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Evaluating "Meaningful Differences" in Learning and Communication Across SES Backgrounds

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Abstract

Socioeconomic status (SES) differences in language development are ubiquitous, but existing research has yet to wrestle with how language gaps reflect (*a*) differences in relevant concepts for communication, (*b*) comprehension strategies to access meanings, and (*c*) production practices that express social identity. In child-directed input, parents use verbs to describe similar concepts across SES, and the largest gaps emerge when frequent meanings are being conveyed. During comprehension, children acquire infrequent aspects of grammar across SES but differ in context-specific strategies for interpreting likely meanings. In production, children are sensitive to sociolinguistic implications and adopt context-specific strategies to signal social identity. This suggests that language is a flexible medium for communicating thoughts and that SES effects signal latent differences in meanings and identities across social classes. Whether language gaps contribute to achievement gaps may depend on the extent to which learning and communication draw on these meanings and value these identities.

The whole idea of a stereotype is to simplify. Instead of going through the problem of all this great diversity—that it's this or maybe that—you have just one large statement; it is this.

—Chinua Achebe

[Egalitarianism] should promote institutional arrangements that enable the diversity of people's talents, aspirations, roles, and cultures to benefit everyone and to be recognized as mutually beneficial.

—Elizabeth S. Anderson (1999, p. 308)

1. INTRODUCTION

Social class exists across all societies, and families talk differently across social classes. In the United States, decades of research have uncovered socioeconomic status (SES) variation across a range of language metrics, including children's vocabulary size (Hart & Risley 1995, Hoff 2003), language processing (Huang et al. 2017, Weisleder & Fernald 2013), brain development (Noble et al. 2005, Romeo et al. 2018b), and academic achievement (Durham et al. 2007, Lurie et al. 2021). SES differences in development are mediated by a myriad of factors within parental input, including the number of words spoken (Golinkoff et al. 2019, Hart & Risley 1995), frequency of child-directed speech (Hoff-Ginsberg 1986, Rowe 2008), conversational turn taking (Hirsh-Pasek et al. 2015, Romeo et al. 2018a), gestures (Rowe 2000, Rowe & Goldin-Meadow 2009), and decontextualized language (Demir et al. 2015, Rowe 2012). The early emergence of SES differences and their persistence into the school-age years have inspired interventions to reduce "language gaps" by changing how lower-SES parents communicate with children (Leung et al. 2020, Ramírez et al. 2020, Rowe & Leech 2019, Suskind et al. 2016).

Despite their ubiquity, it remains unclear which SES differences meaningfully contribute to learning and communication and which ones simply reflect variation in how individuals talk across social groups. While there is general consensus that language skills are affected by early environments and that poverty contributes to achievement gaps, SES research is inherently non-experimental, and the profusion of co-occurring factors creates hurdles for inferring the causes and consequences of language differences (Baugh 2017, Ellwood-Lowe et al. 2016, Medin et al. 2010). Without systematic frameworks for evaluating which SES differences are merely differences (e.g., akin to the number of hairs on one's head) and which ones could potentially interfere with learning and communication (e.g., akin to transfer effects in second language learning), it may be tempting to take a data-driven approach and assume that all SES differences are potential magnets for achievement gaps. From an intervention perspective, this guess-and-check strategy is impractical since vast resources would be needed to test an unconstrained hypothesis space. As a scientific endeavor, this approach may incorrectly attribute differences that exist within society to processes that occur within individuals. For example, there are well-known gender differences in how individuals talk (Eckert 2012, Labov 1972a, Tannen 1995), and there are on average gender pay gaps in society (Blau & Kahn 2017). But it would be a logical error to assume that women are paid less because of how they talk or that changing how women speak would be sufficient to close pay gaps.

For SES differences, the meaningfulness question is inherently difficult to answer since it requires linking observable language metrics (e.g., number of words spoken) to the unobservable processes that generate them (e.g., how a speaker's intended meaning is conveyed via words in sentences, how this meaning is reverse engineered in the minds of listeners) and describing how these relations can vary across learners over multiple time scales (e.g., past, current, and future communicative contexts). Each of these elements is complex in its own right, and this review takes first steps toward developing a framework for understanding their connections. We start from the premise that language functions as a medium for exchanging relevant information for a current

context and for establishing relationships between individuals within social groups. Since SES environments introduce shared and unique communication demands, language development is the dual process of learning systems for expressing one's needs (acquiring linguistic forms) and using those systems to affiliate with individuals who have similar needs (expressing social identity). This framework is informed by rich literatures in sociolinguistics, which traces how speakers' production of linguistic features is inextricably tied to their social identities (Campbell-Kibler 2007, Eckert 2012, Labov 1972a), and cognitive science, which describes how cross-cultural differences in linguistic forms are affected by their efficiency in real-time communication and learnability in year-to-year development (Kemp et al. 2018, Kirby et al. 2015, Lupyan & Dale 2016). By grounding SES differences within functional descriptions of language use, we can distinguish pathways that generate measurable gaps and delineate specific situations that may generate learning and communication mismatches.

Our central hypothesis is that language gaps in production and comprehension are the observable signals of harder-to-observe differences in meanings and identities that vary across SES backgrounds. In this review, we explore these nonlinguistic bases of language differences across three domains: (*a*) meanings that parents routinely communicate, (*b*) strategies that children adopt to interpret likely meanings, and (*c*) practices that children employ to express social identities. Across these areas, we demonstrate that language is a highly flexible, context-sensitive medium that adapts to the needs of current communication for parents and children alike. Thus, when we find language gaps across SES, they may reflect less about the observable linguistic forms and more about the underlying social and conceptual knowledge that parents and children draw from when navigating different lived experiences. During development, children bootstrap both linguistic and nonlinguistic knowledge from the same sets of communicative interactions. Our counterintuitive proposal is that language learning may be the easy part of development and that the much harder procedures are the ones required for acquiring systems of structured knowledge in social and conceptual domains. If this hypothesis is correct, then interventions that focus on changing how parents or children talk or listen may place excessive attention on the observable linguistic signals rather than their social and cognitive bases. Also, how language gaps contribute to academic achievement may largely depend on whether future learning draws on early learned concepts and value differences in social identities.

