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Rethinking Multilingual Experience through a Systems Framework of Bilingualism: Response to Commentaries

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Author's Response

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Abstract

In *Rethinking Multilingual Experience through a Systems Framework of Bilingualism* (Titone & Tiv, 2022), we encouraged psycholinguists and cognitive neuroscientists to consider integrating SOCIAL and ECOLOGICAL aspects of multilingualism into a collective understanding of its cognitive and neurocognitive bases (i.e., to rethink experience). We then offered a framework – the SYSTEMS FRAMEWORK OF BILINGUALISM – and described empirical challenges and potential solutions with applying this framework to new research. Since the paper's publication, several eminent colleagues read and commented on our Keynote, noting both its strengths and areas for improvement. We read each commentary with enthusiasm and gratitude. Here, we briefly respond to several salient points raised, which led us to clarify and improve our theoretical approach. We first address what the commentaries agreed were strengths of the framework. We follow this with a discussion of what the commentaries stated could be improved or extended. We conclude with ways that we modified our model to collectively address concerns raised in the commentaries.

In *Rethinking Multilingual Experience through a Systems Framework of Bilingualism* (Titone & Tiv, 2022), we encouraged psycholinguists and cognitive neuroscientists to consider integrating SOCIAL and ECOLOGICAL aspects of multilingualism into a collective understanding of its cognitive and neurocognitive bases (i.e., to rethink experience). We then offered a framework – the SYSTEMS FRAMEWORK OF BILINGUALISM – and described empirical challenges and potential solutions with applying this framework to new research. Since the paper's publication, several eminent colleagues read and commented on our Keynote, noting both its strengths and areas for improvement. We read each commentary with enthusiasm and gratitude. Here, we briefly respond to several salient points raised, which led us to clarify and improve our theoretical approach. We first address what the commentaries agreed were strengths of the framework. We follow this with a discussion of what the commentaries stated could be improved or extended. We conclude with ways that we modified our model to collectively address concerns raised in the commentaries.

In terms of strengths, an emergent theme across commentaries was the clear advantage of the *Systems Framework's* goal to integrate across socioecological levels in the study of multilingualism. Caldwell-Harris (2022) asserted that forward-thinking multicausal frameworks can illuminate longstanding questions within the study of bilingualism (e.g., past empirical controversies, language policy missteps, decision-making related to learning multiple languages). DeLuca (2022) wrote that the article represents a key step forward in describing and quantifying the multidimensional spectrum of bilingual experiences, in a manner that goes beyond existing models of bilingual neurocognition. Ellis (2022), a member of the Douglas Fir Group that applied socioecological to second language learning, noted that we presented a "well-crafted, engaging, and persuasive case", and moreover, he encouraged taking it further towards a COMPLEX ADAPTIVE systems framework of bilingualism. Genesee (2022) offered important evidence for a sociocultural approach from the perspective of developmental studies of language learning in children. Gullifer and Anderson (2022) asserted that our approach was innovative within the study of multilingualism and that there is merit for adult psycholinguistic researchers to embrace the complexity that is appropriate for the cognitive phenomena of interest (e.g., it helps defend against overly simple scientific stories where complexity is ignored). Kroll, Chan, Cheng, and Scontras (2022) emphasized the historic opportunities and challenges associated with bringing multiple disciplinary perspectives together and commented that our approach is an ambitious attempt to do so. Finally, Luk and Grundy (2022) agreed that it is time for people who study the cognitive and neuroscientific basis of language to embrace socioecological theories, attending to the qualitative differences that characterize multilingualism. Collectively, the comments raised by these researchers, who have each made foundational contributions to the study of language and multilingualism, give

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us confidence that our approach aligns well with multilingualism research across different disciplines, and can be an important step forward. However, it is also clear that we are only at the beginning stages of this endeavor, and there are many ways to refine the approach.

