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Putting the terms "monolingual" and "bilingual" under the microscope

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The study of infant speech perception is nearly 50 years old (see Jusczyk, 1997, for review). In her Keynote address, Werker skillfully demonstrates just how far the field has progressed since its inception in the 1970s. Her article outlines several exciting new themes that she feels are crucial to moving the field forward, such as the existence of universal preparedness for language learning, the surprising relationship between referential knowledge and the acquisition of language-specific phonetics (hint: it is a two-way street), the distinction between native language phonetics and native language phonology, the multisensory nature of speech, and last but not least, monolingual versus bilingual development.

As I read Werker's Keynote, I found myself focused on the last of these themes: monolingual versus bilingual development. Up until about 10 years ago, most infant speech perception research was focused on monolingual infants. In addition, despite the fact that the majority of infants in the world are being raised in multilingual environments, consideration of multilingual language acquisition in infancy has only recently started to become commonplace. Nonetheless, work in this area has made remarkably rapid progress, showing, for example, that fetal exposure to two maternal tongues sets the stage for bilingual development (Byers-Heinlein, Burns, & Werker, 2010), that exposure to multiple languages has cognitive benefits in infancy (Kovacs & Mehler, 2009), that amount and type of input is closely linked to bilingual children's speed of word recognition (Hurtado, Gruter, Marchmann, & Fernald, 2014), and that bilingual infants can differ systematically from monolingual infants in how they behave in laboratory language tasks (Byers-Heinlein, 2014). These are just a few of the exciting advances made this past decade in our understanding of monolingual versus bilingual development. Therefore, Werker's focus on this issue clearly reflects a

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very positive trend in the field; studying both monolingual and bilingual language acquisition is absolutely crucial to developing accurate and generalizable models of early speech perception.

Nonetheless, as I read this Keynote article, I kept coming back to the same question. Is it sufficient to ask how speech perception differs in bilinguals versus monolinguals? Is reliance on this binary distinction too simplistic? Perhaps by being more attentive to the specific home environments experienced by children visiting our labs (e.g., the many different types of monolingual and bilingual environments), we could uncover new insights into early language development. After all, as Werker points out, language may be our most "experientially sensitive and responsive cognitive attribute." Therefore, by lumping all monolinguals in one bin and all bilinguals in another, are we not passing up an excellent opportunity to analyze the effect of fine-grained experiential variation on infant speech perception and language development?

Although there are many dimensions along which monolinguals and bilinguals can differ, the number (and type; and source) of language variants an individual infant experiences strikes me as a particularly fruitful dimension for infant language scientists to consider. It is important to note that by exposure to variants, I do not simply refer to exposure to different languages; I refer to accent and dialect varieties too. Exposure variation along these dimensions is exceptionally high in the neighborhood where my lab is located (over half of the population in the Greater Toronto Area was foreign born). One child's primary language input might come from her French–English bilingual mother who was born in Jamaica. Another child may have Texan parents and a full-time nanny from the Philippines. This same child might Skype regularly with her grandparents who live in New Zealand. Another child living next door may be acquiring English from parents who were born in Ontario and speak English as their first language, but receive a large chunk of her language input from the local daycare where she is exposed to half a dozen nonnative varieties of English. Any one of these three hypothetical children could be monolingual or bilingual (depending on whether their input was primarily in English or in multiple languages). However, these children all have an important experiential factor in common: they are all exposed to multiple varieties of English. At the same time, however, they are all experiencing language variation in distinct ways. For example, some are getting exposure to the locally dominant variety of English at home whereas others are only hearing it outside the home. Some are hearing a mix of nonnative and native accents, whereas others are hearing only different regional varieties of English. Some have massive exposure to one particular variety of English through only a single talker, whereas others are exposed to multiple talkers for each language variety spoken in their environment. What sorts of insights might we be missing out on if we categorize all children who hear at least 90% English together as monolingual and all the children who hear say 30% of a second language as bilingual, and then fail to further examine subgroups within these populations?

To better appreciate this point, consider for a moment how we think children learn the sound structure of their native language(s). Speech development is assumed to be heavily reliant upon bottom-up perceptual input, with infants relying

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on the distribution of fine acoustic–phonetic detail in their input to bootstrap their native language (e.g., Johnson, 2016; Jusczyk, 1997, Werker, this volume). We know that second language speakers tend to carry over certain aspects of their native language phonology when they speak in their second language (Archibald, 1998), and this can affect the distribution of phonetic patterns in children's language input (e.g., Fish, Garcia-Sierra, Ramirez-Esparza, & Kuhl, 2017; Schertz, Buckler, Klammer, & Johnson, 2016). On the processing end, we know unfamiliar regional variants of a familiar language can present quite a challenge for children, especially before the age of 19 months (e.g., Best, Tyler, Gooding, Orlando, & Quann, 2009; Van Heugten, Krieger, & Johnson, 2015), and that infants probably do not always handle variation in the realization of word forms as efficiently as adults (e.g., Schmale, Cristia, Seidl, & Johnson, 2010). Given all of this, how can we not look beyond generic labels "monolingual" and "bilingual" and attend to the specific details of children's language input?

In recent years, infant speech perception researchers have just begun exploring the effects of this type of variation on children's performance in lab tasks (e.g., Floccia, Delle Luche, Durrant, Butler, & Goslin, 2012; Van der Feest & Johnson, 2016), but not to the extent that you might expect. One reason speech scientists have been slow to explore this route may be in part because unlike sociolinguistics who rely on methodological tools like in-depth interviews with individuals, those of us who study infants are generally reliant on methodologies that tell us about the behavior of large groups of infants. The development of highly sensitive infant testing methodologies that will give reliable data on individual infant development are still a dream at this point. Nonetheless, recent work emerging from my own lab has supported the notion that infant speech perception researchers cannot afford to continue to ignore this type of variation in children's language learning environments (Buckler, Oczak-Arsic, Siddiqui, & Johnson, 2017; Van Heugten & Johnson, 2017). Ignoring the many nuances distinguishing one monolingual from another, or one bilingual from another, may hinder us from developing infant speech perception models that can explain real language acquisition in all its naturally varied contexts. Put another way, the children we typically classify as monolingual and bilingual are hugely variable in terms of the language environments they experience, and yet language development generally proceeds without difficulty despite this variability. Our current models of infant speech development were not necessarily designed from the bottom up with this type of variability in mind. Developing a better understanding of the many paths children may embark on, and the mechanisms they rely upon, to achieve mature adultlike language abilities may require us to redefine our notion of the typical language learner (be they monolingual or bilingual).

In summary, the work outlined in Werker's Keynote provides an impressive foundation for the field to build upon. The themes she outlines are essential and important to the advancement of our field. As the field moves forward, however, I would like to suggest that greater attention to monolingual and bilingual language development *in all their varied forms* will undoubtedly lead to new exciting discoveries in the next 50 years.

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