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# 1 Five Questions about Language Learning

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This chapter poses five questions about language learning. At the moment, the field does not have answers to these questions, although there is a great deal of thought-provoking work.

Question 1 is, How much variability exists in language development? No matter how much innate knowledge is assumed to be present, the child still has a lot to learn. No specific language can be innate. At most, an abstract representation of the building blocks is innate—where building blocks include both absolute universals (grammatical properties that hold for all languages) and relative universals (dimensions of grammatical variation). Language acquisition is not the same for everyone. Some children are early talkers and some are late talkers; some children are developmentally delayed in particular aspects of language development, such as tense. Even for children who are neither dramatically early nor dramatically late, even for children who are "typically developing," acquisition is not uniform.

Take, for example, work in my laboratory on children's production of overt subjects in English (Valian et al., 2020). Figure 1.1 shows, for the Manchester corpus (Theakston et al., 2001), the percentage of nonimitative utterances with verbs that contain a subject, plotted over time.

Twelve children were taped thirty-four times over a one-year period, starting when most of the children were between 1 yr 10 mo (1;10) and 2;0. Mostly, and overall, children increase how often they use subjects. But some children start out with high subject use and stay high; others show a nice upward function; yet others bounce around. Some of the variability may be due to vagaries of the subject matter, the questions the parent was putting to the child in a particular session, the extent to which the children are speaking of themselves or others, and so on. But, taken at face value, these twelve curves show that the inner structure of development is not uniform. That is, when we look closely, we see not only that different children develop at different rates but that the developmental curve differs from child to child.

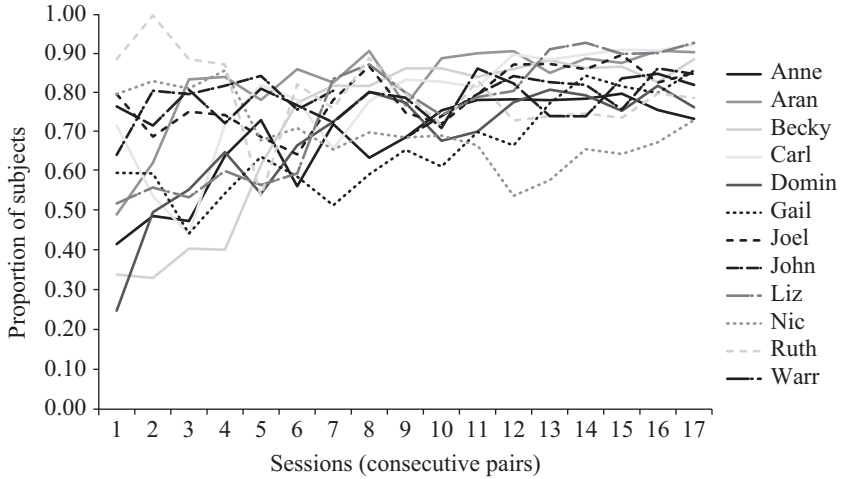


**Figure 1.1**
Percent subject use with verbs in nonimitative, nonimperative utterances by twelve 2-yr-olds observed thirty-four times over the course of one year.

Given this, then, we also ask, What is the significance of the developmental variability that we see? One possibility is that children's percent subject use differs because the input differs; children might be directly responsive to their parents. First, however, parents in general—and the parents in the Manchester corpus are no exception—are much more consistent in their use of subjects than children are. Second, the Manchester children's subject use overall is not significantly correlated with their mothers' subject use overall ($r(10) = .35$, $p = .12$).

A different possibility is that children's output bears a noisy relation to what they actually know (just as adults' output does, if to a lesser degree). Children have less-developed higher-level cognitive functions than adults do; hence children may not have full control over their output. If that were the case, we should expect to see evidence that children's limited cognitive functions are directly linked to their use of subjects. In a suite of elicited imitation experiments, Valian and colleagues (Valian & Aubry, 2005; Valian et al., 1996, 2006) found that English-speaking children used subjects more when fewer cognitive resources were necessary.

But the sizable variability we see in children's developmental trajectories is hard to attribute solely to differences in cognitive resources. All children tend to find longer sentences more challenging to imitate than shorter sentences; all children tend to find it easier to imitate a sentence on the second attempt than the first attempt; all children tend to find it easier to include a subject if the verb's direct object supplies little information value to the sentence.

