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GENDER DIFFERENCES IN LANGUAGE DEVELOPMENT

Suyunova Mohinur Ilhom qizi

MA student in Foreign Language and Literature Department, Uzbekistan State World Languages University

A R T I C L E I N F O.

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Abstract:

Gender differences in language can be signs of cognitive differences, but can also by themselves be the cause for such differences. Females have a slight linguistic advantage over males, but effect sizes are small, and gender explains very little of the variance seen in the normal population (1%–2%). However, males outnumber females in the lowest 10th percentile in language tests (2:1), causing males to more often be diagnosed with developmental disorders, which rely on tests of language development. Thus, gender differences in language are negligible, if you focus on the whole population, but if you focus on language deficits, gender differences are outspoken. Differences in voice and word use can be observed among the genders, making it possible to predict gender from these measures with a high degree of certainty. A subtle finding is that women use more first person pronouns. This is also observed in depression, which is more prevalent in females, opening up a potential link. Sex chromosome trisomies are often accompanied by language deficits, but the causes for this are not known. No gender differences are observed in the linguistic symptoms of neurodegenerative disorders. Poststroke aphasia is more prevalent among women than among men, but this seems to be an age-effect. A link between the brain and gender differences in language is thus missing.

Emergence of language and developmental trajectories of many linguistic skills are characterized by similar developmental stages, regardless of the cultural and linguistic context within which children are born into and grow up in. However, early language acquisition is also characterized by large variability in timing, style, and learning strategies among infants. What does the variability in this development depend on?

According to the neuro-constructivist approach, language development is intertwined with other cognitive, social, and relational skills, and the construction of meanings is mediated by common domain-general neural systems. Similarities and differences among children in terms of their acquisition processes are linked to the dynamic and complex interactions between biological and environmental factors (Bates & Dick, 2002; Karmiloff Smith, 2013).

In trying to explain this variability, several studies have explored the role of gender,1 and have indicated an advantage for girls with respect to boys for various aspects of language development, and particularly in the early stages of lexical development (e.g., Bornstein et al., 2004; Fenson et al., 2007; Galsworthy et al., 2000). The majority of these studies were conducted using the MacArthur-Bates Communicative Development Inventories (MB-CDIs), as the most frequently used parent questionnaires for early communication and language evaluation in infants and toddlers (Fenson et al., 2007).

These include several different forms. The Words and Gestures (WG MB-CDI) form was developed to evaluate infant action–gesture production and vocabulary comprehension and production, from 8 to 24 months (in the Italian version; Caselli et al., 2015). The Word and Sentences (WS MB-CDI) form was developed to evaluate toddler vocabulary production and early morphosyntactic abilities, from 18 to 36 months (in the Italian version; Caselli et al., 2015). Currently these MB-CDIs have been adapted for use in >100 languages, which also allow cross-linguistic comparisons. Moreover, the availability of large samples of longitudinal and cross-sectional data collected using these MB-CDIs provides data for the analysis of developmental trends, variability among children, and gender differences (https://mb-cdi.stanford.edu/; http://wordbank.stanford.edu/).

However, in the majority of the studies based on parental questionnaires, the analysis of potential gender differences has been addressed mainly to present separate norms for boys and girls, without deepening the possible theoretical explanations of the eventual differences found between the two genders and the factor(s) that might cause such differences.

In the present paper, we review studies on gender effects in early language development (some of which were conducted in our own research laboratory), with the aim to clarify from which age any gender advantage eventually emerges, and until which age it remains evident. In the next section, research on the early production of actions and communicative gestures in girls and boys will be presented and discussed. Then in the following section, we focus on gender differences in early lexical comprehension and production. Finally, in discussing the results from different studies, we will consider three possible conceptual frameworks to explain gender-based variability in language development that consider biological and neuropsychological factors, as well as the role of adult–child interactions, with the suggestion that some gender differences in action, gesture, and lexical development depend on the interactions between these different factors. During the first phases of development, infants engage in several different forms of expression. Along with vocalization, babbling, and their first tentative words, infants produce functional actions in relation to toys and tools, which demonstrate their understanding of the nature of these objects and how they are used (e.g., combing with a comb, drinking from a bottle). They also produce other types of motor behaviors that do not involve objects, but rather only their bodies, hands, and facial expressions (e.g., waving their hand for "ciao," clapping hands), and these acquire meaning through dyadic child–caregiver interactions. According to our more recent theoretical perspective, gestures as words arise from actions, and they are deeply related to language and cognition; that is, gestures and speech are considered to be part of the same cognitive and communicative system (Iverson, 2010; Volterra et al., 2017, 2018).

