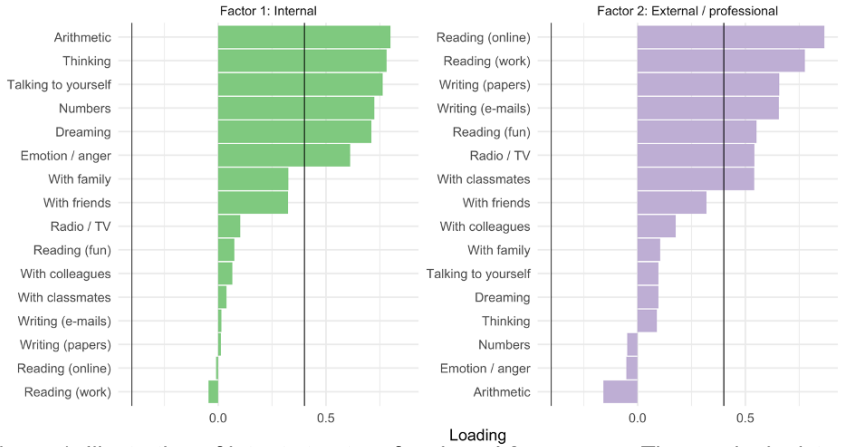

Figure 1. Illustration of latent structure for sheer L2 exposure. The x-axis depicts each communicative context for which exposure was computed. The y-axis depicts the factor loading. Each factor is displayed as a separate panel together with a label for what that factor likely represents.

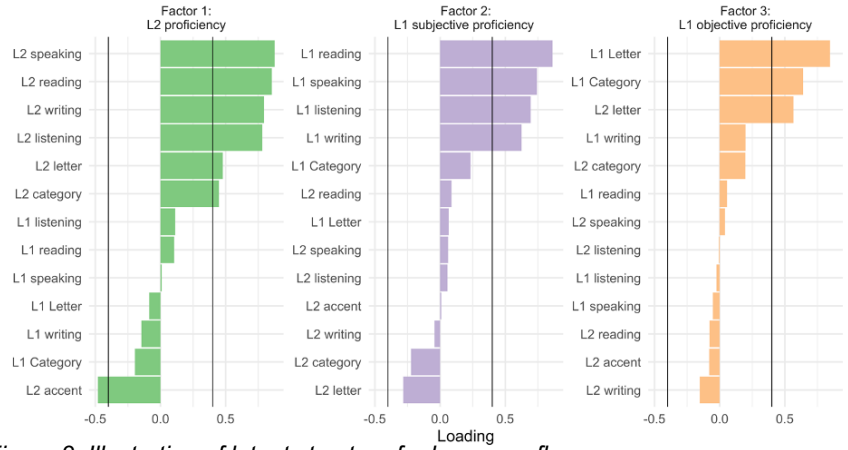

Figure 3. Illustration of latent structure for language fluency.

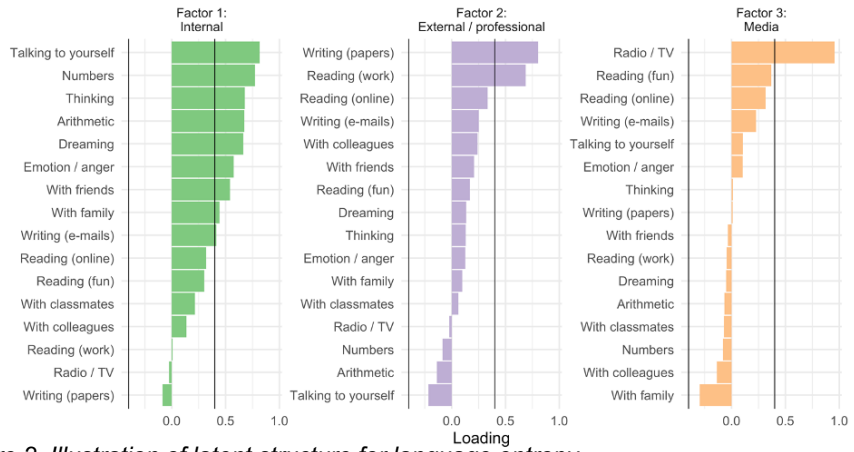

Figure 2. Illustration of latent structure for language entropy.

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