One area of future improvement concerns the double-edged sword of complexity with respect to any psychological (or scientific) phenomena. This was also noted by Bronfenbrenner when he described science as often being caught between the "rock" of rigour and the "soft place" of relevance (see Keynote for description). Speaking to this issue, Gullifer and Anderson noted that complex views of cognition and language must defend against the inherent preference within science for simplicity (see also, Caldwell-Harris, 2022; DeLuca, 2022; Luk & Grundy, 2022). Indeed, all introductory psychology students are familiar with Ockham's razor (i.e., the law of simplicity or parsimony), according to which simpler and more parsimonious accounts of phenomena are preferred to complex ones, all other things being equal. However, as Gullifer and Anderson argue (correctly in our view), "The danger of a simple story is believing that the phenomenon is also simple."

On this point, psychology's preference for simplicity has never been uniformly applied, and rightly so for situations where simplicity is not justifiable. Accordingly, Caldwell-Harris (2022) argues in her commentary that psychologists have also exhibited strong preferences for spotting confounding or third factors that qualify overly simple interpretations that are consequently inconclusive. To further illustrate this point, we turn to the example raised by Gullifer and Anderson (2022), DeLuca (2022), and Luk and Grundy (2022) about the ongoing debates about whether monolinguals differ from bilinguals in general cognition (or other capacities). As indicated in the commentaries and elsewhere, while some researchers express a simplicity bias by only accepting binary yes or no, main-effects-style answers, others express a confound-spotting preference by suggesting that phenomena of interest are systematically complex and interactive (see Caldwell-Harris' commentary for an interesting example of understanding what might improve literacy among deaf signers). Even Ockham acknowledged the need for both approaches, with the qualification that an explanation should be as simple AS POSSIBLE, or that "plurality should not be posited WITHOUT NECESSITY" (our emphasis; reviewed in Danek, Rainer & Della Sala, 2022, who also claimed that the "simplicity" interpretation of "razor" in Ockham's original writings may have been a translation error). On this point, we and others contend that complex theoretical accounts, which consider the socioecology of multilingual experience, are often necessary to explain language phenomena. This sentiment is endorsed across several commentaries (Caldwell-Harris, 2022; DeLuca, 2022; Genesee, 2022; Luk & Grundy, 2022), and many other papers in the field at large.

Gullifer and Anderson's commentary also reinforces our point that significant practical challenges arise when curating and analyzing complex datasets relevant to a socioecological view of multilingualism. Related to this, Kroll et al. (2022) noted that different types of data (e.g., qualitative vs. quantitative) can vary dramatically in their perceived relevance and prevalence across disciplines (e.g., psycholinguistics vs. sociolinguistics), making it tricky at best to align knowledge across disciplines. Kroll and colleagues' commentary also taught us that we must strive for greater precision and clarity when integrating across a wealth of disciplinary experimental or theoretical traditions that address inherently complex phenomena such as language. For example, Kroll and colleagues commented that our approach was too focused on quantitative contributions without acknowledging the role of rigorous qualitative methods, thereby overlooking any contributions cognitive and psycholinguistic accounts could have for sociolinguistic knowledge. However, our intent on both counts was to affirm exactly the opposite. First, we completely agree that sociolinguistic findings (ascertained qualitatively or quantitatively from any relevant data source) have value. Second, we completely agree that sociolinguistics has much to gain from psycholinguistic studies – although we de-emphasized this point as we felt it most appropriate to speak about our own discipline and what we can learn from others.

In our view, relevant data from almost all sources (e.g., reaction time, neural measures, questionnaires, interview data, naturally derived corpora, structured interviews, language attitudes about identity or other subjective constructs, census data, etc.) could be fruitfully considered when evaluating any multidetermined phenomenon, such as language. The reasons include making it possible to align similar theories across disciplines that may not normally refer to each other, as well as different methodological approaches that address compatible theoretical questions. However, if a desired end goal is to align different sources of data with methods for statistical testing and evaluation within a study, practically, we must transform varied data into appropriate forms. These forms could be fully quantitative (e.g., using language entropy or social network measures directly in our statistical models), mixed quantitative and qualitative (e.g., splitting a sample into subgroups based on a qualitative difference, or administering a social network survey as an oral interview), or as Gullifer and Anderson suggest, using qualitative methods to inform or guide later quantitative approaches (and vice versa). Ultimately, the dividing lines between quantitative and qualitative approaches can be as rigid or as permeable as researchers decide they should be.