In the remainder of this review, we briefly unpack the state of SES research: what we know, what we do not know, and three well-established findings that set the stage for unraveling mechanisms involved in language gaps. We then evaluate the extent to which language gaps are linguistic versus conceptual/social in nature by investigating pathways between (*a*) form and function in parental input, (*b*) grammar and parsing in children's sentence comprehension, and (*c*) context and identity in children's language production. These test cases highlight the ubiquity of language gaps but also suggest that their origins reflect systematic, nonlinguistic factors that vary across SES. Hence, these gaps are largest when parents communicate frequently occurring, routine concepts (and not when using rare words) and children interpret likely sentence meanings (and not in knowledge of infrequent aspects of grammar) and are influenced by the social factors that guide production. We close by considering how this new understanding of language gaps informs our evaluation of SES impacts on learning and communication and future research that examines specific pathways for academic challenges.

2. SES DIFFERENCES: WHAT DO WE KNOW, AND WHAT DON'T WE KNOW?

A central paradox within SES research is the fervent disagreement in how to interpret language gaps despite the strong consensus about the basic ingredients that enable learning and

communication. At a high level, researchers largely agree that conversations between parents and children achieve specific goals, which are shaped by within- and between-SES variation in family lives (Hofferth & Sandberg 2001, Ochs & Kremer-Sadlik 2015). The textures of family lives are idiosyncratic and differ along factors such as which parents work outside the home (Bianchi et al. 2006, Goodwin 2007), types of structured and unstructured activities in daily and weekly routines (Hofferth & Sandberg 2001), number of children in households (Goodwin & Goodwin 2013), and many more. These factors shape the pragmatics of family communication, speaker goals, and speech acts (Goodwin & Cekaite 2013; Hoff-Ginsberg 1986, 1991). For example, families with multiple children introduce the need to use language to collaborate, negotiate, and protest with siblings (Dunn & Shatz 1989, Havron et al. 2019b). Likewise, if parents and children spend hours apart during their day, they may routinely request information about the past (e.g., *What did you do today?*).

On the child learning side, parental speech acts are probabilistically associated with syntactic forms (e.g., *wh*-questions, relative clauses), which in aggregate shape the distributional properties of input for language learning (Perkins & Lidz 2021, Yang et al. 2022). For example, parents frequently issue commands in the form of imperatives (e.g., *Put on your socks!*), and this shows up in about one-third of parental utterances that omit grammatical subjects (Cameron-Faulkner et al. 2003, Laakso & Smith 2007, Tardif et al. 1997). Distributional properties of parental input inform the algorithms that children adopt to interpret sentences (Huang et al. 2013, MacWhinney et al. 1984). For example, in English, a canonical subject–verb–object word order leads to sentences where first noun phrases (NP1s) are often agents (Chan et al. 2009), while in prodrop languages like Italian, salient subjects are often omitted in the discourse (Bates et al. 1982). Thus, English-speaking toddlers learn to identify agents in sentences by focusing on word order (e.g., agent-first bias) while Italian learners attend to lexical semantics (e.g., animate NPs) (Bates et al. 1984). This demonstrates that young children are sensitive to broad-scale regularities in how their language conveys sentence meanings.

Within this general backdrop of language development, SES-related language gaps are well documented. We focus on understanding three widely cited patterns:

1. Parental production: The 30-million-word gap remains a focal point of SES research (Golinkoff et al. 2019, Hart & Risley 1995) and is related to other aspects of parental input (e.g., child-directed speech, turn taking, gestures, decontextualized language). SES differences in parental input are predicted by parental education and knowledge of child development (Rowe 2008, Rowe et al. 2016, Vernon-Feagans et al. 2008).
2. Children's comprehension: Eighteen-month-olds from lower-SES backgrounds are slower to recognize frequent words in sentences (e.g., *apple*, *ball*) compared to higher-SES peers (Fernald et al. 2013, Hurtado et al. 2008, Weisleder & Fernald 2013). Individual variation in the speed of word recognition predicts vocabulary size 6 months later, suggesting that real-time comprehension mediates relationships between SES and vocabulary development.
3. Children's production: Language gaps are well documented in children's vocabulary size (Hart & Risley 1995, Hoff 2003), syntactic complexity (Huttenlocher et al. 2002, 2010), turn taking (Hirsh-Pasek et al. 2015, Romeo et al. 2018a,b), and decontextualized language (Demir et al. 2015, Tabors et al. 2001). However, it remains unclear whether they reflect differences in linguistic knowledge versus communicative contexts for language use.

Understanding the implications of these SES differences requires wrestling with how and why these gaps are observed in language. **Figure 1** illustrates two hypothesized pathways. In current research, a dominant perspective is that language gaps arise from variation in SES environments, which influence parental input and in turn child development (**Figure 1*a***). Thus, if we alter

a Linguistic Knowledge

b Concepts and Social Cognition
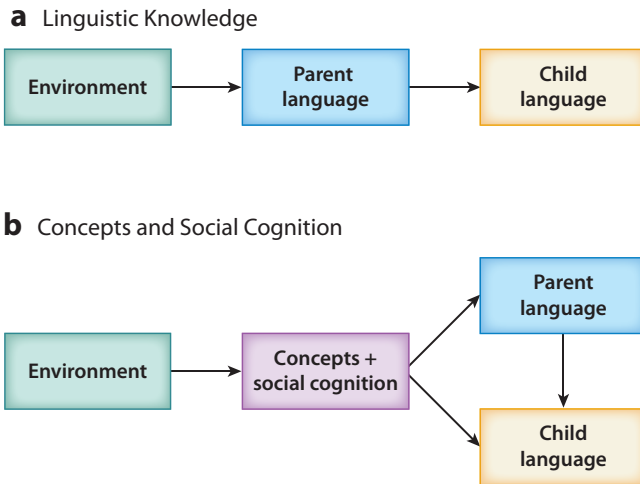
Figure 1

