# SEX DIFFERENCES IN EARLY CATALAN LANGUAGE ACQUISITION THROUGHT THE MACARTHUR-BATES COMMUNICATIVE DEVELOPMENT INVENTORIES

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***Abstract:*** *The present study examines sex differences in early language acquisition in Catalan by analysing lexicon and morpho-syntax. A total of 883 parents of children aged 16–30 months completed the MacArthur-Bates CDI. Children were grouped by sex and age (16–20, 21–25, 26–30 months). Results from 2×3 ANOVAs showed that girls outperformed boys in vocabulary, MLU, and Complexity Index. However, post hoc analyses indicated significant differences only in the 21–25-month group. Significant age-by-sex interactions in morpho-syntax suggest varying developmental patterns. These findings indicate that girls' early advantage appears only at intermediate ages.*

***Keywords:*** *MacArthur-Bates CDI, sex differences; early language acquisition; vocabulary; mean Length of Utterances (MLU)*

## INTRODUCTION

Previous research has linked language development to multiple factors, with the effects of gender being one of the most consistently debated topics in academic and clinical contexts. The male sex has historically been associated with lower language performance (Anastasi, 1958) and a higher prevalence of language-related difficulties (Zambrana et al., 2014). Epidemiological and twin studies consistently show that boys face a significantly higher risk (nearly threefold higher) of language delay and exhibit a higher prevalence of Developmental Language Disorders (DLDs; Chilosi et al., 2021). Nevertheless, recent large-scale studies have reported a more balanced distribution, with smaller differences between boys and girls in terms of DLDs (Calder et al., 2022; Norbury et al., 2016). However, the mechanisms underlying these sex-related differences remain unclear (Chilosi et al., 2021). Biological, neuro-psychological, and cultural factors appear to have an interactive effect while shaping these differences (Etchell et al., 2018; Rinaldi et al., 2023).

Several studies have reported sex-related differences in language acquisition, showing that girls often exhibit more advanced verbal skills and faster vocabulary growth around age two than boys (Galsworthy et al., 2000; Huttenlocher et al., 1991). Furthermore, large-scale studies using the MacArthur-Bates Communicative Development Inventories (CDIs; Fenson et al., 2007) have consistently found early advantages for girls between the ages of 8 and 36 months - across both English and non-English-speaking populations - in communicative gestures, vocabulary acquisition, and word combinations (Eriksson et al., 2012; Fenson et al., 2007; Yoder et al., 1997). However, not all studies using the CDI framework have found sex-related differences in language development. For example, research by Jackson-Maldonado

et al. (2003) and Berglund and Eriksson (2000) reported no significant differences between boys and girls in their linguistic outcomes.

Understanding sex differences in language development has important clinical implications, since stronger language performances observed in girls may lead to underdiagnosis or delayed identification of their language difficulties, partly due to gender-related diagnostic biases (Wiefferink et al., 2020).

Given these clinical implications, the present study aims to contribute further evidence on sex differences in early language acquisition by analysing data on lexical and morphosyntactic development in Catalan-speaking children using the MacArthur-Bates Communicative Development Inventories.

## METHODS

### Participants

The total sample consists of 883 participants aged 16 to 30 months (*M* age = 23.86, *SD* = 4.04), all from Catalan-speaking homes. Premature children weighing less than 1.900 kg were excluded from the study due to medical complications associated with this condition. Table 1 lists the characteristics of the sample.

**Table 1.** *Main descriptive data of the participants.*

| Personal and sociodemographic characteristics | Girls | Boys | Differences between groups |
|---|---|---|---|
| N | 443 | 440 | - |
| Age, *M* (*SD*), months | 23.71 (3.8) | 24.01 (4.2) | $t$ = - 1.1, $p$ = .131 |
| Birth weight, *M* (*DT*), kg | 3.22 (0.47) | 3.28 (0.51) | $t$ = - 1.7, $p$ = .093 |
| Number of ear infections, *M* (*DT*), per year | 0.53 (1.29) | 0.71 (1.34) | $t$ = - 2.0, $p$ = .047 |
| Birth order, *n, %* | | | |
| First | 266, 60% | 263, 59.7% | $z$ = - 0.17, $p$ = .866 |
| Second | 155, 35% | 146, 33.2% | $z$ = 0.42, $p$ = .674 |
| Third | 19, 4.2% | 23, 5.2% | $z$ = - 0.70, $p$ = .483 |
| Fourth onwards | 2, 0.4% | 1, 0.2% | $p$ = 1 |
| Mother's educational level, *n* | | | |
| No formal education | 1, 0.2% | 0, 0% | $p$ = 1 |
| Primary | 33, 7.4% | 41, 9.3% | $z$ = - 0.98, $p$ = .326 |
| Secondary | 138, 31.1% | 146, 33.2% | $z$ = - 0.60, $p$ = .547 |
| University | 263, 59.4% | 247, 56.1% | $z$ = 1.06, $p$ = .288 |