Regardless of how we proceed, as Gullifer and Anderson argue, we must also mind limits to statistical hypothesis testing, frame exploratory research as such where appropriate, and avail ourselves of all manner of methods to reinforce sound science (e.g., reproducibility) for the specific questions of interest. On the topic of reproducibility, we reiterate a point in our original paper. If an original "finding" is not the same as a past study under somewhat reproducible circumstances (i.e., using transparent and accessible methods), the onus is on us to seriously evaluate WHY that may be, rather than quickly dismissing either the original or "replicated" finding (see also, Bak, 2016). Despite our best attempts, there will always be something different across studies, such as the geographic location of the human sample recruited, the social climate or salient events at the time of data collection, and potentially other interactional attributes of location, time, and sample (e.g., the languages spoken ambiently, the societally driven language policies, etc). In the case of multilingualism research, a socioecological model lays bare why those precise sociolinguistic differences are the least avoidable in any replication study. Consequently, they are especially prone to producing confounds or potent additional factors that cloud overly simple interpretations, a point we emphasized in the Keynote (see also, De Bruin, 2019; Grosjean, 1998; Luk, 2022; Navarro-Torres et al., 2021; Wu & Thierry, 2010; Yu & Schwieter, 2018).

A third area of improvement noted in the commentaries concerns extensions of our theoretical framework. As originally stated, we indicated the importance of time, broadly construed (e.g., developmental, historical, longitudinal), though additional work is necessary to concretize this in adult samples. Given the

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focus of our research on adults, we omitted an extensive developmental literature on bilingualism in children and babies, for which Genesee (2022) as well as Luk and Grundy (2022) contributed. Specifically, their comments offered a wealth of data from studies showing how sociocultural factors were paramount in explaining bilingual language production behaviors among children. Especially noteworthy with respect to development is work highlighted in Luk and Grundy's commentary, which described how sociocultural interactions within families reflect a kind of family language policy that has long-lasting impacts on a child's second language behaviors. Shifting to neuroscience, DeLuca (2022; see also Kroll et al., 2022) noted the importance of neuroscientific data, which informs neurocognitive theories of how bilingual experience impacts brain function and structure, and that there can always be convergences and divergence between behavioral and neural data. We fully agree that neural measures will be important to investigate in a manner guided by a *Systems Framework of Bilingualism*, which could also enrich leading theories and exciting data collection in this area (reviewed in Calabria, Costa, Green & Abutalebi, 2018; Green, 2022; Green & Kroll, 2019; Pliatsikas, 2020).

Kroll et al. (2022) commented that we did not adequately discuss sociocultural phenomena such as language identity, although we disagree that the Systems Framework of Bilingualism, which is fundamentally motivated by social factors including identity, would fail to incorporate them. For example, Kroll and colleagues indicate societal factors, which potentially exert distal influence on individual-level outcomes, impact perceived identity. We certainly agree and had originally stated that the different layers of social influence in this system are interactive (a point emphasized in Luk and Grundy's commentary). However, it is not necessarily the case that identity or perceived identity is merely related to the societal layer of the system. In fact, many aspects of personal identity are manifest and dynamically negotiated within one-on-one interactions (interpersonal), as well as small group, context-bound, or community-oriented interactions (ecological). For these reasons, we see the important construct of identity as one of many ego-level attributes that can be jointly and iteratively modulated by socioecological forces across levels.

To highlight the interactive nature of these elements, as well as other interesting comments raised, we revised the primary figure illustrating the model (Figure 1). First, we used dashed lines rather than solid lines for each sphere to demonstrate the permeability of each layer to information from higher/lower order spheres. Second, we added arrows to the ego sphere to demonstrate the importance of interactions between ego and their environments (Luk & Grundy commentary), and to depict bidirectional effects of ego-level characteristics and features of the environment (including identity). For instance, ego's identity is shaped by and contributes to the social characteristics of their ecology (Kroll et al. commentary). Third, we added additional ego-level attributes at the base of the model. These include individual processes related to cognition, behavior, attitudes, neural activity and form, self-perceived identity, and more. The '+' indicates the potential implications to other domains not currently identified. Fourth, we added an additional panel to suggest the wide variety of methods that can address social factors (not an exhaustive list), and to explicitly acknowledge the synergistic roles of quantitative and qualitative methods. These methods include approaches we discussed in the original Keynote, as well as contributions elicited through the commentaries (e.g., ethnographic interviews, developmental perspectives).

