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Language Matters: Denying the Existence of the 30-Million-Word Gap Has Serious Consequences

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Sperry, Sperry, and Miller (2018) aim to debunk what is called the 30-million-word gap by claiming that children from lower income households hear more speech than Hart and Risley (1995) reported. We address why the 30-million-word gap should not be abandoned, and the importance of retaining focus on the vital ingredient to language learning—quality speech directed to children rather than overheard speech, the focus of Sperry et al.'s argument. Three issues are addressed: Whether there is a language gap; the characteristics of speech that promote language development; and the importance of language in school achievement. There are serious risks to claims that low-income children, on average, hear sufficient, high-quality language relative to peers from higher income homes.

As names have power, words have power.
Words can light fires in the minds of men.
Patrick Rothfuss, *The Name of the Wind*

Words do indeed have power. Words, and the concepts they encode, are born in the nexus of social interaction between adults and children. Via syntax, words combine to make sentences that describe events in the world, enabling us to distinguish between, "The baby is on the pillow" and "The pillow is on the baby"—the latter describing a dangerous state. Virtually all children around the world learn language and can effectively participate in

everyday conversations. However, striking individual differences exist among children in their language skills. In industrialized countries, such as the United States, differences in verbal achievement are associated with income disparities, healthcare outcomes, high school graduation rates, job placement, and many more life milestones. Indeed, Cocking and Mestre (1988) argued that "language is the currency of education" for the development of "higher order cognitive and social skills" needed to succeed in school and in life.

Researchers who study language development aim to understand differences in children's language abilities for at least two reasons. First, the study of individual differences advances theories and knowledge on the science of language learning. Second, it is crucial to understand the source of these differences to design effective, evidence-based interventions. Caregivers' conversations with

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children impact early language learning, school readiness, and ultimately school success.

Language is causally implicated in most of what children learn in the first years of life. Indeed, kindergarten language scores, which are deeply rooted in the language development of infants and toddlers, are the single best predictor of school achievement in all subjects in third and fifth grade (Durham, Farkas, Hammer, Tomblin, & Catts, 2007; Pace, Burchinal, Alper, Hirsh-Pasek, & Golinkoff, 2019). Furthermore, children who have better language have better self-control (Roben, Cole, & Armstrong, 2013). Children's language development mediates between their ability to profit from parental autonomy support (conveyed through encouraging language) and the development of executive functioning (Matte-Gagne & Bernier, 2011). Executive functioning, in turn, supports social and academic outcomes (e.g., Zelazo, Blair, & Willoughby, 2016).

When parents read to children and talk to them about the focus of their attention, children acquire more than just language. They acquire concepts and general knowledge that are essential to listening and reading comprehension (e.g., Dickinson, Griffith, Golinkoff, & Hirsh-Pasek, 2012; Grissmer, Grimm, Aiyer, Murrah, & Steele, 2010) and practice learning how to focus their attention (e.g., Mendelsohn et al., 2018). When learning-to-read turns into reading-to-learn, knowledge of vocabulary and sentence structure is required to comprehend texts and to understand teachers and peers. In sum, attention to the amount and quality of children's language exposure is not misplaced: Language experience matters. What Hart and Risley (1995; hereafter HR) famously identified was an enormous difference in the amount and quality of language experience between children who live at different levels of the socioeconomic ladder. Based on home samplings of the speech children heard, HR estimated that by the age of 4 years, the most advantaged children had heard 30 million more words addressed to them than the least advantaged children.

Recognition of the sweeping importance language has for lifelong success, and the remarkable disparities that characterize the language skills of children from middle- and low-income households, helps explain the powerful impact Hart and Risley (1995) observations had on the scientific community. Their identification of a "30-million-word gap" in language exposure between children in their so-called "welfare" group and those in their "professional" group understandably sparked much research and multiple replications of their findings; replications that improved on HR's work by

including statistical evidence that parent input mediates the effects of socioeconomic status (SES) on child language growth (e.g., Hoff, 2003; Hutton-locher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). It also stirred up fierce debate around the interpretation of HR's findings. Thus, Sperry, Sperry, and Miller's (2018; SSM, hereafter) claim that HR were wrong about a "massive Word Gap in the vocabulary environments of young children" (p. 22) requires careful examination.

