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The Exposure Advantage: Early Exposure to a Multilingual Environment Promotes Effective Communication

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Abstract
Early language exposure is essential to developing a formal language system, but may not be sufficient for communicating effectively. To understand a speaker's intention, one must take the speaker's perspective. Multilingual exposure may promote effective communication by enhancing perspective taking. We tested children on a task that required perspective taking to interpret a speaker's intended meaning. Monolingual children failed to interpret the speaker's meaning dramatically more often than both bilingual children and children who were exposed to a multilingual environment but were not bilingual themselves. Children who were merely exposed to a second language performed as well as bilingual children, despite having lower executive-function scores. Thus, the communicative advantages demonstrated by the bilinguals may be social in origin, and not due to enhanced executive control. For millennia, multilingual exposure has been the norm. Our study shows that such an environment may facilitate the development of perspective-taking tools that are critical for effective communication.

Keywords
bilingualism, social cognition, communication, cognitive development, perspective taking, open data, open materials

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Throughout human history, exposure to multiple languages has been the norm, not the exception (Hamers & Blanc, 2000; Werker & Byers-Heinlein, 2008). For example, India alone has 1,576 languages, with approximately 900 in active use (Registrar General & Census Commissioner, India, 2011). China has hundreds of dialects, and both Europe and Africa have overlapping linguistic communities. More than half of the world's population is multilingual, and many more people are regularly exposed to linguistic diversity (Grosjean, 2010). In short, exposure to multiple languages is, and has been for millennia, an integral part of human development. Exposure to diverse linguistic environments provides experience not only in learning languages, but also in understanding other people's perspectives: Children in multilingual environments routinely have the opportunity to track who speaks which language, who understands which content, and who can converse with whom. This raises the intriguing possibility that early multilingual exposure may facilitate the development of social-cognitive tools that are important for effective communication.

Though communication is critical for nearly every facet of human social life, communicating effectively is difficult. Effective communication requires complex coordination of mental states, intentions, and common knowledge (Sperber et al., 2010). Although speech is often ambiguous, people overestimate their ability to communicate effectively (Keysar & Henly, 2002). Listeners are typically unaware that their own egocentric biases can prevent them from taking the minds of speakers into account (Apperly et al., 2010; Epley, Morewedge, & Keysar, 2004; Glucksberg & Krauss, 1967; Keysar, Barr,

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Balin, & Brauner, 2000). Resulting misunderstandings and misinterpretations have noteworthy and deleterious consequences, including exacerbating interpersonal and intergroup conflict (Pronin, Puccio, & Ross, 2002). Therefore, it is crucial to understand the conditions necessary for the development of effective communication and the root causes of miscommunication.

Although early exposure to a language is essential to its later mastery (Newport, 1990), communicating effectively takes more than mastering a language. We propose that early exposure to multiple languages could set the stage for the development of effective communication. Exposure to speakers of diverse languages provides children with social experiences that diverge sharply from those of monolingual children. Regardless of their own proficiency, children in multilingual environments have extensive practice in understanding other people's linguistic perspectives (Yow & Markman, 2011). Language also serves as a robust cue to social group membership (Giles & Billings, 2004; Kinzler, Dupoux, & Spelke, 2007), so monitoring other people's language usage may provide children with information about people's perspectives, social relationships, and communicative goals.

Because bilinguals mentally represent multiple languages and select or inhibit linguistic systems, bilingualism may confer cognitive benefits, such as the development of executive function (e.g., Bialystok & Martin, 2004; cf. Duñabeitia et al., 2014). These potential differences in executive function across groups may account for observations that bilingual children perform better than monolingual children on theory-of-mind tasks (Kovács, 2009; Rubio-Fernández & Glucksberg, 2012) and mental rotation tasks, which require spatial perspective taking (Greenberg, Bellana, & Bialystok, 2013). In the study reported here, we investigated a heretofore unexplored advantage of being raised in a multilingual environment—an advantage that is independent from potential differences in children's executive-function abilities and that does not depend on actually speaking more than one language. We evaluated the possibility that early multilingual exposure may confer unique social communicative skills, even among children who are merely exposed to multilingual environments but who are not bilingual themselves.