Two hypothetical pathways for language gaps. (*a*) Under the Linguistic Knowledge account, variation in SES environment influences parental input, which in turn affects the child's acquisition of linguistic knowledge. (*b*) Under the Concepts and Social Cognition account, language gaps signal underlying differences in nonlinguistic knowledge that exist when experiences differ across SES environments. Abbreviation: SES, socioeconomic status.

parental input, we can modify child development. Yet, language use sits on top of a rich architecture of conceptual knowledge and social cognition, and thus observable language gaps may signal underlying nonlinguistic knowledge that varies when experiences differ across SES (**Figure 1*b***). If this were the case, then intervening on parental input might have minimal impact on child development since parent and child communication would still be primarily shaped by their nonlinguistic environments. Distinguishing whether language gaps are primarily linguistic or nonlinguistic is not straightforward since language and conceptual/social knowledge are all influenced by SES environments. To tease these apart, we will investigate how language use tracks frequent meanings across communicative contexts. Our reasoning is that if language gaps reflect linguistic differences, they should emerge across all contexts to a similar extent whenever parents and children use language. This is akin to how speech from English speakers is always influenced by English linguistic forms. In contrast, if language gaps reflect conceptual and social differences that are visible during communication, their occurrence should vary across contexts and track frequent experiences. This is akin to how experts in a domain (e.g., car mechanics) talk differently from novices because systematic differences in experiences contribute to variation in subject-matter knowledge. Frequent meanings may generate larger language gaps since they reflect the relevant experiences in families' everyday lives.

## 3. PARENTAL INPUT: PATHWAYS BETWEEN SES BACKGROUND AND COMMUNICATION GOALS

Recent debates about the 30-million-word gap have focused on how to count input in language environments and the extent to which child-directed speech is privileged in learning (Golinkoff et al. 2019, Hirsh-Pasek et al. 2015, Sperry et al. 2019). Yet, despite their disagreements, all sides largely assume that parental input reflects properties of parents from a particular SES background (the Linguistic Knowledge account; **Figure 1*a***). This notion is supported by a wealth of evidence

that input profiles are highly correlated within individuals. Parents who talk more also tend to use rare words (Rowe 2012, Weizman & Snow 2001), complex syntactic structures (Hoff-Ginsberg 1991; Huttenlocher et al. 2002, 2010), and decontextualized language (Curenton & Justice 2004, Rowe 2012). These parents are from higher-SES backgrounds, on average. Likewise, SES differences in parental input are predicted by overall parental education as well as specific knowledge of child development (Rowe 2008, Rowe et al. 2016, Vernon-Feagans et al. 2008). Attributing language gaps in parent input to properties of parents makes intuitive sense since speech is shaped by properties of speakers. It is also convenient from an intervention perspective since it suggests that reducing language gaps in development may be as simple as educating lower-SES parents.

Evaluating the validity of this account is challenging since it requires analytical strategies that link the form and function of parental input with sufficient granularity to distinguish SES similarities and differences. It is unclear whether existing work achieves this goal. For example, analyses of decontextualized language (e.g., pretend play, causal explanations) and functional properties focus on relations at the utterance level (Hoff-Ginsberg 1986, Rowe 2012). Analyses of trigrams, morphemes, and clausal/lexical frequency or diversity yield finer-grained metrics but remain agnostic to why forms are used or how they satisfy current communication requirements (Huttenlocher et al. 2010, Pearl & Bates 2022). Both factors can contribute to the illusion of omnipresent language gaps. When parental input is analyzed with insufficient granularity, the shared variance of coarse-grained metrics will lead to multiple correlations. When input analyses are divorced from meaning, it makes it difficult to distinguish whether parents talk the way they do because of internal traits or because this speech satisfies specific goals that arise from stable factors in their external environments. If speech production reflects both speaker traits and communication opportunities, it may be the case that the systematicity of parental input across SES backgrounds is driven by the latter and not simply the former.

To analyze relationships between what parents say and how they say it, we turned to the lexical semantics and syntactic distributions of frequent verbs in child-directed input. Since verbs are known to link speaker goals, caregiver input, and child learning (Gleitman 1990, Huang & Arnold 2016, Van Horne et al. 2017), they may inform which elements of communication generate language gaps. We implemented analyses in the Hall Corpus (Hall et al. 1984), which offers extended conversations between parents and 4- and 5-year-old children during their daily routines (e.g., walking to school, after school, mealtimes, bedtime), sampled from 39 families of varying SES (working class, middle class) and racial backgrounds (White, Black). To increase the interpretability of SES comparisons, we focused on 29 verbs that were regularly used across families (Oppenheimer et al. 2020; **Figure 2*a***). Following a Zipfian distribution, these verbs varied substantially in token frequency. Our linking assumption was that parental production of a verb is an observable signal that is driven by properties of the speaker and communication context in a similar manner across SES. For example, when higher- and lower-SES parents said *think*, we assumed that they did so because the speakers' intentions and communicative contexts related to mental states. Frequent verbs accounted for similar proportions of all verbs used in parental input across SES (i.e., 40% in lower-SES homes, 38% in higher-SES homes).