SSM seek to refute that claim, arguing (a) that they did not replicate HR's finding of SES-related differences but rather found variation within socio-economic strata and (b) that accurately capturing the language experience of children from lower income households requires including overheard speech, not just speech addressed directly to children. Central to SSM's argument is the idea that "definitions of verbal environments that exclude multiple caregivers and bystander talk disproportionately underestimate the number of words to which low-income children are exposed" (p. 2 ms). There are, however, sufficient flaws in this argument that lead us to reject their conclusions.

Is There a 30-Million Gap in Language Exposure Between Children From Low-Income Versus Middle- and High-Income Families? Is There a Corresponding Gap in Children's Language Skills?

SSM's design did not replicate HR's design as they omitted the inclusion of a highly educated group comparable to HR's sample; this fact prevents SSM from making a comparison of their findings to HR's findings. SSM found variability within socio-economic strata, a finding replicated by every study in the literature. Within-group variability is not inconsistent with between-group differences.

Much data suggest that the language exposure gap across income levels is alive and well (e.g., Hoff, 2003; Huttonlocher et al., 2010; Rowe, 2017)—and that there is a corresponding gap in children's language skills. For example, the recent development and validation of a new language screener for children from 3 through 5 (Quick Interactive Language Screener; Golinkoff, de Villiers, Hirsh-Pasek, Iglesias, & Wilson, 2017) led the authors to test more than 250 children from lower income versus higher income homes. Primary caregiver education was used as a proxy for SES, with children of college- and graduate-educated caregivers grouped as higher SES, and children of caregivers without a

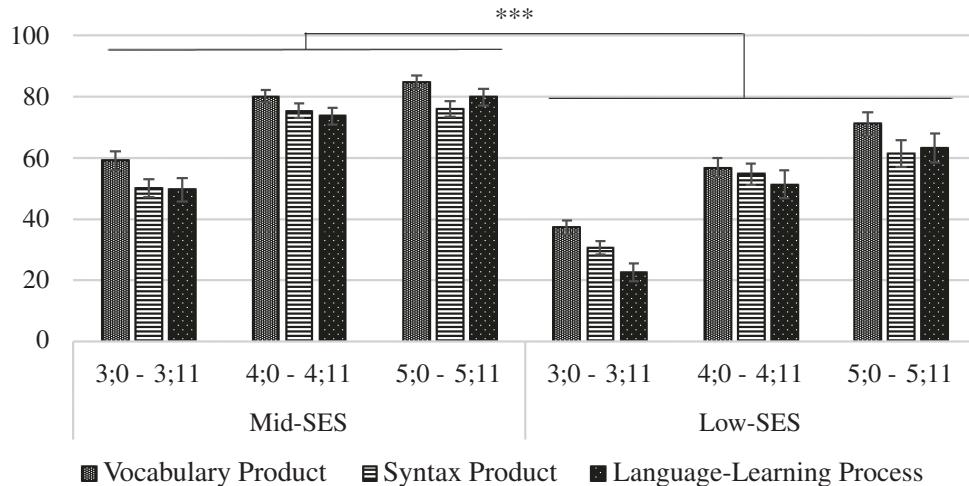


Figure 1. Monolingual children's scores on the Quick Interactive Language Screener (QUILS) by social class (maternal education) plotted by age and by area on the QUILS. The main effect of socioeconomic status (SES) was significant, and there were no significant interactions with age or QUILS area. *** $p < .0001$. (From Levine, Pace, Hirsh-Pasek, & Golinkoff, under review.)

bachelor's degree grouped as lower SES. As Figure 1 indicates, on vocabulary, syntax, and the learning of new language items (referred to as "process"), and at all three ages, children from low SES homes scored significantly below children from middle and higher income homes, on average (Levine et al., under review). Furthermore, when maternal education is used as a proxy for SES (Hoff, 2013), there is a clear relationship with children's language skill (Levine et al., under review). Whether we call it the 30-million-word gap (a catchy phrase that let the public in on the research) or something else, it is clear that those children from low-income homes who hear significantly less language directed to them show a parallel lag in language compared to those from higher income homes who are exposed to more language.