Since the incidence of ear infections differed significantly between boys and girls, a set of control correlation analyses was conducted to ensure that this variable did not account for differences in language skills. The results showed no significant correlations between the number of ear infections and any of the language measures across the entire sample ($r_{Vocabulary}$ = - .041, $p$ = .229; $r_{MLU}$ = .014, $p$ = .694; $r_{Complexity}$ = - .022, $p$ = .522).

### Materials

The data for the present study were collected using the *MacArthur-Bates Communicative Development Inventories: Word and Sentences (Catalan MB-CDI-IIs)* adapted to Catalan (Serrat Sellabona et al., 2022), which was designed for children aged 16 to 30 months. Of all the sections included in this instrument, we used the vocabulary (maximum score: 678; one point per word produced by the child), word combination (MLU - mean length of the three longest utterances produced by the child that the parents remember), and sentence complexity sections (maximum score: 40; one point per each complex sentence).

The Catalan version of the CDI-II demonstrates strong psychometric properties (Serrat Sellabona et al., 2022).

## Procedure

Participants were mainly recruited through early childhood education centres and the authors' professional and personal networks. Each section of the instrument includes self-study instructions, and parents were informed to record only the words that their child produced in any Catalan variant, even if mispronounced.

This is a cross-sectional study and the data on the children were recoded into three groups based on their age: 16-20 months, 21-25 months, and 26-30 months. The results were statistically analysed using IBM SPSS Statistics (Version 29.0.2.0). Three 2(Sex) x 3(Age) univariate analysis of variance (ANOVAs) followed by Bonferroni post-hoc tests were conducted with the following dependent variables - vocabulary, MLU, and complexity.

## RESULTS

Table 2 shows the mean and standard deviation for all subgroups across the three variables analysed.

***Table 2.*** *Mean (standard deviation) of total vocabulary, MLU, and complexity index categorised by age and sex*

| | 16-20 months | | 21-25 months | | 26-30 months | | Total | |
|---|---|---|---|---|---|---|---|---|
| | **Girls** | **Boys** | **Girls** | **Boys** | **Girls** | **Boys** | **Girls** | **Boys** |
| *n* | 108 | 108 | 169 | 154 | 166 | 178 | 443 | 440 |
| Vocabulary | 84.7 (75.7) | 60.6 (66.8) | 280.6 (152.2) | 224.8 (150) | 424.7 (138.2) | 415.2 (151.9) | 286.8 (185.6) | 261.5 (195.5) |
| MLU | 1.9 (1.2) | 1.4 (0.7) | 3.8 (2) | 2.8 (1.5) | 4.6 (2.7) | 4.6 (2.7) | 3.7 (2.4) | 3.2 (2.3) |
| Complexity | 0.5 (1.2) | 0.5 (1.9) | 9.2 (11.3) | 4.8 (7.2) | 21.1 (12.8) | 19.3 (13.8) | 11.6 (13.3) | 9.7 (12.8) |

The three univariate ANOVAs 2(Sex) x 3(Age) on vocabulary, MLU, and complexity (See Fig. 1) yielded a significant main effect of sex with medium effect sizes across all dependent variables: $F_{Vocabulary}(5, 882) = 10.5$, $p = .001$, $\eta^2 = .012$; $F_{MLU}(5, 761) = 9.8$, $p = .002$, $\eta^2 = .013$; $F_{Complexity}(5, 867) = 8.6$, $p = .003$, $\eta^2 = .010$. Similarly, the ANOVAs yielded a significant main effect of age with large effect sizes across all dependent variables: $F_{Vocabulary}(5, 882) = 454.3$, $p = < .001$, $\eta^2 = .509$; $F_{MLU}(5, 761) = 106.7$, $p = < .001$, $\eta^2 = .219$; $F_{Complexity}(5, 867) = 273.6$, $p = < .001$, $\eta^2 = .387$. A significant interaction effect between sex and age was found for MLU with a medium effect size ($F_{MLU}(5, 761) = 3.7$, $p = .023$, $\eta^2 = .010$), as well as for complexity with a small effect size ($F_{Complexity}(5, 867) = 3.2$, $p = < .040$, $\eta^2 = .007$). No significant interaction effect was observed for vocabulary ($F_{Vocabulary}(5, 882) = 2.6$, $p = .077$, $\eta^2 = .006$).