Using the WG MB-CDI, several studies have described the acquisition of different types of action–gestures that are performed by infants and toddlers. The WG MB-CDI includes the following categories: First communicative gestures, which include deictic gestures (e.g., pointing) and conventional gestures (e.g., pointing to cheek to indicate that something tastes good); games and routine (e.g., clapping hands); actions with objects (e.g., eating with a spoon or fork); imitating adult actions (e.g., put key in door and lock); and pretending to be a parent (e.g., put a doll to bed).

The majority of normative studies conducted using the WG MB-CDI have reported data on gender differences in action–gesture production, although often such results were not the focus of the studies, and were not further analyzed and discussed. Fenson et al. (1994, 2007) referred an advantage of girls

over boys for actions and gestures production, and Butterworth and Morissette (1996) reported that girls point about 1 month before boys, and that the age of pointing onset predicts both the number of gestures produced and the first word comprehension a few months later. These results have been confirmed by other studies conducted with infants exposed to languages and cultures that are not English–American.

For example, girl advantages in action–gesture repertoires were reported by Blases et al. (2008) for Danish, and by Eriksson and Berglund (1999) for Swedish. In particular, Eriksson and Berglund (1999) showed that only two subscales yielded significant effects for gender, where girls scored higher than boys for both scales: "First communicative gestures" and "pretending to be a parent." An interaction of gender with age was also reported for these two scales: thedifferences between girls and boys increased in the older age groups (i.e., 16 months).

In a cross-linguistic perspective, Eriksson et al. (2012) merged data from studies on early language skills in boys and girls based on the MB-CDI that were conducted in 10 non-English European language communities, to study the differences between girls and boys as a function of both age and language community. The sample consisted of 13,783 children from the following language communities: Austrian German, Basque, Croatian, Danish, Estonian, French, Galician, Slovene, Spanish, and Swedish. The WG MB-CDI and WS MB-CDI forms were used according to the children's ages. For action–gesture, the girls produced a greater number of gestures than the boys up to 13 months of age. The differences between the girls and boys then decreased from 14 months of age, apparently due to a ceiling effect for girls. Looking at the tails of these distributions, Eriksson and colleagues (2012) reported that in the lower tail, the boys were overrepresented (1.21 boys for each girl), and in the higher tail, they were underrepresented (0.69 boys for each girl).

In the Italian normative study of the WG MB-CDI that was based on a cross-sectional sample of 648 children (45.7% girls), no gender differences emerged in their action–gestures production (Caselli et al., 2015). However, different results were reported by Sansavini and colleagues (2010), who carried out a longitudinal study in typically developing infants for their early development of communicative gestures, object-related actions, and word comprehension and production, including their reciprocal relationships. In this study, 22 monolingual Italian infants were followed monthly from 10 to 17 months using the Italian short form of the WG MB-CDI, which consists of a checklist of 100 lexical items (word comprehension and word production) and of a checklist of 18 actions–gestures. Seven of these were defined as "communicative gestures" (i.e., deictic gestures, first communicative gestures, and games and routine), with the remaining 11 defined as object-related actions (i.e., actions with objects that imitate adult actions, and pretending to be a parent).

Considering their results on communicative gestures, at the first age considered (10 months), the mean number of gestures produced by infants corresponded to about half of the gestures listed in the questionnaire, although there was great individual variation, which gradually decreased. The effects of age and gender on the communicative gestures were significant, with the children increasing the number of communicative gestures they produced according to their age, and with girls producing more communicative gestures than boys.

