Nespor, M., Peña, M., & Mehler, J. (2003). On the different roles of vowels and consonants in speech processing and language acquisition. *Lingue E Linguaggio*, *2*, 203–229.
Nishibayashi, L.-L., & Nazzi, T. (2016). Vowels then consonants: Emergence of a consonant bias in early word form segmentation. *Cognition*, *155*, 188–203.
Orena, A. J., Theodore, R., & Polka, L. (2015). Language exposure facilitates talker learning prior to language comprehension, even in adults. *Cognition*, *143*, 36–40.
Perrachione, T. K., Del Tufo, S. N., & Gabrieli, J. D. (2011). Human voice recognition depends on language ability. *Science*, *333*, 595.
Polka, L., & Werker, J. F. (1994). Developmental changes in perception of nonnative vowel contrasts. *Journal of Experimental Psychology: Human Perception and Performance*, *20*, 421–435.
Poltrock, S., & Nazzi, T. (2015). Consonant/vowel asymmetry in early word form recognition. *Journal of Experimental Child Psychology*, *1312*, 135–148.
Tincoff, R., & Jusczyk, P. W. (1999). Some beginnings of word comprehension in 6-month-olds. *Psychological Science*, *10*, 172–175.
Tincoff, R., & Jusczyk, P. W. (2012). Six-month-olds comprehend words that refer to parts of the body. *Infancy*, *17*, 432–444.
von Holzen, K., Rider, D., & Nazzi, T. (2017). *Consonant and vowel processing in 5-, 8-, and 11-month-olds own name recognition: The role of acoustic/phonetic and lexical factors*, Poster presented at the 14th International Congress for the Study of Child Language (IASCL): Lyon, France July 17–21, 2017.
Werker, J. F., & Tees, R. C. (1984). Cross-language speech perception: Evidence for perceptual reorganization during the first year of life. *Infant Behavior & Development*, *7*, 49–63.

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Commentary on "Perceptual Beginnings to Language Acquisition" by Janet Werker

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It is hard to think of an area of infant language development that has not been shaped, in some way, by Dr. Janet Werker. Her early work on experience-driven changes in speech perception deeply altered our field's conception both of the nature of speech perception and, more important for her future research, the nature of the type of learning performed by young infants. In aggregate, Werker's research provides an exceptionally nuanced picture of the mind of the infant, seeking and discovering structure in the world without external instruction or reward. Her research over the subsequent decades has pushed deeper into these results, greatly increasing our understanding of the types of learning that underlie

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infants' precocity in the domain of native speech perception, early lexical learning, and how they are integrated.

Reading her paper, it becomes more and more abundantly clear that the oft-used term "prelingual infant" is an utter misnomer. There is no moment postnatally when the infant is not a linguistic being. Infants are attuned to their native language (or, in many of Werker's studies, native languages) from as early as they can be studied. What they make of linguistic input, and how the input interacts with their extant biases and expectations, is the focus of Werker's research program.

To address these questions, Werker embraces complexity. Her paper reads like a tour de force of what happens when scientists are not balkanized. For example, consider the fascinating discovery that newborn infants' auditory preferences include both speech and other primate vocalizations (Vouloumanos, Hauser, Werker, & Martin, 2010). Rather than brushing these results under the rug in favor of a simpler "speech is a privileged stimulus" hypothesis, Werker and her collaborators expanded their field of study beyond simple speech versus nonspeech dichotomies. In the paper, she writes that "appealing as the distinction is, it is not merely the communicative versus noncommunicative nature of speech that underlies its neural specialization, but something as well about the match between its properties and the resolving capabilities of the related brain structures" (page 705). This is a fascinating extension of a research question that had previously been considered to be essentially settled.