Several commentaries also noted how a *Systems Framework of Bilingualism* could be used to illuminate past controversies, to advance current questions and active areas of research, and to potentially connect with language policy within the study of multilingualism. With respect to illuminating past controversies, Caldwell-Harris argues that a systems framework offers a potentially viable explanation for correlational data that offer the illusion of causal connectedness. As one example, she discusses the observed limits on ultimate L2 attainment associated with the age of second language learning and brain maturational changes. While some have argued for a causal link between neural maturation and the ways the human brain might acquire an L2, Caldwell-Harris argues that a systems framework suggests that social factors could also be at play – specifically, the social supports for L2 learning or retention may simply not be the same for children and adults, suggesting a variety of potentially more complex interpretations of the same data (see the commentary for additional examples).

With respect to a *Systems Framework of Bilingualism* motivating new questions, Ellis (2022) urged us to embrace even newer ways of thinking and conducting scientific investigations that derive from the study of complex adaptive systems and complexity theory. The fields of research indicated by Ellis are fascinating and have only started to make their way into the study of multilingualism (e.g., network science approaches, complexity theory

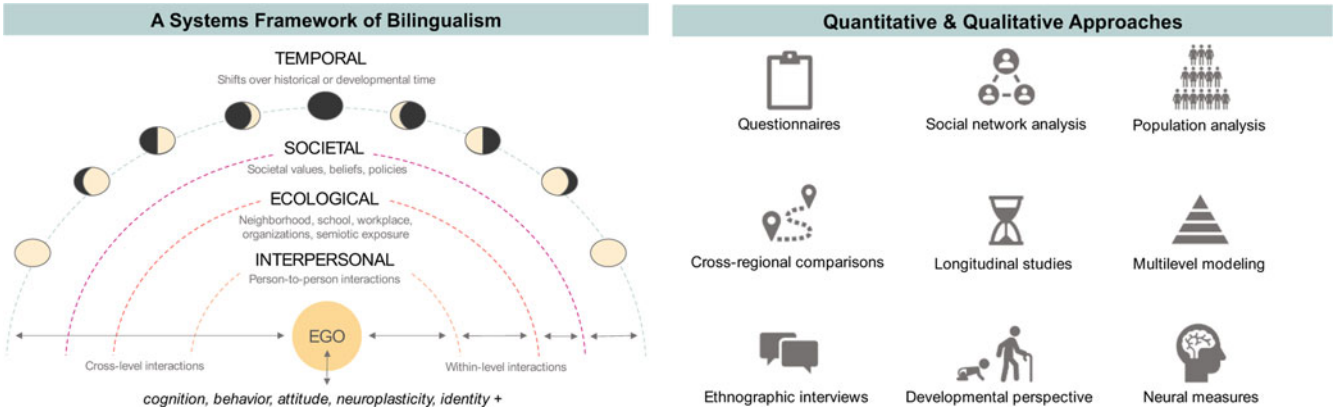


Fig. 1. An updated figure depicting the *Systems Framework of Bilingualism*. The left panel depicts the framework itself; the right panel depicts a sampling of methodological approaches that can be used to test empirical questions arising from the model. See text for additional description.

