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VISUAL INFORMATION-SEEKING BEHAVIOR OF CHINESE- AND ENGLISH-SPEAKING CHILDREN

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EVIDENCE FROM CROSS-CULTURAL STUDIES shows that children soak up culturally specific graphical knowledge from their communities. Recent cross-linguistic studies suggest that they develop some language-specific behaviors that are reflected in non-linguistic cognitive skills. It may follow that children also absorb visual information-seeking behaviors from their cultural/linguistic communities. Studies carried out by Lucy and Gaskins (2001, 2003), Levinson (2003), and Bowerman and Choi (2003) provide evidence that adults and children exhibit the influence of language specific diversity on visually prompted, non-linguistic cognitive tasks. The recent comparative research of Lucy and Gaskins (2003:479–81) with Yucatec speakers and American English speakers has investigated number-marking patterns in several contexts and across ages. Their results show that the nonverbal cognitive responses of adults as well as 9-year-old children agree where the languages agree and differ where the languages differ. Several of Levinson's studies related to linguistic relativity in the spatial domain suggest that certain concepts embedded in a language are reflected in every aspect of the language community—the way doors open, the spatial arrangement of objects, the nature of gestures (2003:43). He argues that toddlers are informed continuously through thousands of details of their built environment and by the way people around them conduct interactions. Bowerman and Choi (2003:398–411) in their work with Korean speakers and English speakers, using a preferential looking study, found that children as young as 18 months in the early linguistic stage adopt language-specific principles of categorization, but that infants in the prelinguistic stage are much less sensitive to such categories.

Building on such findings and his own theory of neurocognitive language development, Lamb (2000:186) asks how visual input is associated with perception, thought and language. He points out that because children's visual intake is so overwhelmed by the flux of environmental information, they must learn to select which features to attend to and which to ignore. He hypothesizes that this selection process is largely guided by the language of members of the children's community.

In this paper I report on a study conducted in China and the United States that investigates how children in their early years seek information visually in naturally occurring situations. The working hypothesis is that although individuals in all cultures exhibit great variation in behavior, children exhibit clusters of nonverbally expressed attributes of visual information-seeking behavior that are associated with their specific cultural/linguistic community. Although this study does not directly

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address the interplay between language-specific behavior and non-linguistic cognitive skills, it may provide clues about it.

1. HISTORY OF THE RESEARCH. For the last 20 years I have been investigating culturally embedded repertoires of practice in China and the United States that are related to visual processing. These lay the foundation for the current study and point toward a possible proclivity for culturally or linguistically associated perceptual development in children. These studies, in turn, are rooted in Regan's extensive investigations into the nonverbal and specifically into the visual semiotic of Chinese culture (e.g. Regan, Stephenson & Pine 2000, Regan & Hong 1984, Regan, Zhou & Hong 1987), including adults and children attending to and remembering two-dimensional detail and prelinguistic communication studies among Chinese- and English-speaking toddlers. Both the Regan studies and my research are based in part on the recognition that the structures of Chinese[1] and English are distinctly different in a number of areas. However, our focus on the nonverbal and the behaviors related to the development and use of a visually complex written system has left untouched the close comparative linguistic analysis that may be helpful to pursue in light of the Lucy, Levinson and Bowerman studies.

1.1. PREWRITING STUDY. My first study relates to the question of whether children exhibit clusters of culturally similar attributes (Pine 1992, 1993). It asks whether the 'prewriting' of 2- and 3-year-old children in China and the United States included characteristics associated with the writing system of their respective speech communities. Seventy-five children in each country were asked to 'write a letter just like their parents or grandparents do'. **Figure 1** shows typical samples of their prewriting. The 150 samples were analyzed for 3 interval-ratio variables (number of configurations, size of the configurations, and amount of paper used) and for the presence or absence of 30 attributes that had been identified in the adult English and Chinese writing.

The 2- and 3-year old children exhibited a considerable amount of graphical knowledge that revealed culturally clustered patterns that had not been explicitly taught to them. The three interval-ratio variables showed the differences between the Chinese prewriting and the U.S. prewriting to be significant at the p=.0001 level. The presence or absence of the 30 attribute variables predicted country of origin correctly for the Chinese sample 88% of the time and for the U.S. sample, 92% of the time. The most heavily weighted marker variables were short line segments that included angles, hooks or curves and long curving or looping lines. The Chinese children made very small configurations, the U.S. children much larger ones; the Chinese children used many short lines and angles that filled little space; the U.S. children tended to use long, continuous curving or back and forth lines that filled the paper.