We propose that routine exposure to people who speak different languages provides children with a formative communication environment that is fundamentally different from that experienced by monolingual children. Exposure to diverse sociolinguistic environments could grant children a profound understanding of differences between people's perspectives, naturally enhancing their communicative abilities. Such diverse linguistic experiences may facilitate early development and expression of effective interpersonal communication. In other words, we suggest that the social consequences of growing up in a multilingual, rather than monolingual, environment are not necessarily due to the impact of being bilingual per se, but rather may be a result of social exposure to diverse speakers. To evaluate this possibility, we recruited children from monolingual and multilingual environments and compared their ability to effectively understand another person's intended meaning in a social communication task.

Method

Participants

Seventy-two 4- to 6-year-old children (mean age = 5.42 years, range = 4.03–6.88 years) participated in the study. All the children lived in the greater Chicago area and were recruited from a database for psychology research. They received a small gift for participating, and their parents received a travel reimbursement. Seven additional children were tested but were not included in the final sample because of experimenter error (n = 1), failure to complete the tasks (n = 3), or failure to follow instructions (n = 3).

Our final sample included 24 children in each of three language groups: monolingual (M = 5.33 years, range: 4.04–6.88 years), exposure (M = 5.42 years, range: 4.04–6.63 years), and bilingual (M = 5.42 years, range: 4.03–6.70 years). We chose to include 24 children in each language group as it allowed us to fully counterbalance the design. The children were classified into language groups on the basis of parental report. Parents received a list of possible language categories and were asked to classify their child's language experience (see Supplemental Method and Analyses in the Supplemental Material available online). Children were included in the monolingual group if a parent reported that they heard and spoke only English and had little experience with other languages. Children were included in the exposure group if a parent reported that they were primarily English speakers, but had some regular but limited exposure to another language. Children were included in the bilingual group if a parent reported that they were exposed to English and another language on a regular basis and were able to speak and understand both languages.

Parents also provided demographic information about their child and their family. To control for potential covariation, we collected information on maternal education and family income, which did not differ systematically across the language groups. Similar numbers of children had mothers with at least a bachelor's degree (monolingual group: 75%; exposure group: 75%; bilingual group: 71%), $F(2, 69) < 1$, and average family annual income, on a scale from 1 (< $15,000) to 9 (> $150,000),[1]

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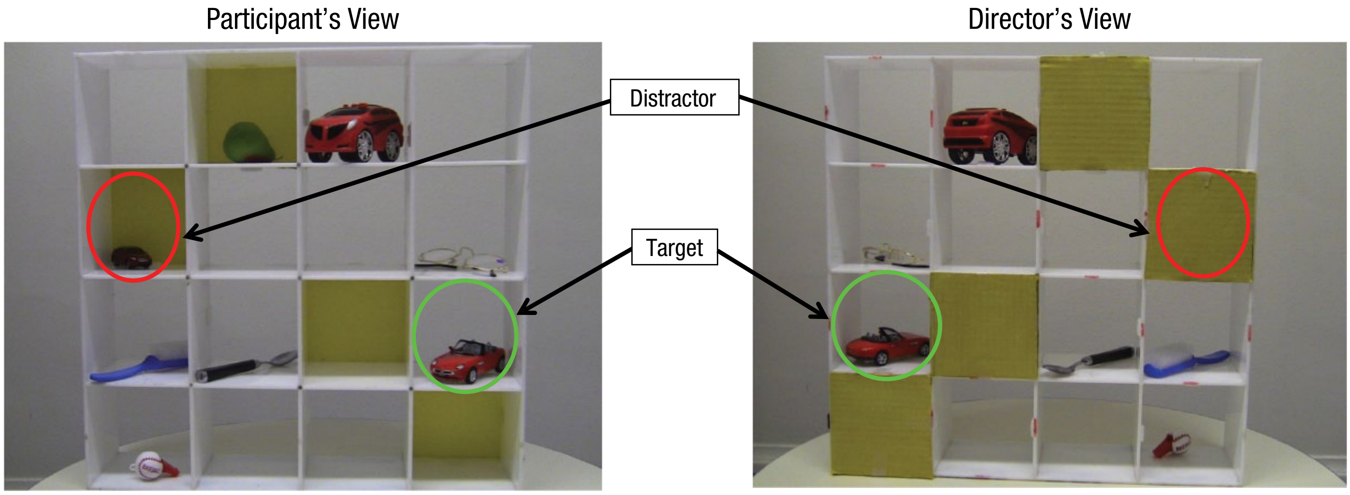

Fig. 1. Example of a grid used in the social communication task, as seen from both the participant's and the director's perspective. The critical instruction in this case was, "I see a small car. Can you move the small car under the spoon?" The director could not see the smallest car, which served as a distractor.

was not different across the groups (monolingual group: $M = 6.6$; exposure group: $M = 6.4$; bilingual group: $M = 6.2$), $F(2, 68) < 1$ (for additional demographic information, see Tables S1 and S2 in Supplemental Method and Analyses).

