Brief report

Preschoolers’ knowledge about language-specific properties of writing

Shoko Otake¹, Rebecca Treiman¹* and Li Yin²

¹Department of Psychological and Brain Sciences, Washington University in St. Louis, Missouri, USA
²Department of Foreign Languages and Literatures, Tsinghua University, Beijing, China

According to the differentiation hypothesis, young children’s attempts to write show characteristics common to all writing systems, such as linearity. Characteristics that are specific to the writing system of the child’s culture emerge only later. We tested this hypothesis by presenting adults who knew both Chinese and English with written productions of Chinese and United States 2- to 5-year-olds and asking them to judge the nationality of the writer. Adults performed significantly above the level expected by chance even with the productions of 2- and 3-year-olds, suggesting that knowledge of language-specific characteristics emerges earlier than previously thought. Children appeared to show more language-specific characteristics in their names than in other writings, for adults performed better with children’s names than with other items.

Statement of contribution

What is already known on this subject?
- Children’s early attempts to write may show general properties of writing, such as linearity.
- Knowledge of language-specific features is thought to develop later.

What does this study adds?
- Adults judged whether a writer was an United States or a Chinese child.
- Adults performed above the level of chance even with the productions of 2- and 3-year-olds.
- Children begin to learn about language-specific features earlier than previously thought.

Children in modern societies begin to learn about the notation systems of their culture, including writing, at a young age (Andersen, Scheuer, Perez Echeverria, & Teubal, 2009). Children show some knowledge of the visual properties of writing as early as 3 years of age, allowing adults to judge above the level expected by chance whether a scribble was produced in response to a request to write or a request to draw (Levin & Bus, 2003; Otake, Treiman, & Yin, 2017; Treiman & Yin, 2011). According to Tolchinsky (2003), adults can do this because children’s early attempts to write show features that are common to all writing systems, such as linearity and lack of iconicity. Only later, according to Tolchinsky’s differentiation hypothesis, do children learn about features such as horizontality or verticality that vary across writing systems.

*Correspondence should be addressed to Rebecca Treiman, Department of Psychological and Brain Sciences, Washington University in St. Louis, Campus Box 1125, One Brookings Drive, St. Louis, MO 63130-4899, USA (email: rtreiman@wustl.edu).

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Supporting the differentiation hypothesis, Tolchinsky-Landsmann and Levin (1985)'s analyses of Israeli children's writings suggested that 4-year-olds have acquired the universal characteristics of writing but that characteristics that are specific to Hebrew, such as right-to-left directionality, are not acquired until age 5. Similarly, Puranik and Lonigan (2011) reported that US 3-year-olds generally showed universal characteristics but not language-specific ones when writing words other than their own names.

The present study provided a new test of the differentiation hypothesis by comparing the productions of US and Chinese 2- to 5-year-olds whose attempts to write their names and the words ‘fire’, ‘sun’, and ‘water’ had been collected in earlier studies (Otake et al., 2017; Treiman & Yin, 2011). The US and Chinese children had produced their writings under very similar conditions, using the same types of paper and the same utensils. Here, we showed the productions to adults who knew both English and Chinese, asking them to guess the nationality of the writer. We gave adults feedback about the correctness of their responses, allowing them an opportunity to learn which clues were most helpful in determining the writing system to which a child had been exposed. According to Tolchinsky’s (2003) differentiation hypothesis, no helpful cues exist in the productions of 2- and 3-year-olds and so adults should perform at chance levels. We also compared adults’ performance on children’s productions of their names and other words to test the idea that children write their names in a more advanced way than they write other words (Levin, Both-de Vries, Aram, & Bus, 2005; Puranik & Lonigan, 2011; Tolchinsky-Landsmann & Levin, 1985).

**Method**

**Participants**

We tested 16 Washington University students and community members aged 18–23 who reported that they fluently read and spoke both Chinese and English. Ethical approval for the study was granted from Washington University.

**Materials and procedure**

We used productions from the 82 US and 73 Chinese children from Otake et al. (2017) and Treiman and Yin (2011), respectively, who wrote all four targets, 620 productions in all. Table 1 shows the number of children in each country in different age groups, using similar age cut-offs as in Otake et al. (2017). Figure 1 shows some sample productions. The productions were scanned into a computer and changed into black-and-white images with the backgrounds erased. A label was placed on the left of each image to indicate the target. Adults viewed the images on a 17” screen in a different random order for each participant. For each image, participants were asked to press one key if they thought the writer was American and another key if they thought the writer was Chinese. They were asked to type a 1- to 2-word reason for their judgement and indicate their confidence in

<table>
<thead>
<tr>
<th>Group</th>
<th>Age range</th>
<th>United States</th>
<th>Chinese</th>
</tr>
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<tbody>
<tr>
<td>Young</td>
<td>2;0–3;3</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Middle</td>
<td>3;4–4;2</td>
<td>30</td>
<td>17</td>
</tr>
<tr>
<td>Old</td>
<td>4;3–5;5</td>
<td>26</td>
<td>30</td>
</tr>
</tbody>
</table>

*Table 1. Number of children in each age group*
their decision on a 5-point scale. Participants were then told whether their decision was correct.