1.2. NOTICING BEHAVIORS IN EVERYDAY LIFE. Working with Regan and Chinese colleagues we ran series of tests to explore visual acuity both in China and the United States—the identification of one complex geometric shape from the next; finding the

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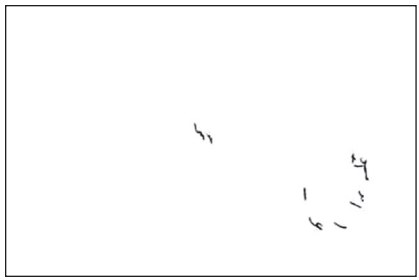
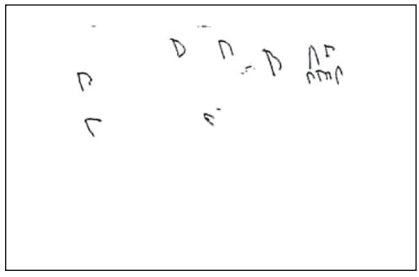
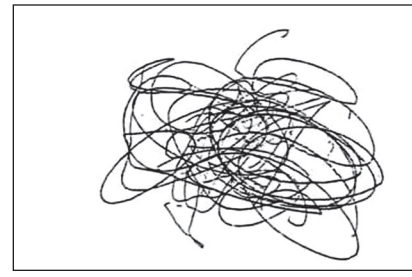


Chinese: 2 years, 11 months

U.S.: 2 years, 11 months



Chinese: 3 years, 5 months



U.S.: 3 years, 5 months

Figure 1. *Typical U.S. and Chinese prewriting. Original papers were 5.5 x 8 inches.*

one mistake in a row of identical characters; the ability to copy unknown characters, words and geometric patterns; and the facility to reproduce complex characters and English words from memory after a 10-second look. The results of these tests highlighted a presence among the Chinese children and adults of an attention to detail and a highly accurate visual memory for two-dimensional figures when compared to native English-speaking children and adults. One study, for example, showed Chinese first graders much more skilled at copying unknown complex characters, English words, and abstract figures than their native English counterparts (Stephenson 1994). Almost all of the studies, however, pertained to understanding culturally specific clusters of behavior surrounding two-dimensional shapes. Our results suggested a need to explore more complex phenomena.

1.3. REMEMBERING AND DECODING. Two Chinese colleagues and I (Pine, Huang & Huang 2003) carried out studies of the literacy practices and strategies that primary school children in China report using to remember and decode the densely packed characters of their writing system. In the last of these studies, using single character words with small errors in them to stimulate children's oral commentary, we interviewed thirty first, second and third grade Chinese children about the strategies they used to remember and decode characters. The results were clearly different from what has been found in the United States. A typical response from a Chinese first grader went like this:

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Interviewer:	Is [the character] right or not?
Child:	No.
Interviewer:	How do you know that?
Child:	Because the end part of it shouldn't be this horizontal bar, but four dots.

Each response was analyzed in relation to the final ten categories that were developed using a constant comparative method (Glaser & Strauss, 1967:156). The children employed remembering strategies that overwhelmingly utilized what we defined as 'structural analysis'. They separated the structure of the character into explicit parts, associated the character or part of it with another known character or small units of another character, and scanned for details and particular strokes. At all three grade levels, they clearly reported turning toward visual segmentation and their visual knowledge of characters and character parts to decode and remember characters. A second grade child, for example, talking about how she remembered the character *yàn* (燕) [swallow], divided it into multiple parts:

> I divide it into several parts. The bottom part is four points; the middle part is a *kǒu* (口) [mouth] and a separated *běi* (北) [north]; the upper part is a *cǎo* (艹) [a component meaning *grass*] and a dash. [Hand motions accompany all 3 parts—upper, middle, lower.]