Procedure

To test our hypothesis, we presented the children with a social communication task that required taking an interlocutor's perspective. Participants sat across a table from a confederate (the "director"), who asked them to move objects around a 4 × 4 grid. Four grid squares were occluded, so that only the participant, and not the director, could see their contents. The director wore black matte sunglasses throughout the task and was instructed to maintain her eye gaze toward the center of the grid when giving instructions, in order to avoid unintentionally leading the children toward the target object with her gaze.

To ensure that the children understood the task and had experience with what the director was able to see, we had them first complete a practice trial from the director's side of the table. In this trial, an experimenter helped the children give instructions to move objects, and the director followed the instructions. Twice, the director intentionally committed egocentric errors, moving an object that was occluded from the participant's view. After each error, the experimenter asked the participant if the object the director moved was correct and guided the participant to repeat the instruction. On the second attempt, the director moved the correct object. When the practice trial was completed, the experimenter asked the director and participant to switch locations and confirmed that the participant understood who could see which objects.

After the practice trial, participants received a total of 12 instructions, 3 for each of four different grid setups. For each grid, one critical test instruction was ambiguous: The instruction could refer to a mutually visible target object or to a distractor object that was visible only from the child's egocentric perspective. To succeed, participants had to take the director's perspective and choose the mutually visible target rather than the distractor, which was hidden from the director's view. For example, for the grid in Figure 1, the critical instruction was, "I see a small car. Can you move the small car under the spoon?" Because the director specifically said that she was talking about the car that she could see, the target of the instruction had to be the smallest car that both the child and the director could see. It could not have been the distractor, a smaller car that was occluded from the director's view.

On each trial, a coder noted whether the participant moved the requested object. During the task, participants' eye gaze was recorded by a video camera that was centered on top of the grid and angled toward participants, approximately 16 in. from their heads. Another video camera was located behind participants to record the movement of objects on the grid. A reliability coder used the eye-gaze videos to determine whether participants looked right or left immediately after hearing each instruction and used the videos from behind the participants to determine whether the object they moved was from the right or the left side of the grid. The target and distractor were always placed on opposite sides of the grid, and their lateral locations (left vs. right) were counterbalanced across the grid setups. Data from critical

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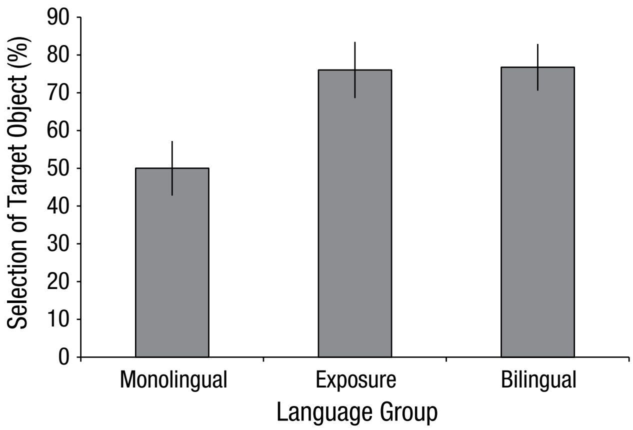

Fig. 2. Percentage of critical trials on which participants in each of the three language groups correctly identified the target. Error bars indicate ±1 *SEM*.

trials were later recoded according to whether the object first looked at was the target or the distractor and whether the object eventually moved was the target or the distractor. The reliability coder was unaware of the lateral locations of the target and the distractor and was uninformed about the language backgrounds of the participants.