Speech Directed to Children Supports Language Learning

SSM's claim on the value of overheard speech requires serious examination. As SSM themselves note, there is need for additional information about when and under what circumstances overheard speech might facilitate language learning. However, there are no data to suggest that overheard speech promotes language learning during the period when children are first breaking into language (Shneidman, Arroyo, Levine, & Goldin-Meadow, 2013; Weisleder & Fernald, 2013). On pages 8 and 9 [ms pages], in fact, SSM state that when the effects of overheard speech are compared against language

directed to children, only the latter predicts later language learning and outcomes. Other data that can be brought to bear on the topic of overheard speech indicate, for example, that young learners, do not learn from televised displays (Kuhl, 2010) but only learn when displays (like video chat) are responsive to the infant's behaviors (Roseberry, Hirsh-Pasek, & Golinkoff, 2013).

The enormous benefits of child-directed speech for language learning relative to overheard speech sparks the question of learning mechanisms. That is, *why* do children learn language better from child-directed speech than overheard speech? Several straightforward explanations exist. First, the attentional demands of overheard speech greatly exceed those of child-directed speech. For young children to benefit from overheard speech, they must stop whatever they are doing themselves and direct their attention to an interaction between other people. This is not an easy feat, especially because infants and toddlers have enormous difficulties inhibiting attention to salient stimuli to attend to other things. Typically, studies of overheard speech are conducted in lab environments in which experimenters exert thorough control over other stimuli and minimize attentional demands (e.g., Yuan & Fisher, 2009). In these situations, where nothing else is vying for the toddler's attention, learning occurs, although not reliably until about 2 years of age (Messenger, Yuan, & Fisher, 2015). Moreover, demonstrating that an infant or child *can* learn from overheard speech does not make this an efficient or advantageous path to language learning. Indeed, language input that

meaningfully builds on what children are doing in the moment, is rooted in shared attention, and models the use of syntax by using recasts and expansions of their utterances best facilitates language learning (e.g., Harris, Golinkoff, & Hirsh-Pasek, 2010; Malin, Cabrera, & Rowe, 2014; McGillivray et al., 2017). As countless studies have shown, *back-and-forth conversations that are both temporally and topically contingent on children's contribution, are the fuel that prime the learning of language* (Goldin-Meadow et al., 2014; Reed, Hirsh-Pasek, & Golinkoff, 2017; Romeo et al., 2018; Tamis-LeMonda, Kuchirkko, & Song, 2014).

Second, the social-cognitive demands of overheard speech likewise exceed those for child-directed speech in that children have to infer others' interests and intentions, making sense of third-party interactions rather than one-on-one exchanges. When caregivers talk to children, in contrast, the child's task is easier, albeit still challenging: Children must connect the words they hear to the objects and actions of their own attention and still resolve referential ambiguities.

Third, the characteristics of speech directed to young children differ from adult-directed speech in content, prosodic cues, grammatical complexity, physical cues to meaning such as gestures and touch, and so forth (e.g., Golinkoff, Can, Soderstrom, & Hirsh-Pasek, 2015). These differences occur cross-culturally (e.g., Fernald et al., 1989). The many social cues that accompany speech to children help them to map words to world. Of course, SSM note that children likely search for behavioral cues in others' actions to learn word meanings from overheard speech, and sometimes use distributional cues to infer the meaning of novel verbs (Yuan & Fisher, 2009). Again, however, just because children can exploit these cues under some circumstances does not mean that leveraging the richer set of cues that accompany child-directed speech would not make the process more efficient. Furthermore, when parents repeatedly label the objects of infants' attention and their actions during routines, these behaviors contain rich contextual cues to word meaning. A child sitting in a high chair who hears, for example, "Juice. You like your juice?" is receiving input that is uncharacteristic of adult conversations, in which decontextualized talk is geared toward other things like movies, politics, work, and so on etc. Deciphering decontextualized talk is a challenge to young children but without participating in the exchange and being privy to informative social cues, the task may become impossible.

In short, overheard speech does not support early language learning because language growth requires

much more than words passing children's ears. Thus, fleshing out models of overheard speech will not contribute to closing the persistent, average language lag found between children from lower income homes and those from middle and upper income homes. This conclusion leads then to the next question on the quantity versus quality of language inputs: *Which aspects of the language directed to children are important for language development?*

Quantity Versus Quality of Communicative Exchanges: What Really Matters?