1.4. PRELIMINARY LOOKING-BEHAVIOR STUDIES. In the process of completing the literacy study, I returned to an earlier study I had begun on looking behavior. That study probed naturally-occurring looking events across ages in both China and the United States as they were noticed by cultural outsiders. For example, we from the U.S. noticed that a Chinese adult asking a toddler to perform a visual task would gently push the child's head, tilting it farther forward over the task than it had been. The adults explained this action as giving the children assurance. Chinese colleagues observed that U.S. parents at such places as the zoo or a museum were unusually casual about pointing out what children should be noticing. The U.S. adults explained that their general pointing or comments were sufficient for a family outing.

In observing Chinese and U.S. adult/child interactions I found several differences, with one clearly delineated. Of 77 Chinese adults observed holding babies and young children, 74 held them in an almost identical position with the child's head at eye level with the adult's eyes (**Figure 2**). Of the 75 American adults observed holding children, there was no such consistency. Instead, 10 distinct U.S. holding positions emerged, varying from high on the hip with the child looking in a number of directions to flat against the body with the head covered (Pine 1997a:9).

Other portions of this study systematically recorded observations of children ages 1 to 4 years in China and the U.S. in naturally occurring situations in homes and public places. Although many of these children were probably native speakers of Chinese or English, this information was not recorded. Data were collected primarily by

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Figure 2. *Adult indicating behavior: carrying positions in China. Traced from representative photos taken in China, ages 6 months to 3 years (Pine 1997b:519).*

participant observers trained to estimate time and child ages accurately. Some were videotaped. Six coding categories such as the size of the object of focus emerged from this study and became a base for the current study.

2. THE CURRENT STUDY: ANALYSIS AND FINDINGS. The current study carries the previous looking-behavior study to a new level[2]. Focusing on 2- and 3-year-old children in China and the United States, I have investigated visual information-seeking behavior in more detail across twice as many categories, taking advantage of digitized videorecording which allows for finer grained analysis than analogue. In China the sample was limited to those acquiring Chinese (Pǔtōnghuà) as their first language, in the U.S., to those acquiring English as their first language. Forty events selected from the digitized tapes were analyzed by separate categories. The data for the object of focus category were drawn from both the preliminary study and this one. The 40 events, 20 from each country, were selected from over 75 events in each linguistic community, controlling for a comparable number of preschool, home and public venue contexts as well as age differences.

Visual information-seeking behavior of young children includes such naturally occurring activities as looking at and poking a bit of dirt; looking at a small bug for a concentrated time; watching colorful balls fall through an irregular structure; watching animals at the zoo or water toys as they use them or looking at the world through a sieve. It might also be watching a teacher demonstrate a lesson or a grandfather demonstrating how to blow bubbles. An *event* of visual information-seeking behavior is a time span during which a child focuses on one thing, to investigate it, observe it, or interact with it. The primary mode of interaction is visual, even though other modes are involved. An event ends when a child changes to a different activity, is out of view of the camera, or when the video has been following the child for 15 minutes.

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Child's primary focus	**Materials used**
• size of the object of focus	**Adult involvement**
• distance from eye to the object*	**Adult/Child agendas**
• movement of the object	**Adult/Child interaction**
• nature of child's focus (visually locked, steady, jerky, etc.)	• adult orients child • adult simplifies task • child seeks adult assistance
Body movement	**Duration of looking**
• speed/amount of movement*	• number of sub-events (focus changes)
• what portion of body is moving*	• average length of focus
• area child uses	
• hand movement	

Table 1. *Current coding categories for visual information-seeking behavior. *Those with stars were added by Chinese colleagues, among them a linguist.*

2.1. CATEGORIES. Categories were derived from the previous looking behavior study, from studies by Rogoff et al. (1993:1-57), from Chinese colleagues, and from data analysis (**Table 1**). Several categories that emerged from the data appear to be potential markers of culturally clustered patterns associated with visual information-seeking behavior.