In addition to performing the social communication task, participants completed the Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 2007), which measures verbal ability; the Dimensional Change Card Sort task (DCCS; Zelazo, 2006), which measures executive function; the nonverbal visual-spatial intelligence component of the Kaufman Brief Intelligence Test (KBIT-2; Kaufman & Kaufman, 2004), which measures fluid intelligence; and a second short task assessing visual perspective taking.[2]

Results

We first evaluated whether children in the three language groups had comparable abilities to understand language. Vocabulary scores on the PPVT-4 were not significantly different across the groups (monolingual group: M = 115.4; exposure group: M = 110.5; bilingual group: M = 110.5), $F(2, 66) < 1$. In addition, all the children were able to follow the director's instructions in the absence of a distractor: Accuracy on unambiguous trials was high across the board (monolingual group: M = 99.5%; exposure group: M = 99.0%; bilingual group: M = 99.5%). These results suggest that the three groups had comparable proficiency in English.

To evaluate the children's ability to take the director's perspective in order to understand her intended meaning, we analyzed their selections on the critical trials and found a dramatic difference. Whereas the majority of children in the exposure (63%) and bilingual (58%) groups moved the target on all four critical trials, only a minority of monolingual children were able to perform at that level (21%), $\chi^2(2, N = 72) = 10.14$, $p = .006$, $\varphi = .38$. Examining the average percentage of trials on which the target was correctly moved (see Fig. 2), we found a significant effect of language group, $F(2, 69) = 4.77$, $p = .01$, $\eta^2 = .123$; children in the exposure and bilingual groups regularly took the director's perspective (Ms = 76% and 77%, respectively), whereas monolingual children were at chance in selecting between the target and the distractor (M = 50%). Children in the bilingual and exposure groups were significantly more likely than children in the monolingual group to move the target, $t(46) = 2.81$, $p = .007$, $d = 0.83$, and $t(46) = 2.51$, $p = .016$, $d = 0.74$, respectively, whereas the performance of the bilingual and exposure groups did not differ, $t(46) = 0.072$, $p = .94$, $d = 0.02$.

To analyze performance on the critical trials while controlling for potential covariation, we ran a quasibinomial logistic regression with the following predictors: language group (monolingual, exposure, bilingual), gender (male, female), maternal education (bachelor's degree, no bachelor's degree), DCCS score, age (in months), income level, PPVT-4 score, and KBIT-2 score. There was a significant overall effect of language group, likelihood ratio $\chi^2(2, N = 68) = 6.64$, $p = .036$. The exposure group and the bilingual group both significantly outperformed the monolingual group—exposure group: $\beta = 1.27$, $t(42) = 2.13$, $p = .037$, 95% confidence interval (CI) for the odds ratio (OR) = [1.08, 11.69]; bilingual group: $\beta = 1.22$, $t(44) = 2.07$, $p = .042$, 95% CI for the OR = [1.04, 10.97]. Critically, no other factors were significant predictors of performance on the critical trials (see Table S3 in Supplemental Method and Analyses for additional details on this model). Thus, monolingual children were less able than children who were exposed to another language to interpret the director's intended meaning. This demonstrates that early multilingual exposure enhances the development of effective interpersonal communication abilities.

To further evaluate participants' performance, we considered their patterns of looking as well as the objects they moved. Although looking toward an object typically precedes moving it (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995), a participant's initial gaze does not necessarily dictate his or her final choice. Indeed, in a prior study using a similar social communication task, adults made fewer errors than children in the objects they moved, but adults and children were equally likely to make egocentric first looks to the distractor object (Epley et al., 2004). Thus, although the ability to correct initial egocentrism seems to improve over development, an initial tendency toward egocentrism remains. In light of these findings, we evaluated whether the bilingual and exposure groups outperformed the monolingual group

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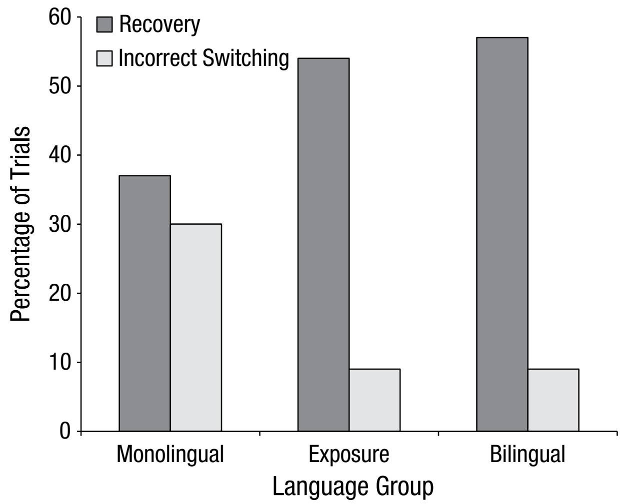

Fig. 3. Percentage of critical trials on which participants in each of the three language groups first looked at one object and then moved a different object. *Recovery* refers to looking at the distractor and then moving the target; *incorrect switching* refers to looking at the target and then moving the distractor. More recovery than incorrect switching suggests active successful perspective taking.

