

# Noun plural inflection in German-speaking individuals with Down syndrome

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## Abstract

The aim of the study was to investigate noun plural inflection in German speaking individuals with Down syndrome (IDS) in comparison to a control group of typically developing (TD) children. 40 noun plurals with different German inflectional endings were elicited. Accuracy scores as well as error types were analysed. Group comparisons indicated that noun plural inflection is affected in the participants with DS. In contrast to the TD children the dominant error type of the IDS were omissions, i. e. unmarked forms. This finding suggests that the observed deficit is not restricted to inflectional morphology per se, but also involves a violation of a prosodic constraint operating on the output of German noun plural inflection.

Keywords: Down syndrome, morphology, plural inflection, developmental language disorder

## Introduction

Down syndrome, caused by a trisomy of chromosome 21, is typically associated with delays and deficits in language acquisition. It has been argued that inflectional morphology is particularly affected in individuals with Down syndrome (henceforth IDS) (Chapman et al. 1998). Detailed analyses of inflectional deficits are, however, still relatively sparse. Moreover, studies have come to divergent findings with respect to inflectional deficits in IDS: while some have reported such deficits (e.g. Eadie et al. 2002, Penke 2018), others have found inflectional morphology to be unimpaired (e.g. Christodoulou & Wexler 2016, Ring & Clahsen 2005). We will contribute to this research by presenting data on German noun plural inflection.

German noun plurals can be marked by the inflectional endings *-s*, *-e*, *-er*, *-n*, *-en*, or can remain unmarked. Native German plural nouns are subject to a prosodic constraint that requires the plural form to end in a reduced syllable, i.e. an unstressed syllable with Schwa or a syllabic sonorant (e.g. *Bär* - *Bären* 'bear(s)', *Tisch* - *Tische* 'table(s)', *Kind* - *Kinder* 'child(ren)') (Neef 1998).

## Method

### Participants

31 monolingual German-speaking children and adolescents with DS (12 female), aged 4;07 to 19;02 years (*M* 14;05), participated in the study. Two of

them had a mild hearing loss, for the remaining IDS no permanent hearing loss had been diagnosed. Nonverbal mental age of the participants with DS was assessed using the SON-R 2.5-7 (Tellegen et al. 2007). It ranged from 2;11 to 6;05 years ( $M$  4;05). 26 monolingual typically-developing (TD) children, matched in chronological age to the MA of the IDS (3;04-5;07 years,  $M$  4;05) served as a control group.

### Procedure

40 noun plurals (eight plurals each for the endings *-s*, *-er*, *-e*, *-n* and *-en*) were elicited from each participant in a previously randomized order. All items were matched for lemma and plural-form frequency according to the CELEX database (Baayen et al. 1993). To tap into the productive abilities of the participants all tested items were of relatively low frequency.

Participants saw a picture with one object which they were asked to name, and were then presented with a picture showing three of these objects to elicit a plural form. They were tested individually after a short familiarization with the task. Test items were presented in the same previously randomized order. Participants' reactions were transcribed and included in the analysis if the target or a related noun was produced intelligibly.

### Data analysis

For each participant the percentage of correctly produced plural forms was calculated. In addition, the produced errors were analysed and categorized as either omission errors, i.e. production of the singular form without an inflectional ending (e.g. *Bär* instead of *Bären*), or substitution errors with an incorrect ending (e.g. *Bäre* instead of *Bären*). Group comparisons were performed using Welch's *t*-test and repeated measures ANOVA.

### Results

The participants with DS produced on average 38.2 analysable nouns out of the 40 elicited forms (95.5%). In the control group the mean number of analysable nouns was 39.8 (99.5%). The mean accuracy score of the group of IDS was 32.8% ( $SD$  24.7%, range 0%–85.0%), whereas the mean accuracy score of the TD group was 62% ( $SD$  13.6%, range 35.0%–82.5%), a significant difference ( $Welch(48.125) = 5.65$ ,  $p < .001$ ,  $d = 1.432$ ). Accuracy scores did not correlate with chronological or mental age in both participant groups ( $p > .1$  each).

The results of the error analysis are displayed in Fig. 1. They show that most of the errors in the group with DS were omission errors. In the group of TD children, on the other hand, substitution errors constituted the dominant error type. The repeated measures ANOVA with GROUP as between-subjects factor and ERROR TYPE as within-subjects factor yielded a significant GROUP\*ERROR TYPE interaction ( $F(1,55) = 12.76$ ,  $p = .001$ ,  $\eta_p^2 = .188$ ), confirming that the distribution of errors differed in the two participant groups.

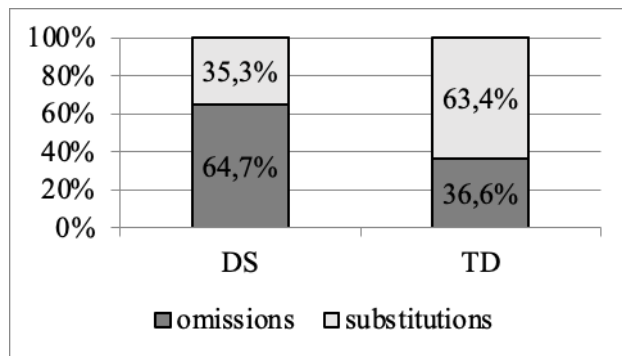


Figure 1. Mean percentage of omission and substitution errors.

A prosodic constraint requires all native German noun plurals (i.e. plurals other than *-s*-inflected) to end in a reduced syllable. For nouns requiring a plural form on *-e*, *-er*, or *-en* an omission of the plural ending (e.g. *3 Bär*, *3 Tisch*, *3 Kind*) results in a violation of this constraint. Error analysis yielded that a substantial proportion of the incorrectly produced plural forms for these nouns were left unmarked by the participants with DS ( $M$  61.5%) and were, thus, violating the prosodic constraint on plural forms. This proportion was significantly lower in the group of TD children (39.2%) ( $Welch(54.898) = 2.64, p = .011, d = .69$ ). The high proportion of produced plural forms that do not adhere to the prosodic constraint on German plural nouns suggests that this prosodic constraint is not fully operative in the participants with DS. Interestingly, however, the huge majority of the unmarked forms produced by the IDS were accompanied by a quantifier (e.g. the numeral *three* or the quantifier *many*) (86.4%), suggesting that the concept of plural was expressed by the quantifier instead of the unavailable inflected plural form.

## Discussion

Our results provide evidence that noun plural inflection is affected in German children and adolescents with DS. The significant difference in performance to a group of TD children matched in chronological age to the nonverbal mental age of the participants with DS indicates an inflectional deficit that cannot be accounted for by the cognitive limitations of IDS. These findings support previous research that found inflectional morphology to be impaired in IDS (e.g. Eadie et al. 2002; Penke 2018).

Moreover, the findings on incorrect, unmarked plural forms indicate that the observed deficit is not restricted to inflectional morphology per se, but encompasses the prosodic constraint that operates on the output of German noun plural inflection and requires these forms to end in a reduced syllable.

Despite these deficits, the observation that most unmarked nouns were produced with a preceding quantifier suggests that our participants with DS

have already grasped the concept of plurality and were expressing it via a quantifier when they did not succeed in marking plurality by the inflectional ending (see Clark & Nikitina 2009).

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