2.1.1. SIZE OF THE OBJECT OF FOCUS. This category emerged from the earlier looking-behavior study and has held steady ever since (**Figure 3**). Objects in the different size categories include such items as the following:

0-1": **Both countries**: ants, dirt particles, grain kernels
China: some school manipulatives (e.g. linking toys; puzzle pieces; paint-covered tissue paper balls, about .25" to .33" dia.)
1"–6": **Both countries**: Legos for toddlers
China: pots and pans for playing, blocks
U.S.: beads for stringing, cars, geometric pattern shapes
6"–1': **China**: some blocks, a balloon, a Lego Ferris wheel
U.S.: blocks, pots and pans for playing, toy computer

The Chinese speakers focused on smaller objects, the English speakers on larger. Focusing on objects of 1 inch or less was especially unusual for the U.S. children. While 22 cases were found among the Chinese speakers, only 3 cases occurred during the English speakers' events. Although more English-speaking cases fell into the next category, 1"–6", there were still almost twice as many Chinese cases. Alternatively, fewer Chinese-speaking children focused on objects as the object size increased, with the exception of the 4' to 10' category, which consisted primarily of zoo animals. Note that preschool materials were another environmental influence since in both countries

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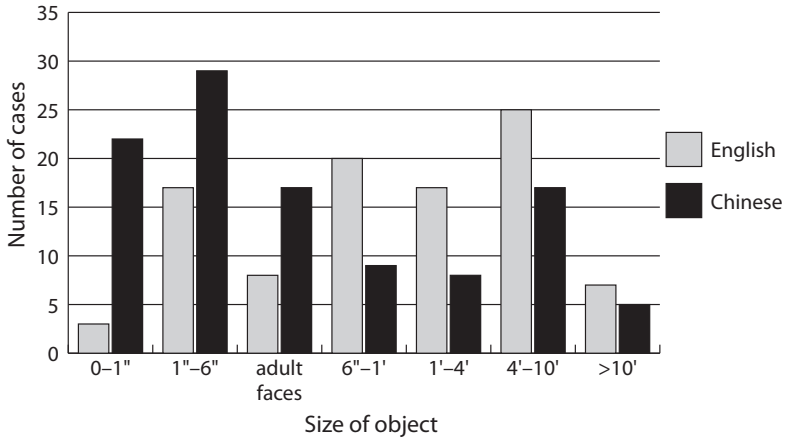

Figure 3. *Size of the object of focus for 2- and 3-year-old children. English speakers: n = 37, number of events = 92. Chinese speakers: n = 44, number of events = 99.*

many of them are between 1 and 6 inches. Of the 17 U.S. cases in that category, 12 involved preschool materials.

2.1.2. DISTANCE FROM EYE TO OBJECT. Chinese collaborators introduced this category and made sure it was kept. Their insistence was reinforced by a poem I heard recited in a first grade classroom recently. As the reading comprehension lesson ended, the teacher prepared the children for a lesson in writing characters. She added, 'but first of all, tell me the principles for writing'. In unison the children recited the following poem, which rhymes in Chinese:

The body is one fist's length from the table.
The eyes are 0.3 meters from the paper.
The fingers are 0.033 meters from the tip of the pencil.
Good eyesight is important to us all.

The 40 events in this category did not yield clear results. This is partially due to the substantially different contexts selected for videotaping in the two countries. Ongoing data collection with a Chinese colleague is working toward more standardized, yet naturally-occurring contexts.

2.1.3. DIAMETER OF AREA USED. Two categories related to body movement have yielded interesting results—the diameter of the area used by the child while engaged in a looking event, and the speed of the child's body movement during an event. The Chinese children almost always stayed within a 0 to 2' diameter, even though in every analyzed event there was ample space available for more movement and the children were not physically constrained. In only 3 of the 20 Chinese events did the child use

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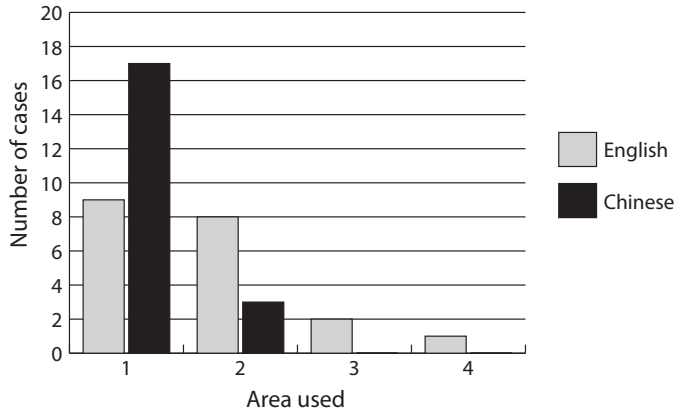