New analyses of child-directed speech suggest that quantity per se is not as useful to young children as is the *quality* of this speech. The quality of language addressed to children has been conceptualized in several ways, with two vital ingredients being the lexical diversity of language input and the reciprocity of communications between parents and children. Studies that pit quantity (word tokens) against diversity (word types), or that create computational models of input (Jones & Rowland, 2017), indicate that lexical diversity grows in importance with child age, in line with children's expanding vocabularies. Rowe (2012) showed that parents' vocabulary diversity as reported at 30 months, and not quantity of words per se, predicted children's vocabulary at 42 months. However, quantity mattered at 18 months for predicting vocabulary at 30 months, likely because children need to hear a significant amount of child-directed language to fuel the language-learning process.

When language is examined in terms of the nature of the communicative interactions between mothers and children, quality again surpasses quantity of words in predictive power (Hirsh-Pasek, Adamson, Bakeman, Owen, Golinkoff, Pace, et al., 2015). That is, the "fluency and connectedness" of mother-child interactions when children were 24 months of age predicted children's language status a year later at 36 months, far more than the number of words mothers used. Crucially, this sample contained all low-income families, suggesting that the "conversational duet" set up between caregivers and children matters more than social class for children's language success. These findings again confirm SSM's claim that there is a "wide range of maternal talkativeness within low-income families" (p. 12 ms). That "wide range" matters—even for phonetic perception in the first year. Infants who "lose" perception of nonnative phonemes earlier than their peers develop more language sooner

(Melvin et al., 2016). This variation within SES is entirely consistent with the evidence that differences between levels of SES matter; for fording this milestone, the linguistic richness of the home environment is what counts and not family income.

A recent paper addressed an aspect of quality in a different way—asking how real-time variation in children’s conversational turns with parents relates to brain function that underlies language processing (Romeo et al., 2018). A diverse group of 4- to 6-year-old children were scanned in a functional MRI (fMRI) machine while they listened to age-appropriate stories played forward and backward to obtain a difference measure of language processing. They were also administered a range of language tests (e.g., Peabody Picture Vocabulary Test, Clinical Evaluation of Language Fundamentals®, 5th ed.) and their home language environments recorded for analysis. The results were striking. Conversational turns with a parent, rather than the sheer amount of language to which children were exposed, predicted greater activation in Broca’s area, even after controlling for number of parent words, child words, and a host of other variables. In fact, conversational turns combined with Broca’s activation mediated the relationship between parent education and children’s language scores.

Yet another study examined the quality of language and behavioral interaction during storybook reading and how it related to neural activation in 4-year-old children from low-income families (Hutton et al., 2017). First, the authors scanned children in an fMRI machine while children listened to alternating trials of a woman telling a short story or tones that mimicked human speech. These data were the baseline needed to assess which brain areas respond during listening comprehension. Second, the authors rated the quality of shared book reading between mothers and children, coding behaviors such as “child-adjusted voice,” discussions during and before reading, open-ended questions, and whether they related the story to the child’s life. These components of “dialogic reading” (Whitehurst et al., 1988) were related to differences in brain activation in Broca’s area. Thus, Romeo et al. (2018), Hutton et al. (2017), and numerous behavioral studies (e.g., Cartmill et al., 2013; Malin et al., 2014) find that language quality and reading quality are contributors to children’s brain development and language growth. In this regard, SSM report on the extensive personal stories told in working-class African American families to their children, certainly valuable exchanges for children’s later vocabulary development (Sperry & Sperry, 1996, 2000).

Because variation in language experience relates to children’s verbal scores and to neural activation, interventions that solely focus on increasing the *quantity* of language children hear—whether overheard or child directed—are misdirected. The emphasis should instead be on creating interventions in which nurturing adults converse *with* children on topics of interest to the children; overheard speech lacks the richness necessary for helping children link the language they hear to the world. Caregivers can be encouraged to have such conversations. The 30-million-word gap project (Suskind et al., 2016) showed that sharing data with parents gathered using the Language Environment Analysis (LENA) (Boulder, CO, USA) recording device encouraged conversation between parents and children and increased the number of conversational turns from pre- to postintervention. Overheard speech cannot replace one-on-one dialogic reading or conversations with children about their interests.