To understand how verb usage relates to broad pragmatic functions, we first categorized lexical meanings based on concreteness, drawn from independent norms of how easily concepts could be seen, heard, and touched (Brysbaert et al. 2014). Conceptually, this metric is related to analyses of decontextualized language: descriptions of events that do not occur in the here and now (Snow 1990). On average, higher-SES parents use more decontextualized language (Rowe 2012, Uccelli et al. 2019), which contributes to the syntactic complexity of parental input compared to lower-SES counterparts (Hoff-Ginsberg 1986, 1991; Huttenlocher et al. 2002, 2010). Consistent with these findings, **Figure 2*b,c*** reveals that verbs with more abstract meanings (e.g., *know*,
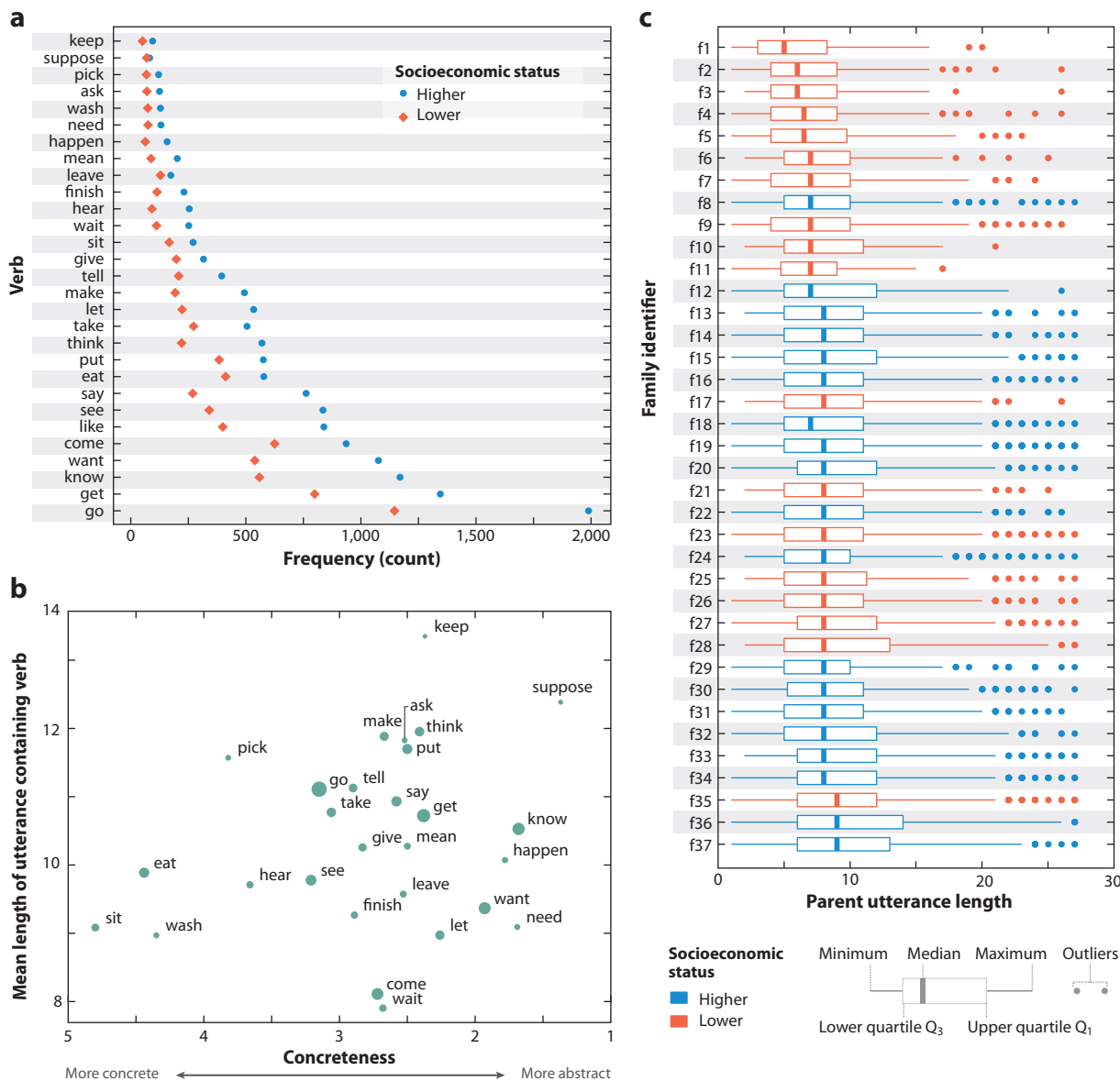
Figure 2

Analyses of parental input from the Hall Corpus (Hall et al. 1984). We identified 29 verbs used across SES backgrounds and extracted utterances containing those verbs ($n = 5,867$ utterances from lower-SES parents; $n = 11,178$ utterances from higher-SES parents). (*a*) Token frequency of verbs by SES. On average, higher-SES parents produced target verbs more frequently compared to lower-SES parents, and this difference was greater for more frequent verbs. (*b*) Mean length of utterance by concreteness ratings of target verbs. Circle size indicates the token frequency of verbs in the corpus. On average, utterances containing abstract verbs were longer than ones containing concrete verbs. (*c*) Median length of utterance by each parent and SES background. On average, higher-SES parents produced longer utterances compared to lower-SES parents, but there is considerable variability in utterance length within parents and SES background. Abbreviation: SES, socioeconomic status.

suppose) occurred in longer sentences compared to verbs with more concrete meanings (e.g., *eat*, *sit*). Likewise, on average, higher-SES parents produce longer utterances than lower-SES peers (Hoff-Ginsberg 1991; Huttenlocher et al. 2002, 2010). Together, these findings demonstrate that verb analyses are sensitive to established patterns within parental input.

Next, to evaluate potential causes of language gaps, we analyzed the distribution of verbs across SES backgrounds. If parental input arises from broad parental traits, we might expect token frequency to be greater across all verbs for higher-SES parents compared to lower-SES parents (Golinkoff et al. 2019, Hart & Risley 1995, Hirsh-Pasek et al. 2015). Likewise, if parental input reflects specific educational factors, then we might expect SES differences to emerge precisely among infrequent words (Rowe 2012, Weizman & Snow 2001). Instead, **Figure 2a** illustrates that verb distributions are strikingly similar across SES backgrounds. All parents were more likely to refer to frequent concepts like GO, GET, and KNOW compared to less frequent concepts like KEEP, SUPPOSE, and PICK. This regularity is consistent with the notion that parental input is driven in part by shared communicative requirements across SES, including words to facilitate child-rearing activities like feeding, sleeping, and enrichment (Bianchi et al. 2006, Ochs & Kremer-Sadlik 2015). These findings also have implications for current interventions that seek to close language gaps by intervening on parents. If parents are simply asked to talk more, the increased input will occur mostly over words that are already frequent and where there is presumably already sufficient input for learning.