No significant interactions between age and gender emerged. The emergence and development of the ability to perform object-related actions occurred later than for communicative gestures. Very few object-related actions were noted at the earliest age assessed, and there were large individual variations. At the final age considered (17 months), object-related actions were being produced by most of the infants, with a decrease in the inter-individual variation. The effects of age and gender on object-related actions were significant, as well as their interaction. At 10 months, boys started to perform object-related actions as well as girls, but from 11 months, the girls developed their action repertoire faster than the boys. In conclusion, Sansavini et al. (2010) showed an effect of gender on communicative gestures and on object-related actions for the first time, which was seen when these were kept separate from each other.

As indicated above, only a few studies have explicitly focused on gender differences in gestures production. One of the few exceptions was based not on parental questionnaires, but on direct observations of the children (Özçalişkan & Goldin-Meadow, 2010). In this study, 22 girls and 18 boys from 14 to 34 months were observed at home (every 4 months) while interacting with their parents, and as they progressed from one word to multiword speech, with no differences seen in the number or type of gestures that boys and girls produced during the observation sessions. The only difference between girls and boys was in the production of supplementary ges-ture + speech combinations (e.g., saying the word "eat" while pointing at a cookie). According to various authors (Capirci et al., 1996; Capobianco et al., 2017; Iverson & Goldin-Meadow, 2005) the age at which children first express two ideas in a gesture + speech combination predicts the age at which they produce their first two-word sentence ("eat cookie"). As can be seen from the results reported, the title of the paper by Özçalişkan and Goldin-Meadow (2010), as "Sex differences in language first appear in gesture," is actually misleading, as the only difference between girls and boys was in the production of supplementary gesture + speech combinations and multiword combinations. In both cases, boys are likely to lag behind girls. Taken together, the data reported in this study and as already reported by other studies, showed only that the advantage for girls in early word production might lead to an advantage in the gesture +speech and speech + speech combinations.

For word comprehension and production, the majority of normative studies conducted using the MB-CDIs reported separate norms for boys and girls, as they showed significant differences in lexical development between girls and boys. Fenson et al. (1994, 2007) indicated that mean scores tend to be higher for females than for males of the same age. As a consequence, girls often reach various milestones 1 to 2 months before boys.

A cross-linguistic study conducted by Eriksson and colleagues (2012), as already mentioned above, also explored gender differences in word comprehension and production. For word comprehension, they reported on the main effects of age and language community: older infants understood more words than younger infants, and the number of words children understood varied for different language communities. Although the effect of gender was not statistically significant, boys appeared to be overrepresented in both of the tails of the distribution, with 1.19 and 1.03 boys for each girl in the lower and higher tails, respectively. For word production, in a cross-linguistic study, Eriksson and colleagues (2012) reported on the main effects of gender, age, and language community. Girls produced more words than boys, and older toddlers used more types of words than younger toddlers. The difference between girls and boys increased with age. The effect of language community indicated that children from different language communities produced different numbers of words, in particular at an earlier age. For the lower tails for the WG MB-CDI and WS MB-CDI forms, there were 1.28 boys for each girl and 1.13 boys for each girl, respectively. For the higher tails for the WG MB-CDI and WS MB-CDI forms, there were 0.70 boys for each girl and 0.65 boys for each girl, respectively.

A similar advantage for girls was shown for word combinations, probably because girls had a larger expressive vocabulary size than boys. They interpreted the lack of significant interactions between gender and language community as an indicator of the robustness of the advantage of girls across different language communities (Eriksson et al., 2012).