In short, we do not yet know how to understand the variability in children's development of syntactic structure, of which the production of subjects in English is one manifestation. The clinical importance of understanding natural variation is obvious: if there is more variation in so-called typical development than we have recognized, we run the risk of mischaracterizing children who are not typical.

For example, children with autism are often characterized as having a distinct language profile that typically developing children do not have. Gernsbacher et al. (2016), reviewing the evidence for echolalia, pronoun reversal, and an exaggerated or reversed lag between comprehension and production, conclude that none of those features can be taken as hallmarks for children with autism because all those features characterize typically developing children as well.

Question 2 is a suite of questions: Do all children converge on the same grammar? If there are differences, are those differences significant? How do different grammars arise? Variationist studies suggest, again, more variability than we might have imagined. The Yale Grammatical Diversity Project (Zanuttini et al., 2018) lists over thirty structures in which North American speakers differ, sometimes in what they produce, sometimes in what they deem grammatical, and sometimes in both. Some of the differences seem minor: "Here's you some pizza" is an extension of the dative that most North Americans find ungrammatical, but the variation might be easily handled. The fact that it might be easy to accommodate the variations should not minimize their grammatical importance. They potentially provide us with information about the dimensions along which languages can vary and the dimensions along which they do not vary (Kayne, 2008, 2013).

Some variations, such as subject-aux inversion in embedded clauses, are deeper. Take, for example, "For a lot of things, I don't know why do I do them." That string seems ungrammatical on several fronts, one of which is the presence of subject-aux inversion in the embedded clause. Some speakers might label such instances as ungrammatical even though they utter them and write them, while other speakers utter them and find them grammatical. Even without the inversion, some speakers will find the string ungrammatical but may nevertheless produce it because English allows no options once one has started the utterance with "For a lot of things."

In a commentary on heritage language learners (Valian, 2020), I suggest that everyone might speak a different variety of English (and, by extension, of whatever language is their native language). Kayne (2013) has developed this point at some length, working within a microparametric framework. He suggests that it is feasible for the child to set one hundred different parameters and that the

variations those combinations provide would easily account for the existence of many trillions of languages. The more tractable number he considers, thirty-three parameters, would yield more than eight billion languages. It is not clear, however, that thirty-three parameters would exhaust the microvariation within a language family or suffice to distinguish different language families. Nor is it obvious that every variation should be considered a microparametric variation.

Questions 1 and 2 are about variability in language and in learners of a first language. Question 3 asks how children are characterized as heritage learners. To quote Rothman (2009):

> A language qualifies as a heritage language if it is a language spoken at home or otherwise readily available to young children, and crucially this language is not a dominant language of the larger (national) society. Like the acquisition of a primary language in monolingual situations and the acquisition of two or more languages in situations of societal bilingualism/multilingualism, the heritage language is acquired on the basis of an interaction with naturalistic input and whatever in-born linguistic mechanisms are at play in any instance of child language acquisition. Differently, however, there is the possibility that quantitative and qualitative differences in heritage language input and the introduction, influence of the societal majority language, and differences in literacy and formal education can result in what on the surface seems to be arrested development of the heritage language or attrition in adult bilingual knowledge.

Heritage learners show a variety of differences compared to monolingual learners, in addition to a range of similarities (for review, see Polinsky & Scontras, 2020; see also Kupisch et al., 2014; Kupisch & Rothman, 2018; Stangen et al., 2015). Specifically, Rothman's definition allows for true bilingualism only when the larger society is bilingual. A true bilingual would have to grow up in a bilingual community, where there is no dominant language. If one of the languages you are exposed to is not the language of your wider community, then you are a heritage speaker of that language, rather than a native speaker, no matter how large your subcommunity is and no matter what your performance is. Rothman's definition may also put some speakers in the category of not having a native language.

Consider immigrants, the status of whose language(s) changes. Maria (not her real name) was born in Honduras, where the community language was Spanish. Her mother is American and her father is Honduran. At home her mother spoke English and her father spoke Spanish. Spanish would appear to be Maria's native language, and English her heritage language. At age three, Maria moved with her family to the United States, at which point the community language became English. Her mother continued to speak to her in English. Her father continued to speak to her in Spanish, but she often replied to him in English. How can we classify Maria now? Did she switch from being a heritage speaker of English to being a heritage speaker of Spanish? Did

Spanish stop being her native language and English start being her native language? Or did she have two heritage languages and no native language?