Another hint that communicative contexts may be shaping parental input lies in the vast variability in utterance length. If parental traits were the sole driver of parental input, then one would expect these factors to affect utterances every time parents produced speech. Instead, **Figure 2c** illustrates that within extended language samples, the same parent produces both long and short utterances across contexts, and lower-SES parents produce both long and short utterances in general. Since utterances are embedded in conversations, a given utterance length may be more related to the current communication goals (e.g., available time for chitchat) than general traits of speakers (e.g., parental education). Moreover, if parents produce utterances to satisfy the goals of specific contexts, then understanding the causes of language gaps requires describing in detail how contexts vary across SES and what forms are used to satisfy communication goals. This is admittedly difficult to do based on transcripts alone. Finally, if SES differences in language gaps primarily exist within the social and conceptual dimensions of communication, this raises doubts about the potential efficacy of interventions that alter linguistic behavior without changing the nonlinguistic dimensions that drive communication needs.

4. CHILDREN'S COMPREHENSION: PATHWAYS BETWEEN PARENTAL INPUT TO SENTENCE MEANING

Current understanding of language gaps in children's comprehension has been shaped by the finding that 18-month-olds from lower-SES families are slower to recognize words in spoken sentences compared to peers from higher-SES families and that individual variation in the speed of lexical processing predicts vocabulary size 6 months later (Fernald et al. 2013, Hurtado et al. 2008, Weisleder & Fernald 2013). A standard interpretation of this statistical relationship is that real-time processing causes developmental outcomes. On the face of things, this account fits with wide-ranging facts about acquisition. Across languages and dialects, distributional properties of parental input inform children's parsing strategies (Byrd et al. 2022, Huang et al. 2013, MacWhinney et al. 1984), and spoken-language comprehension influences learning of linguistic forms (Huang & Arnold 2016, Havron et al. 2019a, Lidz et al. 2017). In training studies, manipulating short-term input statistics alters children's real-time predictions (Qi et al. 2011, Yazbec et al.

2019), and computational models readily capture these relations (Chang et al. 2006, Dell & Chang 2014). Taken together, these observations suggest that millisecond gaps during spoken-language comprehension scale up and have the power to alter the trajectory of year-to-year acquisition (Christiansen & Chater 2016, Havron et al. 2019a).

However, there are vast differences in the time scale between real-time processing (e.g., milliseconds, minutes) and developmental outcomes (e.g., months, years), and descriptions of mediating processes remain opaque. As such, a causal story makes nontrivial assumptions about the extent to which (*a*) short-term input simulations adequately model long-term effects and (*b*) language gaps in real-time processing are widespread across communicative contexts (Huang & Ovans 2022). With respect to the latter assumption, children from higher-SES backgrounds are known to adapt their processing strategies to idiosyncratic properties of current communication, such as recently heard syntactic structures, background noise, and speaker identity (Babineau et al. 2020, Martin et al. 2022, Yurovsky et al. 2017). This suggests that processes underlying spoken-language comprehension are properties of both the learner <u>and</u> current communication and that language gaps in word recognition may not generalize to all aspects of comprehension. If language gaps are not ubiquitous across comprehension, then a simple causal story over monolithic constructs of processing and development may need to be supplanted by more complex, piecemeal descriptions of how processing–development relations are instantiated across informative test cases and how they highlight multiple pathways between these time scales.

To begin this enterprise, we turn to the test case of spoken-language comprehension of passive sentences, which are infrequent in parental input generally (Gordon & Chafetz 1990, Maratsos et al. 1985) and are even less frequent in input from lower-SES parents (Huttenlocher et al. 2002, 2010). Children from higher-SES backgrounds often misinterpret passives (Brooks & Tomasello 1999, Demuth 1989), and a straightforward prediction is that lower-SES counterparts will exhibit even greater difficulties (Linguistic Knowledge account; **Figure 1*a***). However, another possibility is that syntactic parsing strategies are context dependent (Dautriche et al. 2014, Huang et al. 2013, Huang & Ovans 2022). When sentences like the one shown in example 1 unfold incrementally on a word-by-word basis, children from higher-SES families initially interpret NP1s as causative agents (e.g., *the blicket* is a predator). This supports correct interpretations for actives but creates conflicts when interpreting passives, which require revising earlier commitments after the past participle. Importantly, children are less likely to adopt an agent-first bias when NP1s as in example 2 are known words, which introduce less uncertainty about potential meanings. In contexts where children no longer need to revise early commitments, they accurately assign roles for passive sentences.

(1a)   Active: The blicket is eating the seal.   [*the blicket* is an agent → PREDATOR]
(1b)   Passive: The blicket is eaten by the seal.   [*the blicket* is a theme → PREY]

(2a)   Active: The seal is eating the blicket.   [*the blicket* is a theme → PREY]
(2b)   Passive: The seal is eaten by the blicket.   [*the blicket* is an agent → PREDATOR]