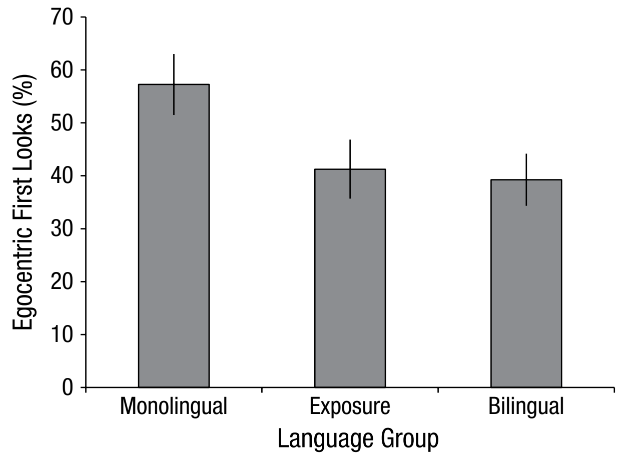

Fig. 4. Percentage of critical trials on which participants in each of the three language groups made an egocentric first look to the distractor. Error bars indicate ±1 *SEM*.

in their ability to recover from an initial egocentric first look and to make the correct selection.

There are two ways that the final object moved on a critical trial could differ from the initial choice of which object to look toward. First, after looking at the distractor, a child could recover from his or her egocentrism and move the target (*recovery*). Alternatively, the child could first look at the target but eventually make a mistake and move the distractor (*incorrect switching*). If these patterns occurred at equal rates, these behaviors would reflect the contribution of random error to performance. In contrast, higher rates of recovery compared with incorrect switching would suggest active, successful perspective taking. In the bilingual and exposure groups, the rate of recovery was much higher than the rate of incorrect switching—bilingual group: 57% recovery vs. 9% incorrect switching, $\chi^2(1, N = 92) = 25.64$, $p < .01$, $\varphi = .53$; exposure group: 54% recovery vs. 9% incorrect switching, $\chi^2(1, N = 92) = 21.86$, $p < .01$, $\varphi = .49$. In contrast, monolinguals showed similar levels of recovery and incorrect switching (37% recovery vs. 30% incorrect switching), $\chi^2(1, N = 85) = 0.42$, $p = .52$, $\varphi = .07$ (Fig. 3). Therefore, the patterns of looking and moving suggest that the children in the bilingual and exposure groups actively took the director's perspective but that the children in the monolingual group did not.

Even more impressively, the bilingual and exposure groups were less egocentric from the outset: They made fewer egocentric first looks than monolingual children (38% and 42% of critical trials vs. 57%, respectively), $\chi^2(2, N = 262) = 6.99$, $p = .03$, $\varphi = .16$ (Fig. 4). To analyze the children's initial looking behavior while controlling for potential covariation, we ran another quasibinomial logistic regression with the same predictors as in our first model. There was a significant overall effect of language group, likelihood ratio $\chi^2(2, N = 63) = 8.53$, $p = .014$. The exposure and bilingual groups both made significantly fewer egocentric first looks than the monolingual group—exposure group: $\beta = 0.78$, $t(38) = 2.13$, $p = .038$, 95% CI for the OR = [1.04, 4.58]; bilingual group: $\beta = 1.03$, $t(42) = 2.66$, $p = .010$, 95% CI for the OR = [1.29, 6.02]. No other factors were significant predictors of children's initial looking behavior (see Table S4 in Supplemental Method and Analyses for additional details on this model).

These results indicate that children in the bilingual and exposure groups were spontaneously more attuned to the perspective of the speaker compared with children in the monolingual group. This finding is particularly intriguing given that initial egocentrism may not decrease throughout the life span (Epley et al., 2004). The fact that the bilingual and exposure groups made fewer spontaneous egocentric looks may have important consequences for their interpersonal communication across development; exposure to diverse language environments could lead to a fundamentally different interpretation of communicative intentions.