Throughout the paper, Werker points to areas where her theoretical frameworks have been modified based on new empirical data. To any students reading this Commentary: take note! This is a scientist who believes in the power of data in theory building. It takes much more courage and conviction to change, and to develop new studies to test updated theories, than to stick to one's guns. The section of the paper outlining progress in understanding the relationship between phonological and lexical development is a beautiful example of Werker's intellectual prowess. Her early work suggested that young infants were unable to detect phonetic distinctions in the context of a word-learning task (e.g., Stager & Werker, 1997). These findings contrasted with research in the area of infant lexical processing, which suggested the presence of more detailed phonological representations (e.g., Swingley & Aslin, 2000). The paper details the multiple routes that Werker took to attempt to unpack these apparent differences, including collaborations with Swingley that revealed the important role of methodology (Yoshida, Fennell, Swingley, & Werker, 2009), collaborations with her former students that revealed ways in which other task demands affect performance on this task (e.g., Fennell & Werker, 2003), and extensive theory development (e.g., Curtin & Werker, 2007; Werker & Curtin, 2005).

This line of research, investigating phonological and lexical development in tandem, is currently leading Werker in exciting new directions. In the paper, she reviews new studies that include socioeconomic status manipulations and children at risk for language disorders. I am delighted to see that Werker, like others of us who are primarily focused on typical language development, is beginning to investigate individual differences and their ramifications for language outcomes. I anticipate that this line of work will be just as impactful as her previous work, and will be of particular interest to the developmental language disorders research

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community. I am also excited to see that she is considering the implications of evidence showing lexical knowledge in infants 6 months of age or younger (e.g., Bergelson & Swingley, 2012) on theories concerning the relationship between phonological and lexical development. To what degree do these processes unfold in parallel versus in an integrated fashion? I agree with Werker that these relationships are likely to be bidirectional, and I am eager to see research on very young infants that teases apart the causal relationships.

It is impossible to write about Werker's research program without commenting on its extraordinary breadth, from phonemes to syntax. Even more impressive, at least to me, is her emphasis throughout on mechanism, and the myriad ways in which she approaches this issue. She manipulates linguistic experience via native language status (monolingual vs. bilingual and even trilingual) and lab manipulations (such as the statistical distributional learning studies). She manipulates visual and oro-motor experience in the lab, as well as experience with the referents to be learned. She manipulates developmental time, including both chronological and gestational age (as in the premature birth studies). In addition, most unusually for someone in our field, she manipulates plasticity via pharmacological interventions (with infants whose mothers were medicated for depression). While these manipulations may appear disparate, they are seamlessly integrated in her theoretical work, and mutually inform one another throughout her research program.

As researchers and scholars, we are lucky to generate just one paradigm-changing study in our career. Werker somehow manages to shake up the field every few years. She is truly at the cutting edge in every possible way. I cannot wait to see what she does next!

REFERENCES

Bergelson, E., & Swingley, D. (2012). At 6–9 months, human infants know the meanings of many common nouns. *Proceedings of the National Academy of Sciences*, *109*, 3253–3258.

Curtin, S., & Werker, J. F. (2007). Perceptual foundations of phonological development. In M. Gareth Gaskell, G. T. M. Altmann, P. Bloom, A. Caramazza & P. Levelt (Eds.), *Oxford handbook of psycholinguistics*. New York: Oxford University Press.

Fennell, C. T., & Werker, J. F. (2003). Early word learners' ability to access phonetic detail in well-known words. *Language and Speech*, *46*, 245–264.

Stager, C. L., & Werker, J. F. (1997). Infants listen for more phonetic detail in speech perception than in word learning tasks. *Nature*, *388*, 381–382.

Swingley, D., & Aslin, R. N. (2000). Spoken word recognition and lexical representation in very young children. *Cognition*, *76*, 147–166.

Vouloumanos, A., Hauser, M. D., Werker, J. F., & Martin, A. (2010). The tuning of human neonates' preference for speech. *Child Development*, *81*, 517–527.

Werker, J. F., & Curtin, S. (2005). PRIMIR: A developmental framework of infant speech processing. *Language Learning and Development*, *1*, 197–234.

Yoshida, K. A., Fennell, C. T., Swingley, D., & Werker, J. F. (2009). Fourteen month-old infants learn similar sounding words. *Developmental Science*, *12*, 412–418.

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