We examined the interpretation of active and passive sentences in 129 children aged 3–7 years in Maryland and Washington, DC (Huang et al. 2017, Leech et al. 2017). On average, lower-SES families had a median income of $16,875 per year and 13 years of education. Higher-SES families had a median income of $79,565 per year and 17 years of education. Consistent with prior work (Hart & Risley 1995, Hoff 2003), overall vocabulary size in this sample was smaller for children from lower-SES backgrounds compared to higher-SES peers on average. Children were presented with spoken sentences like the ones in examples 1 and 2 and acted out their interpretation using
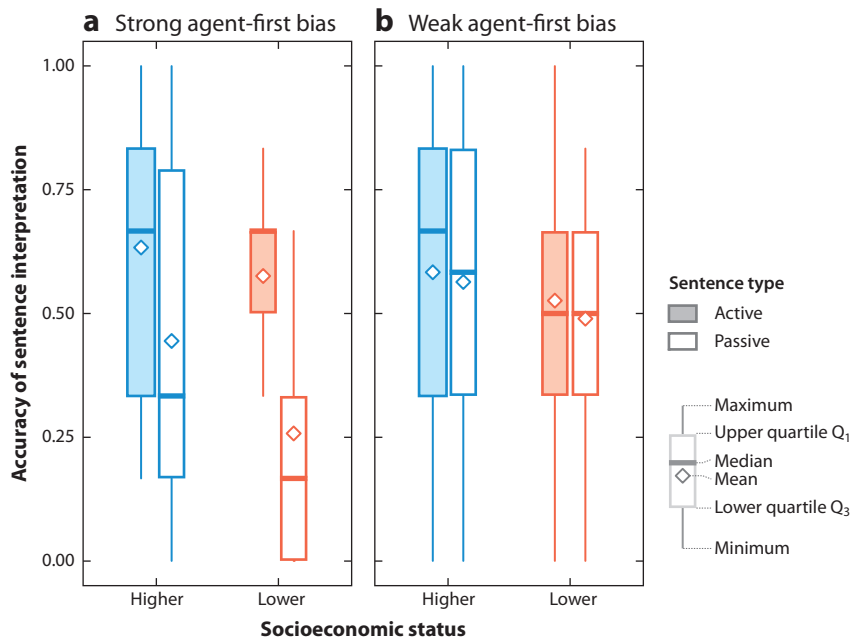
Figure 3

Sentence comprehension in 129 children from varying SES backgrounds. (*a*) In sentences with a strong agent-first bias, children were less accurate at interpreting passives compared to actives, and those from lower-SES homes experienced more difficulties. (*b*) In sentences with a weak agent-first bias, children were as accurate at interpreting both passives and actives, and no SES differences were found. Abbreviation: SES, socioeconomic status.

toys or pictures. Prior parsing patterns among children from higher-SES backgrounds offer predictions about where language gaps may emerge. If spoken-language comprehension is solely a property of the learner, then we might expect syntactic parsing to be consistently less accurate for children from lower-SES backgrounds, akin to the word-recognition effects (Fernald et al. 2013, Hurtado et al. 2008, Weisleder & Fernald 2013). Alternatively, if comprehension is also a property of current communication, then we might expect children from lower-SES backgrounds to adapt their parsing strategies, much like higher-SES peers. This may lead to language gaps that are context dependent and specific to sentences in which children face greater uncertainty about potential interpretations (e.g., example 1) compared to when uncertainty is lower (e.g., example 2).

Our results reveal evidence of the latter. **Figure 3*a*** illustrates that when sentences featured initial uncertainty (e.g., *The blicket is eat…*), all children adopted an agent-first bias, which generated greater accuracy for active compared to passive sentences. While no SES differences were found with actives, children from lower-SES backgrounds were less accurate with passives compared to higher-SES peers. Critically, a different pattern emerged when children heard sentences that weakened the agent-first bias (e.g., *The seal is eat…*). **Figure 3*b*** illustrates that when syntactic revision was no longer required, all children interpreted passives as accurately as actives, and no SES differences were found. Thus, despite the infrequency and complexity of passives, all children understood the relevant grammar and could access this knowledge in specific sentence contexts. Moreover, the fact that language gaps arose only when syntactic revision was required suggests that SES differences in real-time processing are context dependent and not a sweeping property of learners. Additional evidence comes from relations to aggregate linguistic knowledge

as measured by vocabulary size. While children with larger vocabularies were more accurate at interpreting passives that required syntactic revision, this relationship was absent when revision was not required. This observation suggests that relations between processing and development are complex and that predicting variation across individuals requires specific descriptions of mediating processes.

One question that arises from these findings is whether language gaps in revising initial interpretations reflect language-specific strategies for interpreting meanings or more general SES effects of executive functioning (Noble et al. 2005; Romeo et al. 2018b, 2022).

Among children from higher-SES backgrounds, individual differences on the Simon-Says and Flanker tasks predict recovery from misinterpretations (Qi et al. 2020, Woodard et al. 2016). If executive functioning abilities are related to revising the agent-first bias, then SES effects on the Stroop task should generate SES differences in interpreting passives. We recruited a sample of 46 children aged 3–6 years who varied in SES background and differed in the accuracy of naming on incongruent Stroop trials, where the name of a blue dog is "Red" (Huang & Hollister 2019). On average, lower-SES families had a median income of $38,250 per year and 13 years of education. Higher-SES families had a median income of $97,500 per year and 17 years of education. Unlike the previous sample, overall linguistic knowledge was similar across SES backgrounds. When sentences promoted an agent-first bias, children interpreted passives worse than actives. However, there were now no SES differences in interpreting passives. This finding suggests that overall linguistic knowledge affects children's parsing strategies and that executive functioning may have minimal effects once this is accounted for.

Taken together, these findings offer a much more complex view of relationships between processing, development, and their associated metrics. Even when overall linguistic knowledge varies across SES (e.g., vocabulary size), all children acquire infrequent aspects of grammar and recruit this knowledge to interpret these sentences accurately in specific contexts. This suggests possible distinctions between frequency effects at different time scales. Since development offers an extended window to accrue relevant input for acquiring linguistic knowledge, frequency may have smaller impacts on comprehension (long game). In contrast, processing entails converting fast-moving speech signals into meaning before they disappear, and thus real-time interpretation may benefit from heuristics that encode frequent meanings like the agent-first bias (short game). This division is inconsistent with the view that millisecond gaps in comprehension automatically scale up to achievement gaps in acquisition. If this were the case, language gaps in processing would reliably emerge across sentence contexts and consistently predict linguistic knowledge. Instead, we find that SES differences are more limited to contexts where children adopt parsing heuristics in the face of greater interpretive uncertainty.