Figure 4. *Diameter of area used by child. Rated from 1 to 4 (1 = 0–2 ft., 2 = 2–6 ft., 3 = 6–10 ft., 4 = > 10 ft.).*

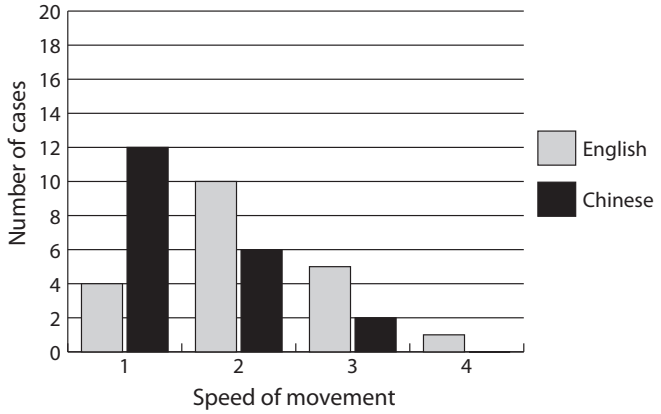

Figure 5. *Speed of children's movement while engaged in a visual information-seeking behavior event. 1 = still, very slow; 4 = moving quickly (e.g., jumping up and down or moving shakers very fast while looking at them).*

more space than this (**Figure 4**). The English-speaking children, on the other hand, used a much larger area. The amount of space available for movement was similar in both the Chinese and the U.S. contexts.

2.1.4. SPEED OF CHILDREN'S MOVEMENT. The speed of movement category (**Figure 5**) rated a child's total body movement during a looking event on a progressive scale of 1 to 4, with 1 being still or very slow. Although not quite as differentiated as the Diameter of Area Used category, a clear difference exists between the movement speeds of the English speakers and the Chinese speakers. The Chinese speakers were more

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likely to be still, often moving only their hands. Twelve of the 20 Chinese speakers were rated at 1, still or very slow, while only 4 of the 20 English speakers were rated at this level. Six English speakers were rated at a 3 or 4, while only 2 Chinese speakers were rated at 3 and none at 4. These findings are augmented by adult comments made while viewing videotapes of the other culture's children. The U.S. adults often described the Chinese children as 'calm' or 'still', whereas Chinese adults tended to describe U.S. children as 'very active' and, often, engaging in 'dangerous' activity.

2.1.5. THE REMAINING CATEGORIES. A number of categories remain to be analyzed, with several posing complicated analytical issues and others requiring more standardized data collection. One category that has created analytical problems is the number of sub-events found within an event. A sub-event is a length of time within an event during which a child focuses on one thing. The next sub-event occurs when a child changes eye focus, and within each event there are many sub-events. Although the primary object of focus is maintained throughout the event, the child often looks elsewhere—at someone walking by, at something dropped, at an additional utensil that could be useful. In the current data sub-events range from 50 seconds to 7 minutes and raise many questions about when a child actually changes focus. Another problematic area is video-recording naturally occurring behaviors in home environments with adults present. Many of the earlier recordings found parents trying to force a child to do a particular activity rather than allowing more natural behaviors to unfold.

3. DISCUSSION. My study suggests, within the considerable limits of the data analysis, that 2- and 3-year-old children whose primary language is Chinese or English have developed different forms of visual information-seeking behaviors. Whether these differences are associated with the structure of their primary languages has not been investigated in this study. However, it could be useful to ask whether these predominately nonverbal data mirror in any way sets of differences that exist in the language structures.

Within the context of questions about how language may influence nonlinguistic cognition, Bowerman and Choi, Levinson, and Lamb all grapple with the linguistic and cognitive development of young children as they come to linguistic fluency. Do concepts such as spatial perception arise in children in the early linguistic stages through a combination of nonlinguistic cognitive development and linguistic guidance? Is linguistic interaction a driving force or are the structures of language infused throughout their cultural environment? Bowerman and Choi (2003:387) argue that research with very young children is valuable as a means for uncovering how flexible—and thus potentially malleable—is their cognitive structuring of the physical and social world.