When Maria was nine, she and her parents returned to Honduras, at which point she had a steep learning curve. She didn't speak Spanish fluently. She was thrown into a rural, Spanish-speaking school for the first year and had no special language classes. She recalls communicating in a choppy manner with classmates, saying phrases, expressing the basics, and relying a lot on facial expressions. She describes herself as having no choice but to learn, and thus learning. Maria completed high school and college in Spanish (except for a year in Italy). By high school Maria considered Spanish to be her native language. She didn't have any issues with writing papers in school and doesn't remember having had any grammatical corrections. At some point, did Maria switch back to being a native speaker of Spanish and a heritage speaker of English? Or, again, does she have two heritage languages and no native language?

Maria returned to the US when she was twenty-seven. Now aged thirty-two, Maria considers English to be her native language. All of her input is English; she speaks English with her friends, watches movies and television in English, and reads only English. When she returns to Honduras, Maria makes occasional mistakes in gender agreement with nouns, a classic heritage language error. She has trouble phrasing some ideas in Spanish, unable to think of the Spanish word, and has to switch to English. She has a tiny but noticeable American accent in Spanish that she and her Honduran friends are aware of. A small accent is also characteristic of heritage speakers. Her Honduran friends teasingly call her *gringa*, which she finds amusing. Maria's American friends tell her she has a tiny accent in English; there is a faint something that is not quite native about her accent. That bothers her because English feels completely natural to her. Maria's younger brother, despite growing up only in Honduras, spoke more English than Spanish as a very young child and had a slight accent in Spanish. He became a native Spanish speaker, without any accent.

How unusual is Maria's experience? All children who emigrate to a new country where the community language differs from the one they grew up in experience a shift, with their native language apparently becoming a heritage language. Perhaps we are better off talking about varieties of a language and ignoring the *heritage* or *native* designation altogether to more fully explore language variation (see, e.g., Otheguy, 2016).

Question 4 asks about the relation between first and second language acquisition. One line of research in second language acquisition investigates the determinants of acquisition and the presence or absence of a critical period (see, e.g., Abrahamsson & Hyltenstam, 2009; DeKeyser et al., 2010; Hartshorne et al., 2018; Slabakova, 2013; Vanhove, 2013). Some learners seem to learn

faster and reach a higher level of attainment than others do. Why is that? When discussing second language learning, researchers speak of an aptitude for learning, something beyond age of acquisition and exposure. Recent work suggests that production, over and above exposure, is relevant (Quirk, 2020; Ribot & Hoff, 2014). But even when one measures a wide range of variables, including aptitude, it is difficult to account for much of the variance in performance.

No one ever speaks of an aptitude for learning a first language. Even precocious learners are not necessarily seen as having a special aptitude for learning language. To be clear, there are predictors of word learning and word order sensitivity (see, e.g., Gervain & Werker, 2013; Werker, 2018), but variation of the sort seen in figure 1.1 has not been a focus of inquiry in first language acquisition. Executive functions may play a role in language acquisition, and that leads to question 5.

Question 5 inquires about the relation between executive function and bilingualism. Executive functions are higher-order cognitive processes that regulate, manage, and integrate lower-level processes. Different researchers vary in what they consider an executive function, though working memory, inhibition, shifting, and updating are commonly identified as executive functions. We adopt the "unity and diversity" model proposed by Miyake and Friedman (2012, based on Miyake et al., 2000) with three main components: a common factor (similar to inhibition) that correlates with the other two components; updating, the ability to remove items held in working memory and replace them with task-relevant information; and shifting, the ability to move from one mental set to another.

Multilinguals have been hypothesized to show an advantage on interference tasks, in which they must ignore irrelevant or conflicting information to provide a correct response (e.g., Bialystok, 2017). The Simon and flanker tasks are two examples. Tasks that measure the ability to update information and shift to new behavior based on new information include the Wisconsin Card Sorting Test. Participants are required to sort a target card to one of four stimulus cards on the basis of shape, color, or number of items on the card, and they must use trial and error to determine the correct sorting rule. When the rule changes without warning, participants must again use trial and error to discover the new rule and continue sorting by the new rule until it changes again (Kousaie et al., 2014; Xie & Dong, 2017).

Bilingualism—the state of knowing and using more than one language, in all its myriad forms—involves negotiating between one's languages. Depending on the context, bilinguals choose which language to use; they switch between their languages when that is appropriate and suppress the language

that is not appropriate. Does that experience with controlling one's languages influence—specifically, does it improve—executive functions?