5. CHILDREN'S PRODUCTION: PATHWAYS BETWEEN SOCIAL IDENTITY AND SOCIETY

Our last test case evaluates language gaps in children's production, which exist in nearly all areas of language, including vocabulary size (Hart & Risley 1995, Hoff 2003), syntactic complexity of utterances (Huttenlocher et al. 2002, 2010), the frequency of conversational turn taking (Hirsh-Pasek et al. 2015, Romeo et al. 2018a,b), and decontextualized language (Demir et al. 2015, Tabors et al. 2001). As in parental production, language gaps in children's production are thought to largely reflect variation in linguistic knowledge across SES backgrounds. Yet, beyond knowledge, children produce language to satisfy the communicative demands of a given context. Thus, properties of utterances will be shaped by factors such as who they are talking to, where and why they are talking, and how these dimensions intersect with sociolinguistic dynamics. These factors are known

to vary across SES (Labov 1972a, Weiner & Labov 1983) and may lead children from different backgrounds to produce different linguistic forms even if they have similar linguistic knowledge.

One area where these effects may be visible is audience design, which describes how speakers alter their utterances based on who they are talking to. In sociolinguistics, there is a rich literature examining how adult speakers use language to express social identity (Campbell-Kibler 2007, Eckert 2012, Labov 1972a) and affiliate with social groups (Acton & Potts 2014, Eckert 2019). Language production varies with multiple elements of social identities including age (Rickford & Price 2013, Van Hofwegen & Wolfram 2010), gender (Craig & Grogger 2012, Rickford & Price 2013), geographic region (Holt 2018, Rickford et al. 2015), and SES background (Horton-Ikard 2006, Horton-Ikard & Miller 2004, Weldon 2021) and serves a pragmatic function of including or excluding individuals from these identities (Eckert 2019). For example, local islanders in Martha's Vineyard intentionally shift their vowel use to communicate a separation between themselves and tourists (Labov 1972b). Middle-class speakers of African American Vernacular English in Washington, DC, vary their use of dialect features (e.g., producing stressed BIN, optional final consonant clusters) based on conversation topics and interlocutors and do so to communicate identities, such as being a working professional or a member of a historically Black neighborhood (Grieser 2015, 2022; Weldon 2021).

Sociolinguistic effects on language production have implications for understanding language gaps in children's production. If linguistic forms covary with social identity, then how parents talk to children reflects not only the distributional input for acquiring words and grammar but also a set of social characteristics, which have been shaped by the values of communities and geographical regions and the relationships of these communities to each other (Johnson & White 2020; Smith et al. 2007, 2013). Children learn both aspects of language during acquisition. In bidialectal communities, parental use of minority dialects such as Scottish English and African American Vernacular English is influenced by social factors such as where and to whom the parent is talking, the communities in which they work and live, and their values about minoritized dialects (Labov 2001, Smith et al. 2013). For example, parents are more likely to use mainstream dialect features as children prepare to enter school, and children mirror the dialect density and dialect-shifting patterns of their parents and how these patterns vary with communicative contexts (Díaz-Campos 2001, 2005). Thus, children not only observe the distributions of linguistic features in parental input but also simultaneously track the social contexts in which they are used.

Beyond audience design, sociolinguistic factors associated with expressing social identity interact with lexical and syntactic distributions as well. The test case of passives offers a window into the complexities of these interactions (Sneller & Fisher 2015, Weiner & Labov 1983). In working- and middle-class neighborhoods in Philadelphia, passives are used by adult speakers of all backgrounds, but their frequency interacts with communicative contexts (i.e., occurring more in formal compared to casual settings), morphological flavors (e.g., *get*-passives like *He got hit* versus *be*-passives like *He is hit*), and a variety of social identities. On average, males produced more *get*-passives while females produced more *be*-passives, and this difference interacted with the age and SES of speakers (Sneller & Fisher 2015, Weiner & Labov 1983). The fact that production of passives varies with situational contexts and multiple dimensions of social identity suggests that SES language gaps may also depend on communicative factors that go well beyond linguistic knowledge.

Together, these patterns shed light on why current analyses of child language production may vastly underdetermine the relevant dimensions that give rise to SES differences. Children's production is often assessed by way of standardized checklists of expressive vocabulary, elicited production of known words, and/or analysis of language samples in a limited set of communicative contexts. On its own, this tool kit is sensitive to how children differ from each other across

SES backgrounds, leading to a proliferation of language gaps. However, without related methods for understanding the communicative contexts that support language production (e.g., who children are talking to, why they are producing speech, how pragmatics interact with words and grammar) and how production varies with social identity, it is difficult to interpret what these language gaps mean. Moreover, adopting a normative bias and assuming that all gaps are deficits will make it more difficult to understand the contexts that enable production. Note that these same issues arise when analyzing parental input; thus, having better tools for measuring and describing language production across contexts will have far-reaching impact.

6. SUMMARY AND FUTURE RESEARCH

Language gaps are ubiquitous across social classes, and this review takes first steps toward developing a framework for evaluating the meaningfulness of these differences for learning and communication. In doing so, we have wrestled with three core challenges in interpreting language metrics and with the extent to which SES differences reflect more fundamental variation in the (*a*) concepts communicated across social groups, (*b*) comprehension strategies to access meanings during communication, and (*c*) production practices that express social identity and group affiliation. Our review of existing findings highlights broad similarities and key differences across SES. Across communicative contexts, all parents produce a similar repertoire of frequent verbs and vary their utterance lengths based on current conversations. Likewise, all children acquire infrequent aspects of grammar and adjust their comprehension strategies based on current sentence properties. Similarities across SES backgrounds contextualize areas where differences emerge. In parental input, language gaps arise from meanings that are common across families; therefore, interventions that ask parents to talk more may not increase input that is different across SES backgrounds. In children's comprehension, language gaps emerge in interpreting sentences that require revising initial misinterpretations, suggesting that the processes that enable access to linguistic knowledge are distinct from those that support the acquisition of knowledge in the first place. Finally, children adjust how they talk based on the demands of current communication; thus, language production likely involves both a transmission of ideas and expression of social identity.