This study was expanded by Frank et al. (2021). Here, they added other language communities, and collected and re-analyzed the data obtained from different countries, to replicate and extend the results of Eriksson (2012). Through the use of a consistent framework for representing and analyzing data collected using the MB-CDIs, they managed to combine a variety of influential previous analyses of MB-CDI data, and they also assessed the consistency of gender effects on vocabulary size. According to their revision of the literature on cognitive differences due to gender, they were able to predict a modest, but consistent, advantage for girls for early vocabulary. By applying a robust analysis method to avoid detrimental effects from outliers, and especially in small subsets (i.e., generalized linear

model), they focused on the age by gender interactions. Their analysis indicated that for word comprehension, despite the small magnitudes of the coefficients, 16 of the 22 languages studied had a female advantage, two languages showed a male advantage, and the remaining four languages did not show any significant age by gender interactions. Frank and colleagues thus concluded that there is some evidence for a modest female advantage in word comprehension.

Turning to word production for the WS MB-CDI form, visual inspection and analysis of the fitted models by Frank and colleagues (2021) showed that 25 of the 26 languages available showed a statistically significant female advantage. In terms of effect size, female advantage was substantially larger than that seen for word comprehension. They also addressed the possible bias of such parent-reporting instruments (as the MB-CDI) toward higher female verbal ability. For this they considered two particular studies, one on gender effects in vocabulary production, as estimated from a naturalistic language (Huttenlocher et al., 2002), and the other on longitudinal data at 20 and 48 months (Bornstein & Putnick, 2012).

On the basis of these studies, Frank and colleagues concluded that the gender effect on early vocabulary could not be solely explained by reporting bias, and so it is likely that the female advantage is real. In the normative study of the Italian version of the MB-CDI that included 1,400 children from 8 to 36 months of age (Caselli et al., 2015), no gender effects were seen for either word comprehension or word production. Then, in the study already reported above by Sansavini and colleagues (2010), no significant differences between girls and boys up to 14 months of age emerged in lexical skills. Girls then showed an advantage that approached significance for word comprehension, from 14 months of age onwards, but not for word production (Sansavini et al., 2010).

In an ongoing screening program that is aimed at the detection of possible communicative/linguistic delays in 24-month-old to 30-month-old children living in northern Italy (Mantua Province; Riorganizzazione dello screening del linguaggio nella Provincia di Mantova), the short form of the Italian WS MB-CDI was used. In this population data set of 8,511 toddlers (3,990 female, 4,521 male) there was a clear gender difference in terms of word production.

After adjusting for age effects, the estimated vocabulary size at 28 months for females was 65.3 words (95% CI: 64.4–66.2), and for males, 53.9 words (95% CI: 53.1–54.8), giving a significant difference of 11.4 words (95% CI: 10.2–12.7; $p < 0.001$). It should be noted that this short-form Italian WS MB-CDI includes 100 words, and thus the difference between the means here represents ~10% of the words included in the original checklist. In terms of the standardized effect size (difference/standard deviation), the gender effect was 0.39, as compared to conventional values of 0.20 (small) and 0.50 (medium).

A study on more than 10,000 German children from 3 to 6 years of age reported that at the younger age, girls performed better than boys in all domains examined (i.e., vocabulary, grammar, speech comprehension, pronunciation, processing of sentences, and nonce words).

However, the effect sizes were small, and the differences decreased with age and appeared to be lost around school age (Lange et al., 2016). In particular, the advantage for girls was evident in all of the tasks used, as well as for the total score at the younger age, while it remained only for articulation and repetition of nonce words by school age.

Furthermore, the variance in language competence was greater among boys than girls. Also taking into account the results from Eriksson et al. (2012), Lange et al. (2016) suggested that boys might simply be overrepresented among children with poor verbal abilities, due to their greater variance and the slightly greater female mean scores.

The significance of a girl advantage was also discussed in an Italian normative study that used a Picture Naming Game with children from 19 to 37 months of age (Bello et al., 2012). This direct assessment included four subtests to evaluate comprehension and production of nouns and predicates. Girls

outperformed boys only in the noun production subtest, and this gender gap decreased with age. Although Bello and colleagues did not offer any clear explanation for the lack of gender differences in the other subtests, they speculated that the lower variability in the comprehension subtests (which were easier than the production subtests) might have masked any gender differences. Similarly, the higher variability in the predi-cate production subtest (the hardest of all) might also have masked any gender differences.

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