At least at first glance, such a negotiation seems to involve language-independent higher-order cognitive (executive) functions—functions that coordinate, integrate, and regulate lower-order cognitive functions. A natural hypothesis is that the experience of managing multiple languages has benefits for higher-level cognition, benefits that could be revealed by tasks designed to measure executive functions that are not related to language (Bialystok, 1999; Bialystok et al., 2005). A different but related hypothesis is that cognitive processes are recruited and modified for bilingualism (Bialystok, 2017). In both formulations, the hypothesized effects are bidirectional—down from executive function to managing one's languages and up from managing one's languages to improving executive function.

Another possibility is that effects are unidirectional, only downward, not upward. On this hypothesis, executive functions are recruited and specialized for bilingualism—but yield no benefits for general executive functions. The inconsistency of findings relating bilingualism and executive function supports that hypothesis. For young adults there is little evidence of benefits from being bilingual on nonverbal tasks that measure executive function, tasks like the Simon task, the flanker task, or switching tasks. When differences are found, they generally show a bilingual advantage (for meta-analytic reviews, see Donnelly et al., 2015; Lehtonen et al., 2018; for other reviews, see Hilchey & Klein, 2011; Hilchey et al., 2015; Klein, 2016; Paap et al., 2015; Valian, 2015). Such null findings might be due to young adults' peak processing efficiency but also might represent unidirectionality.

A similar issue exists with respect to the training of working memory. Working memory is one form of executive function; it is also thought to be a feature of fluid intelligence (*Gf* ). One meta-analysis concluded that there were benefits to *Gf* from *n*-back working memory training (Au et al., 2015), while another found no benefits (Melby-Lervåg et al., 2016). To the extent that there is reliable transfer in working memory training, it appears to be near transfer—transfer to very similar executive function tasks—and not far transfer that involves working memory (De Simoni & von Bastian, 2018; Foster et al., 2017; Shipstead et al., 2012). The claim that failures to find improvement in young adult samples are due to their peak processing efficiency has been proposed in the context of working memory inconsistencies and has also been argued against (see summary in De Simoni & von Bastian, 2018, p. 848).

To take a second example, a meta-analysis suggested that active video game playing has few if any benefits for higher cognitive functions, even though it recruits and uses those functions (Sala et al., 2018). In a third example, intensive

training on a Stroop task, which is thought to require inhibitory control, yielded faster performance on the Stroop task itself but showed neither near nor far transfer to other executive function tasks involving inhibition (e.g., an anti-saccade task) or other executive functions (e.g., an *n*-back task; Talanow & Ettinger, 2018).

To improve performance on a task, people appear to recruit executive functions to develop a number of task-specific strategies that have limited generalizability across tasks. Although the issue is not settled, a case can be made that transfer occurs at most between tasks that are very similar to each other; far transfer does not take place (Foster et al., 2017; Sala et al., 2018).

Also supporting task specificity is an examination of individual differences. Those who benefit most from working memory training are those who performed better at the beginning of training (Foster et al., 2017). One possible conclusion from these and similar data is that a very general skill (such as *Gf* ), or a set of executive functions, underlies performance on many tasks and is adapted to meet the demands of a particular task. Performance on task A is related to performance on task B because people with more general skill will be more successful at developing the task-specific strategies necessary to perform well on each task. If that is so, there is no implication that training on task A will improve performance on task B, even if the two tasks are formally similar, and no implication that improvement on either will lead to improvement of general skill or executive function.

Given the common failure to find transfer of training from one executive function task to another and the suggestion that skills are task specific, it would not be surprising if bilinguals' experience with and expertise in managing their languages did not yield benefits for nonverbal tasks requiring inhibition or management of conflict. The task-specific strategies that are involved in being an expert bilingual may have few if any implications for the task-specific strategies that are involved in other executive function tasks. The finding that older people continue to switch between their languages with ease, even as their cognitive switching ability declines, is compatible with such a task-specific analysis, as are other examples of lack of overlap between language and executive function tasks (Branzi et al., 2016, 2018; Calabria et al., 2012, 2015).

In short, variability seems to be the rule in language acquisition—variability of experience, variability of developmental trajectories, variability of attainment, and variability of relation to executive functions. We have yet to understand the sources and mechanisms of that variability.

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