This framework motivates future research to describe in detail the environments in which language development occurs and the specific processes that generate year-to-year changes and child-to-child differences. We propose four avenues to pursue. First, the idiosyncrasies of family lives suggest the need to document parents' experiences in addition to their language output. While current measures are useful for quantifying well-defined constructs (e.g., word frequency, utterance length), they fail to capture more complex, qualitative dimensions that provide the background for communication. To understand how parental input is shaped by family routines and how these routines vary based on access to resources, choice/flexibility, and internal/external responsibilities, we are conducting parent interviews based on time diaries used in sociology (Bianchi et al. 2006). We begin by recording activities that make up a single day in a parent's life and use this record as a basis for asking about family routines, roles, and responsibilities (e.g., "If you had an unanticipated event come up, how easy or hard would it be to reorganize your daily routine?" "What kinds of resources do you have to use to accomplish your routines?" "Are there aspects of your routine that you'd want to change if you could?"). By examining patterns within family experiences and parents' rationale for their choices, we can make closer inferences about the relationship between SES background and properties of parent input.

Second, within parental input, there is a need for new methodologies and analytical strategies to yield finer-grained descriptions of dimensions beyond sheer quantity. While it is widely acknowledged that communicative environments and goals influence parental input (Hoff-Ginsberg 1986,

1991), it is not always obvious what about these settings makes interactions conducive to language learning. Technological advancements now enable analysis of more subtle environmental cues that children may leverage. Research using large-scale recordings finds that the specificity of spatial, temporal, and linguistic contexts is correlated with parental input and child word learning (Roy et al. 2015), and the relationships between input quantity and diversity can be more informative than their raw totals (Montag et al. 2018). Likewise, the multimodality of communication high-lights the need to understand the temporal dynamics of various input channels and their relations to discourse representations (Suanda et al. 2016). These findings challenge the notion that undifferentiated input quantity is distinctly beneficial and support the adoption of novel methodologies and measures that inform structured variation across SES.

Third, evaluating the meaningfulness of SES differences critically hinges on our ability to spell out the links between language experience and language learning. Doing so may shed light on why language gaps in overall linguistic knowledge track children's comprehension strategies, particularly in contexts that increase uncertainty (Huang et al. 2017, Leech et al. 2017). One hypothesis is that the adoption of parsing heuristics like the agent-first bias reflects a trade-off between input quantity and interpretative precision. The agent-first bias can be unreliable, and children can generate more accurate sentence interpretation by relying on knowledge of verb-specific properties. However, acquiring this knowledge depends on encountering sufficient verb-specific input during development (e.g., hearing sufficient *hit*-sentences to infer the syntactic properties of *hit*). For children from higher-SES backgrounds, greater input quantity offers the evidence base to accurately estimate probabilistic patterns. Likewise, greater lexical diversity in their input may enhance the need to access verb-specific properties during comprehension since idiosyncratic predicates may conflict with the agent-first bias. For lower-SES groups, however, lower quantity and diversity may make this heuristic sufficiently informative since estimating verb biases can be noisy with less input, and verb semantics may imply similar grammatical roles as canonical frames. Thus, children across SES backgrounds may acquire distinct strategies for parsing sentences that are likely to occur in their input.

Finally, within children's comprehension and production, there is a need to describe how linguistic features are linked to social categories during development. In adult comprehension, listeners rapidly update perceptual cues for interpretation by inferring the social categories that generate systematic variability in the linguistic signal (Beltrama & Schwarz 2021, Kleinschmidt 2019, Sneller & Roberts 2018). Likewise, children draw on developing knowledge of social categories to guide cues for comprehension and learning (Tripp et al. 2021, Wagner et al. 2014, Weatherhead et al. 2021). In studies of epistemic trust, children attend to speakers' linguistic tendencies to decide who they want to learn new words from (Corriveau et al. 2016, Landrum et al. 2015, Leech et al. 2019). While children from higher-SES homes prefer speakers who often use passive sentences, lower-SES counterparts prefer those who use active sentences. Thus, early social preferences based on language may lead children to actively adjust their intake of input to match these preferences (e.g., attending to speech produced by preferred speakers). These dynamics highlight the complexity of linguistic and social processes that can contribute to achievement gaps and the need to better understand multilevel interactions across the development of various social groups.

7. CONCLUSION

Understanding the causes and consequences of SES differences in language is difficult because a person's social class is inextricably tied to societal structures and shapes a multitude of decisions in daily life. Moreover, these relationships are probabilistic across individuals (i.e., group

differences do not determine a person's fate) and over time (i.e., wealth and poverty are states, not traits). While existing research primarily attributes linguistic differences to properties of parents and children, our review highlights the extent to which communication is also driven by environmental factors that privilege some concepts and identities over others. These dynamics inform useful and less useful approaches to understanding language gaps. Previous approaches vastly simplified the descriptive challenge of linking input, learning, and processing by assuming that SES environments are immutable and that all differences are potential deficits. This view neglects the fact that we do not yet know what differences are meaningful for learning and communication. That is the empirical question. Importantly, it is the same question being posed in various forms across multiple fields (e.g., language acquisition, psycholinguistics, sociolinguistics, information theory), and taking an interdisciplinary approach has potential for yielding valuable descriptions over variable processes rather than more language gaps.

Reframing the descriptive challenge pinpoints avenues that may yield significant insights. Rather than viewing language experience or outcomes as unidimensional (e.g., the more words the better), we can carve parental input at its joints, according to communicative goals and how they are shaped by the structure of family lives, and operationalize children's language profiles with respect to functional abilities to effectively convey and infer meanings across a variety of speakers and contexts. Describing language development across learners, time scales, situations, and tasks is an ambitious endeavor (to put it mildly) that requires methods for systematically describing interconnected processes in detail and in formats that make mutual contact. Those who have their eyes set on intervention might argue that these are uninteresting questions to pursue. After all, language gaps are obvious, and the implications of achievement gaps are huge. Yet, the pathways connecting the two are far less obvious, and fixing problems requires understanding why they exist in the first place. In service of this goal, we hope that disentangling issues that are often conflated may provide productive paths forward for exploring these deep and enduring questions.

DISCLOSURE STATEMENT

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Contents

Errata

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