Although we proposed that children in multilingual environments have enhanced communication skills because of their social experiences, one might question whether our findings are due instead to enhanced executive function. Mentally representing multiple languages and routinely selecting or inhibiting the appropriate linguistic system may increase executive-function abilities (e.g., Bialystok, 1999; Bialystok, Craik, Green, & Gollan, 2009; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; but see Antón et al., 2014, and Duñabeitia

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et al., 2014). These cognitive benefits may emerge as early as infancy (Brito & Barr, 2012; Kovács & Mehler, 2009) and persist across the life span (Bialystok, Craik, Klein, & Viswanathan, 2004; Rubio-Fernández & Glucksberg, 2012). Thus, if exposure to another language enhances executive function, differences in executive function could conceivably account for our findings by allowing participants to inhibit their own perspective and attend to the director's perspective.

Our data, however, show that differences in executive function cannot account for the observed differences in children's social communication abilities. As described earlier, the cognitive factors we measured (DCCS and KBIT-2 scores) were not significant predictors of children's performance in the social communication task, and differences in performance across the language groups held even when we controlled for these factors. In addition, although we replicated previous findings suggesting that bilingual children may outperform monolingual children on cognitive tasks, we found that our bilingual group also outperformed our exposure group. Specifically, our bilingual group outperformed our monolingual group on the DCCS (M = 2.3 vs. M = 2.0), $t(46)$ = 1.90, p = .063, d = 0.56, and on the KBIT-2 (M = 112.7 vs. M = 103.4), $t(45)$ = 2.05, p = .046, d = 0.61), but our bilingual group also outperformed our exposure group on the DCCS (M = 1.9 for the exposure group), $t(46)$ = 2.48, p = .017, d = 0.73, and the KBIT-2 (M = 101.2 for the exposure group), $t(45)$ = 2.05, p = .046, d = 0.61. Moreover, the performance of the exposure and monolingual groups did not differ on either the DCCS, $t(46)$ = 0.68, p = .50, d = 0.20, or the KBIT-2, $t(44)$ = 0.54, p = .60, d = 0.16. Differences in performance across the language groups held when we controlled for maternal education, income, and gender—DCCS: Wald χ^2 = 8.53, p = .014; KBIT-2: Wald χ^2 = 8.61, p = .014.

In summary, although the bilingual group demonstrated cognitive advantages over the monolingual group, the exposure group did not. Critically, the exposure group was just as successful as the bilingual group at the social communication task, despite having lower executive-function scores. Thus, differences in cognitive abilities cannot explain our findings that both the bilingual and the exposure group outperformed the monolingual group at social perspective taking.

Discussion

A purely monolingual environment is not common in human societies. We demonstrated that the more prevalent environment, which exposes children to multilingual experiences, may provide important tools for effective communication. It is possible that the vast human experience with multilingual exposure may have promoted the development of subtle and unique mental tools that facilitate communication.

Our discovery opens up a host of interesting questions. What exactly are the communication tools that a multilingual environment promotes? What aspects of a diverse sociolinguistic environment afford communicative success? And what facilitates the acquisition of communicative skills across the life span? One possibility is that diverse language exposure at any point in life could aid people in effectively interpreting others' communicative intent. Alternatively, for these communicative benefits to arise, children might need to be exposed to multiple languages before they become entrenched in an egocentric way of interpreting their social world. Future research testing the malleability of interpersonal communication skills across development will elucidate whether there is an early-exposure effect. If multilingual exposure indeed benefits effective communication, then miscommunication might be reduced through active exposure of young children to varied linguistic environments.

Author Contributions

S. P. Fan and Z. Liberman contributed equally to this work, and their authorship order was chosen alphabetically. All authors developed the study concept and contributed to the study design. Testing, data collection, and data analysis and interpretation were performed by S. P. Fan and Z. Liberman. All authors drafted the manuscript and approved the final version.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information can be found at http://pss.sagepub.com/content/by/supplemental-data

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Open Practices

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Notes

1. All three groups spanned the range of scores.
2. For this task, the children sat across from the experimenter, with a glass frame between them. They were asked to draw a letter "C" on the glass with a dry-erase marker. Then, they had up to three tries to draw a shape that looked like a "C" to the experimenter. Differences between the language groups were in the predicted direction, but many participants (n = 17) failed to draw the original letter correctly, so we did not analyze the data.

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