**Results**

Table 2 provides data on the correctness of adults’ judgements. We conducted a multilevel analysis with adult participants, child participants, and target as random factors and child age (in months and centred) and name (child’s name or another target) and their interaction as fixed factors. There was a main effect of age ($\beta = .011, SE = .001, p < .001$), such that adults performed better with the productions of older children than younger children, and a main effect of name ($\beta = .073, SE = .010, p < .001$), such that adults performed better with children’s names than other items. The interaction between age and name ($\beta = .002, SE = .001, p = .05$) arose because the superiority for names over other items was larger for older than younger children.

Data on adults’ confidence rating are shown in Table 3. There was a main effect of age ($\beta = .052, SE = .002, p < .001$), such that adults were more confident in their judgements of older than younger children, and an interaction between age and name ($\beta = .019, SE = .003, p < .001$). The increased confidence for names as compared to other words was more marked when adults judged the productions of older children than of younger children.

To determine how adults’ accuracy compared to the level expected by chance (.50), we calculated the mean score for each adult across children in each age group for names and for other words. Scores were significantly above .50 for each age group for names and non-names according to one-tailed $t$-tests ($p < .001$). When we pooled scores for each child’s productions of the name and of non-names across adults, performance was significantly better than expected by chance by one-tailed $t$-tests ($p = .026$ for non-names for the youngest group, $p < .001$ in all other cases).

![Figure 1. Productions of children of different ages exposed to English or Chinese.](image-url)
Adults often did not provide reasons for their decisions or said that they guessed, so we did not systematically analyse their justifications. The substantive justifications that adults provided often mentioned the presence of letters or characters.

Discussion

Our study was designed to test Tolchinsky (2003)’s differentiation hypothesis, which states that children learn about general features of writing before language-specific ones. Although several previous findings suggest that 2- and 3-year-olds’ attempts to write words other than their names do not show language-specific characteristics (Puranik & Lonigan, 2011; Tolchinsky-Landsmann & Levin, 1985), we found that the productions of US and Chinese children of these ages could be identified above the level of chance by language. One reason why our conclusions differ from those of these previous studies for may be that our participants could use whatever features they found most helpful. For example, participants could have used the squarish shape of a production as a clue that the writer was Chinese even if the form was rather distant from any particular Chinese character. The previous studies assessed children’s knowledge of language-specific features based on the presence of one or two features, specifically left-to-right directionality and letters or forms that were very similar to real letters in Puranik and Lonigan’s study of US children. Also, we trained our participants to maximize their ability to notice cues to whether a production was English or Chinese. Training would not have allowed participants to make distinctions if no cues were available, but it may have boosted their performance.

Our results further suggest that children show more language-specific characteristics when they write their names than when they write other words. This outcome provides new evidence of a name advantage in early writing (Levin et al., 2005; Puranik & Lonigan, 2011; Tolchinsky-Landsmann & Levin, 1985).

A recent study found that young Chinese children show some knowledge of language-specific properties in a recognition task (Zhang, Yin, & Treiman, 2017). Specifically, Chinese 3-year-olds picked Chinese over Kannada beyond the level expected by chance when asked to choose the better example of writing in pairs such as 酉矢 (Chinese) and ಕ್ರ (Kannada). The current results indicate that young children’s knowledge of language-

### Table 2. Proportion of correct judgements (standard deviations in parentheses) for productions of names and other words

<table>
<thead>
<tr>
<th>Age group</th>
<th>Name</th>
<th>Other</th>
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<tbody>
<tr>
<td>Young (2;0–3;3)</td>
<td>0.60 (0.20)</td>
<td>0.55 (0.17)</td>
</tr>
<tr>
<td>Middle (3;4–4;2)</td>
<td>0.72 (0.26)</td>
<td>0.63 (0.17)</td>
</tr>
<tr>
<td>Old (4;3–5;5)</td>
<td>0.92 (0.17)</td>
<td>0.83 (0.14)</td>
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### Table 3. Average confidence ratings (standard deviations in parentheses) on 1–5 scale (5 = highly confident) for productions of names and other words

<table>
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<tr>
<th>Age group</th>
<th>Name</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young (2;0–3;3)</td>
<td>2.55 (0.46)</td>
<td>2.51 (0.22)</td>
</tr>
<tr>
<td>Middle (3;4–4;2)</td>
<td>3.59 (0.79)</td>
<td>2.86 (0.50)</td>
</tr>
<tr>
<td>Old (4;3–5;5)</td>
<td>4.32 (0.48)</td>
<td>3.71 (0.70)</td>
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specific properties also shows itself in production. Although this knowledge increases over the years studied here, in that adults were more confident and accurate in their judgements about the productions of older than of younger children, knowledge of language-specific properties begins to emerge quite early in both production and recognition.

A limitation of the present study is that we were not able to draw conclusions about the properties of the productions on which adults based their judgements. Future studies should examine this issue. Relations between children’s early knowledge of the characteristics of writing and their later literacy skills are another topic for future research.

Despite some limitations, the present results add to our knowledge of emergent literacy by showing that children begin to learn at an early age about the visual properties of writing in their environment. Our results are not consistent with the view that children’s early ideas about writing are largely self-generated, such that exposure to writing takes a substantial amount of time to have an influence (Ferreiro & Teberosky, 1982). Rather, the findings are consistent with views of literacy development that stress statistical learning and children’s interactions with environmental print (e.g., Mano, 2016; Neumann, Hood, & Ford, 2013). Given the frequency with which modern children encounter writing, our results show, they begin to learn about its visual properties as early as 2 and 3 years of age.

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References


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