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approaches, etc.). Ellis' analogy between driving systems and multilingualism is also quite apt. We particularly appreciated the idea that high vs. low entropy multilingual experiences may be akin to stop-and-go city driving vs. steady-state highway driving, respectively. At the risk of torturing the analogy, we would add that multilingual people who operate predominantly in high entropy, stop-and-go city driving might be more inclined to use automatic vs. manual transmissions in their vehicles, thus changing the relative costs for the same type of driving (in both fuel consumption and operator attention). Indeed, this difference may also find an apt analogy in how people can adapt to manual-transmission driving such that they maintain that mode when operating a friend's automatic-transmission vehicle (e.g., when one's foot reflexively searches for a clutch pedal that is not there). Such musings call to mind the work of Grosjean (2016). Green and colleagues (e.g., Calabria et al., 2018; Green, 2011, 2022), and Pliatsikas' Dynamic Restructuring Model (Pliatsikas, 2020) to the extent that multilingual experiences have the power to dynamically change the nature of the "vehicle" over time. A nudge towards complexity theory and adaptive, dynamic systems is also echoed by Caldwell-Harris, who suggests that a *Systems Framework of Bilingualism* might serve as a useful organizational heuristic for developing agent-based models of language learning investment following immigration (see also Caldwell-Harris, 2019).

In closing, we are grateful for both the invitation from *Bilingualism: Language and Cognition* to prepare the original Keynote article, and to our colleagues who devoted time to reading and writing about our paper. We hope that the *Systems Framework of Bilingualism*, while complex and imperfect, will be of some use and inspiration to people in our field to consider more broadly the social and ecological contexts in which we collect our cognitive and linguistic data on bilingual and multilingual adults (e.g., the forthcoming special issue of *Journal of Experimental Psychology* on "cognition in context"). This endeavor gave us a welcome opportunity to think more fully about the implicit and explicit ideas that motivate our own work, offered us a platform to amplify the valuable contributions of our colleagues who already incorporate social factors, and provided a way to consider how socioecological events might impact directly or indirectly the cognitive processes required of multilinguals for successful communication. Naturally, this approach may be of less interest to people who prefer to emphasize questions and approaches that stay more within disciplinary bounds. This is not only acceptable but also advantageous in that researchers interested in more integrative approaches will have richer foundational tools to work with (and vice versa).

Ultimately, the human endeavor we refer to collectively as science benefits from balance across all views and approaches. A personal epilogue illustrating why we believe this balance must include socioecological factors is the following. Since publication of our original Keynote, societal level language policy changes within Quebec, Canada have come to the fore. Specifically, a majority francophone government (recently re-elected with an expanded majority) passed a new language law (formerly known as Bill 96, and now as Law 96) that has significant implications for the sociolinguistic ecology of Quebec, particularly for multilingual regions such as Montreal. Among its many provisions to strengthen French, this law will require all newcomers to Quebec to achieve high proficiency in French within 6 months of arrival, a demand that may neither be achievable for most people nor feasible to assess at scale. The law will also alter the linguistic ecology for students beyond primary and secondary school at the CEGEP level (i.e., junior college), and impact workplace communication in Quebec. Thus, its provisions have the potential to further compartmentalize people socially who have different language statuses and abilities (e.g., those who are legally obliged to attend French school and those who are legally eligible and choose to attend schools that have other languages of instruction). It is clear from where we sit that such laws, operative at a societal level within the *Systems Framework*, will have direct and indirect impacts on people's interpersonal and individual psycholinguistic experiences of multilingualism (e.g., reviewed in Ahooja, Brouillard, Quirk, Ballinger, Polka, Byers-Heinlein & Kircher, 2022; Ballinger, Brouillard, Ahooja, Kircher, Polka & Byers-Heinlein, 2020; Hernández-Rivera, Gullifer & Titone, 2022; Itzhak, Vingron, Baum & Titone, 2017). Such impacts are the explicit goal of any language policy.

Given this real-world scenario, and many others like it around the globe, advancing a socioecologically driven *Systems Framework of Bilingualism* feels urgent to us because it offers a concrete way to theorize and empirically engage with questions about how social forces impact and are impacted by individual behaviors (e.g., the use of French, the retention of English or other heritage languages, the impacts on multilingualism at higher and lower levels of cognition). In so doing, as noted by Ellis (2022), such an approach will allow researchers to better "ask not what's inside your brain – ask what your brain is inside of." We contend that it is exactly this perspective that will generate a more complete understanding of what human language behavior is about, and consequently, how it works neurocognitively.

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