Language Is Key to Children’s School Achievement

Language is the basis for reading and school success. Currently in the United States, there is a large and significant income achievement gap in reading skills when children *enter* kindergarten (Reardon, 2013; Von Hippel & Hamrock, 2016). Indeed, income disparities found in vocabulary skills in kindergarten are the main reason for the income achievement gap in later academic skills (Durham et al., 2007).

We appreciate the strengths-based approach that SSM bring to their work to highlight variation in children’s early verbal environments. We certainly do not support the deficit perspective that all low-income parents do not talk enough with their children. Indeed, our own work with entirely low-income samples finds extensive variation in parent input that predicts child language skills (e.g., Hirsh-Pasek et al., 2015; Pan, Rowe, Singer, & Snow, 2005; Song, Tamis-LeMonda, Yoshikawa, Kahana-Kalman, & Wu, 2012). But the research evidence clearly suggests that building children’s early language skills will help set them up to succeed in school—despite the additional and myriad issues children from low-income families face (e.g., food insecurity, toxocariasis, abuse, neglect, air and noise pollution, lead poisoning, etc.).

Perhaps years ago, when schools moved more slowly and we were not in a knowledge economy, having fewer conversations and poor school achievement was less of a problem. Now however,

as the evidence mounts that language skill is implicated in school achievement, and as kindergarten has become the new first grade (Bassok, Latham, & Rorem, 2016), children are under increasing pressure to perform. As Bassok et al. (2016) found, many public school kindergarten teachers in 2010 (compared to 1998) believe that "academic instruction should begin prior to kindergarten entry." Furthermore, these changes "were more pronounced among schools serving high percentages of low-income and non-White children, particularly with respect to teacher expectations and didactic instruction" (p. 14). Furthermore, recent evidence suggests that the income-based achievement gap in reading does not get smaller across the elementary years (von Hippel, Workman, & Downey, 2017). Thus, we must consider how to "language-ize" children's homes, day cares, and schools to meet this challenge, especially as low-income children experience the brunt of these changes (Masek et al., in press).

In fact, there are interventions that build language and then affect school achievement. Although we cannot review those studies here, suffice it to say that programs like Educare (Yazejian et al., 2017) that begin when children are as young as 9 months of age, increase children's receptive and expressive language 1 year later compared to a control group with the same demographic complexion. High quality early child-care environments can make a difference in children's language, their preparation for school, and their achievement once they get to school (e.g., Vernon-Feagans, Bratsch-Hines, & Family Life Project Key Investigators, 2013). If the literature has defined experience too narrowly, to the disadvantage of nonmainstream families, this simply leads to the next question: What does explain the average gap in children's accomplishments? Our argument—based in the science—is that poor language skills is part of that answer.

Denying the Language Gap and Emphasizing Overheard Speech Can Be Harmful

If people accept SSM's argument that children from low-income households are exposed to sufficient talk to learn language and to do well in school, or that young children need only be bystanders to adult conversations to process language efficiently, efforts to increase children's language exposure and enhance its quality may be treated as suspect. This approach would mislead policymakers, practitioners, and the public. The message should *not* be that children hear enough language but that children

need more opportunities to participate in conversations that focus on their interests during everyday interactions with caregivers (e.g., Romeo et al., 2018). In fact, there is already a disjunction between what the science tells us and what the general public believes. As Zimmerman et al. (2009) wrote,

If adult speech input is presented as intrinsically valuable, because it serves as a model for language that children intuitively copy, then parents can conclude that the more adult speech the better, even if some of this adult speech comes through television or videos. Many parents have drawn exactly such conclusions. (p. 343)

To summarize, rolling back an emphasis on the 30-million-word gap might have unfortunate consequences for children who already have to cope with the deleterious effects of poverty. There is little question that the language addressed to children matters for language development *per se* and for all its collateral benefits—for acquiring information about the world, developing self-regulation skills and executive function, and engaging with teachers and peers. Overhearing language about death and taxes—topics of interest to adults—can never be as effective for language learning as participating in contingent conversations about what matters to children.

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