Lamb and Levinson both describe compelling scenarios about how children might develop perceptual concepts. Lamb (2000:186), in addressing how a concept is learned by children in the initial stages while they are surrounded by a barrage of input, suggests that their early learning must involve a selection process. He hypothesizes that

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in the interconnection of linguistic and additional input, children easily learn 'to discriminate myriad visual and other perceptual properties' guided by members of their linguistic/cultural community. Levinson (2003:43) stresses that the details of the world in which the children interact 'will inform the discerning toddler again and again till she gets the message'.

Many questions arise as to whether the predominately nonverbal, visual information-seeking data presented here can provide clues about the early stages of linguistic development and its relation to the children's language community. Two of the most compelling are the relation of the nonverbal to early language development, and the importance of movement for the two groups.

3.1. POWER OF THE NON-VERBAL. Although this study does not directly address the association of children's visual information-seeking behavior with structural elements of Chinese and English, it opens the question of whether linguistic influences might be associated with early nonverbal variation in looking behavior and what the association might be between their verbal and nonverbal development. Watching the nonverbal interactions of 2- and 3-year-old children second by second on the digitized videos has led me to believe that their nonverbal sign systems are considerably more developed than their verbal. There is a tendency in the U.S., and I believe in China, to focus on their verbal development and in so doing judge them as less developed than they are. At 2 years and early 3's they seem to be getting their 'cultural movements right' in the nonverbal, whereas their language development is much less sophisticated. For example, one video captures the motions of Chinese 3-year olds pretending to cook at their preschool kitchen center. They use a myriad of complex nonverbal interactions: picking up little bits of 'food' from a table and putting them in several bowls, transferring the food bits from one bowl to the next and into a pot, then placing other 'food' from the pot into another bowl and stirring, all in an intricate ballet of preparing food the Chinese way. Although the children talk a little to each other, or to themselves, the complexity lies in their hand movements, not their words. And often they say nothing. Equivalent scenarios occur in the U.S. videos, from cleaning up kitchens to examining lawnmower mechanisms and 'fixing' them to caring for babies. While recognizing that the verbal and nonverbal are knit together, these complex interactions may raise the question as to whether nonverbal behaviors are the leading edge of linguistic development within a continuous feedback loop.

3.2. MOVEMENT. A cluster of questions relates to movement. The questions appear to be important, yet the perceptual concepts embedded in movement are difficult to grasp. In addition movement raises many analytical and interpretive puzzles. U.S. children appear to be fascinated by motion. For instance, in many U.S. videos toddlers in a preschool play-yard watch sand being poured from a teacher's shovel or sifted through a sieve for long blocks of time. They exhibit great enthusiasm for running around looking through their own sieves, seeming to be enchanted by the moving, fractured view of their surroundings. Parents often jiggle something to get children to

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look at it or bounce their children up and down to entertain them. Movement is also involved in what Chinese children look at, but the nature of that movement appears to be different and less dominant. This difference is probably a matter of degree, but it also seems to be quite important to the English speakers and not as important to the Chinese speakers.

How to code moving objects and their focus on them is especially confounding. This is evident in defining sub-events, but also in many other areas. If a child is continuously stacking up geometric shapes from the same toy, one after the other, is this one sub-event or many? What is the object of focus of the child running around looking at the world through a sieve? Such murky areas have not been included in the present analysis, yet they make up a portion of the data that may be very valuable.

Levinson suggests that children's nonverbal behavior patterns—in our case, visual information seeking behavior—may be a capturable reflection of particular language characteristics. Whether my research provides clues about the interplay between language-specific behavior and nonlinguistic cognitive skills is still a distant, if tantalizing question. However, as Levinson (2003:43) suggests, the clues to how we think 'are not all in the language but are distributed throughout the context of language learning…' They are in minute-to-minute interactions and the cultural environment. He hypothesizes that this is true '*because* we think in line with how we speak'. If this concept is accurate, then the current study may provide hints about the cognitive impact of Chinese and English on the nonverbal behavior of the children described here. It may be that this study reflects some of that distribution in Chinese and English.

[1] I am using the term 'Chinese' to refer to Pǔtōnghuà, the official school language of the People's Republic of China. In many Western communities it is called Mandarin.

[2] I want to express my appreciation to all of my Chinese colleagues who have provided insights about this research, with particular thanks to Qiu Wei and her family, Zhang Yafei, and Yu Zhenyou who have brought their expertise and patience to the data collection and preliminary analyses.

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