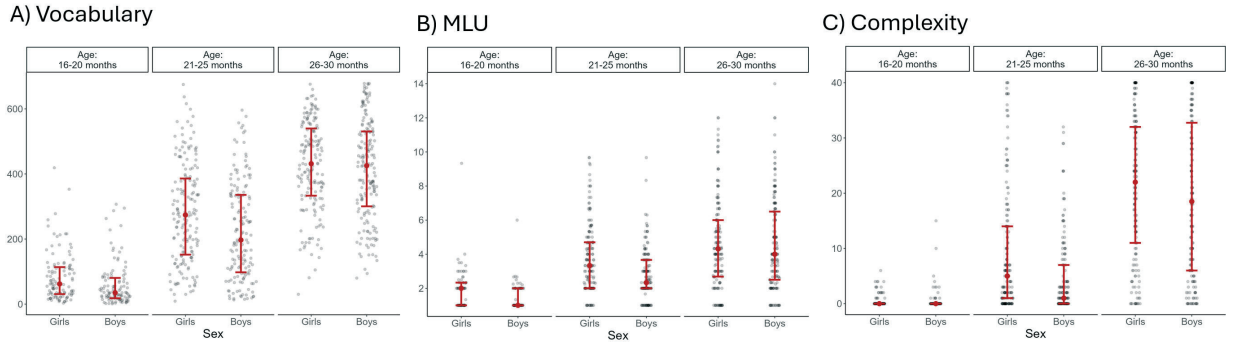


***Figure 1.*** *Acquisition of vocabulary (A), MLU (B), and complexity (B) in boys and girls.*

The post-hoc analyses showed significant effects between all three age groups (16-20 months, 21-25 months, and 26-30 months) across all dependent variables, as well as for both sexes (all $p_s < .003$). Nevertheless, significant effects between the sexes were only found at the age of 21 to 25 months for all variables (all $p_s < .001$; See Fig. 1).

## DISCUSSION AND CONCLUSION

Our results reveal significant sex-related differences in language acquisition, specifically in total vocabulary, MLU, and the complexity index, with girls outperforming boys. Previous studies on language acquisition in English and non-English languages have also found better language skills in girls than in boys (Berglund et al., 2005; Eriksson et al., 2012; Fenson et al., 2007). However, the sex-related differences in the present study are age-dependent, with differences becoming evident only between 21 and 25 months of age, which coincides with the age ranges at which Eriksson et al. (2012) reported significant sex differences for several languages.

The results also show a general increase in vocabulary, utterance length, and complexity along with age. Since the interaction effect of sex and age is not significant for vocabulary, girls outperform boys at all ages (significantly only at 21 and 25 months). In contrast, MLU and morphosyntactic complexity differ across age groups between girls and boys, with girls outperforming boys mainly at ages 21 to 25 months. Overall, sex-related differences appear in the intermediate group and diminish with age, suggesting that these differences are unlikely to persist in later learning (Serrat Sellabona et al., 2021).

Our results align with previous studies suggesting that the advantages for girls are evident when individual variability is high, typically during the early stages of language acquisition (Rinaldi et al., 2023). As language competence becomes more established, this variability tends to decrease. Moreover, the statistical significance of sex-related differences may be partly explained by a higher proportion of boys showing lower verbal abilities. This could help explain why differences are more pronounced during transitional periods such as the word combination stage, when children begin to construct basic grammatical structures. Although the present study does not provide specific data on this aspect, the results are compatible with explanations that emphasise the interaction between maturational and environmental factors in early language development. It has been suggested that parents tend to talk more to girls, as they are more likely to initiate and respond in verbal exchanges. This tendency may be linked to biological differences in perception, attention, and neurological maturity, which can enhance the sensitivity to communication and may reinforce more complex language development through early caregiver-child interactions (Lovas, 2011; Miller & Halpern, 2014; Rinaldi et al., 2023).

In conclusion, the observed advantage in language skills for girls appears to occur mainly in children of intermediate ages, between 21 and 25 months, during the period of morphosyntactic development.

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