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# The Perfective Past Tense in Greek Adolescents with Down Syndrome

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## Abstract

This study investigates the ability of a group of eight Greek-speaking adolescents with Down Syndrome (DS) (aged 18;7-12;1) to handle the perfective past tense using an acceptability judgement task. The performance of the DS participants was compared with that of sixteen typically developing children whose chronological age was matched with the mental age of the DS group. For existing verbs, both groups showed high accuracy scores for sigmatic past tense whilst for novel verbs the DS group performed differently from the controls. Specifically, their judgments were unaffected by a novel verb's similarity to existing verbs, unlike those of the controls, suggesting that the DS participants were less relying on similarity-based generalisations when encountering a nonce word than the controls. Apart from that, we found that people with DS did not show any kind of morphological impairment, replicating previous findings on past tense production on DS.

## Key words

Past tense, Down syndrome, Greek, language disorders

## 1 Introduction

A number of studies suggest that linguistic development is a special challenge for people with Down Syndrome (DS) (Miller, 1988; Chapman, 1995 among others). A third chromosome 21 is said to trigger the onset of the syndrome but what really causes this genetic anomaly is yet unknown. There are three forms of DS, depending on the degree of the chromosomal abnormality. Standard trisomy 21 is the most prevalent type of DS, accounting for approximately 95% of cases where the whole of chromosome 21 is triplicated, whilst mosaïcisms and translocations involve limited triplication of only parts of chromosome 21 and account for 5% of cases of DS (Nadel, 1999). These last two types of DS seem to cause less impaired cognitive deficits in individuals with DS (Gibson, 1973). DS was first described by Seguin (1846) and the English physician Dr. John Langdon Down. Individuals with DS comprise the majority of people with mental retardation. According to early studies (Lenneberg, 1967), the language of people with DS seems to be relatively more impaired than other cognitive functions. In addition, some aspects of language are more affected than others. In particular, individuals with DS show morphosyntactic impairments with a relative sparing of the lexical aspects of language. In other words,

the computational system of language, that is, morphosyntax and phonology, is more severely impaired in DS than the lexical-conceptual part of language (e.g. lexical knowledge, semantics and pragmatics).

## **2 The Past Tense Debate: Single- versus dual-mechanism accounts of mental processing**

A key debate among cognitive scientists concerns the nature of the mental mechanisms involved in inflectional morphology. Studies of the English past tense have attracted considerable attention in the area of language processing because it embraces two strikingly different phenomena, namely, regular and irregular inflection. Research on the acquisition of the past tense in both typical and atypical populations has revealed possible dissociations between the cognitive processes involved in regular and irregular past tense formation. These dissociations have led to the formulation of two main theoretical accounts that underpin the processing of the past tense, namely *single-mechanism* and *dual-mechanism* accounts. Advocates of the single-mechanism account claim that both regular and irregular past forms are acquired and processed in the same way by employing a single processing mechanism and without using explicit representation of morphological rules (e.g. McClelland and Patterson, 2002).

An alternative theoretical viewpoint is the dual-mechanism account, which postulates the existence of two distinct cognitive mechanisms for the acquisition and processing of regular and irregular inflectional morphology. Under this account, regular past tense forms are normally inflected by applying the default rule of *-ed* suffixation to verb stems, which is realized phonetically as the three allomorphs /d/, /t/, or /ɪd/, depending on the voicing of the stem final phoneme, whilst the past tense forms of irregular verbs are stored in the lexicon (Pinker, 1999). From this perspective, *-ed* errors which children sometimes produce (e.g. *\*drawed* instead of *drew*) are taken as rule overapplications. Furthermore, since irregular past forms are stored and retrieved from the lexicon, word-form frequency effects are expected to be found for irregular (but not for regular) past tense forms.

Whilst most previous empirical research has focused on the English past tense, more recent research has also included languages with more complex inflectional systems, for example, Romance languages, such as Spanish (Clahsen, Avelledo and Roca, 2002; Rodríguez-Fornells, Münte, and Clahsen, 2002), Italian (Say and

Clahsen, 2002) and Catalan (Rodríguez-Fornells et al., 2001), as well as Greek (Stavrakaki and Clahsen, 2009). The findings of these studies have provided support for dual mechanism accounts of inflection.

### 3 Past tense morphology in Modern Greek

Modern Greek (henceforth referred to as Greek) possesses a morphological system of great complexity where all stems need to be inflected to surface at the word level. The verbal system presents an extensive morphological diversity since aspect, tense, mood as well as person, number and voice are obligatorily marked on the main verb. Greek verbs ‘have two formally differentiated stems: a present stem and an aorist stem’ (Stephany, 1981: 46). The present stem is used in expressions with an imperfective aspect whilst the aorist stem is used in expressions with a perfective aspect. ‘Aspectual choice in Greek is unavoidable in all tenses’ (Giannakidou 2002: 110). In other words, the categories of tense and aspect are inextricably linked in Greek.

By tense, we mean the time when the action takes place, namely, either in the past or not in the past (Holton, Mackridge and Philippaki-Warburton, 1997). Greek verb morphology distinguishes between past and nonpast tenses. The past tense is differentiated from the nonpast tenses, namely, present and future, by inflectional endings while aspect (both perfective and imperfective) is indicated by the stem. In Modern Greek the marked value for tense is [+past] (Philippaki-Warburton 1973).

Aspect, on the other hand, expresses the way an action is perceived by the speaker at the time of the utterance. In other words, ‘*aspects are different ways of viewing the internal temporal constituency of a situation*’ (Comrie, 1976: 3). In Greek imperfective aspect is used to describe an action which is in progress, repeated or habitual whilst the perfective aspect denotes a completed action. Both perfective and imperfective aspect constitute types of what Smith (1991) calls the *viewpoint* aspect, which is a grammatical category and is generally denoted by a grammatical morpheme adjacent to the main verb. For instance, the perfective past tense is signalled by the affix *-s-*, which is located adjacent to the verb (Rivero, 1992).

Both types of past tense (i.e. perfective and imperfective) form take antepenultimate stress. Furthermore, when the stem of the verb is monosyllabic and starts with a consonant, both imperfective and perfective past tense forms are prefixed

by a stressed syllabic augment *e-*, which constitutes a focal part of past tense formation (Holton et al., 1997; Stavrakaki and Clahsen, 2009).

In addition, the perfective past tense form in Greek distinguishes between sigmatic and non-sigmatic forms, depending on the stem of the verb (Holton et al., 1997; Triantafillidis, 2002; Klairis and Babiniotis, 2004; Stavrakaki and Clahsen, 2009). Sigmatic past tense forms have a segmentable affix *-s-* ('sigma' in the Greek alphabet) and end in *-s-* (e.g. *hala-s-a* 'I spoiled') and are morphologically transparent with phonologically predictable stem alterations and are considered to be rule-based. On the other hand, non-sigmatic past tense forms are morphologically less transparent than the sigmatic ones, as they do not have a perfective past tense affix but idiosyncratic stem changes instead and, thus, are thought to be stored in the mental lexicon as exceptions (Stavrakaki and Clahsen, 2009). Under this view, the Greek verb system is described as a two-way system where the regularity of verb-forms depends upon the presence or absence of the perfective past tense affix *-s-*. Also, the sigmatic and non-sigmatic perfective past tense differ with respect to their frequency distribution. Specifically, Stavrakaki and Clahsen (ibid.) performed a count of the verb lemmas in a large corpus of Greek words and found that the vast majority of perfective past tense forms are sigmatic with a ratio of 14 to 1.

There are linguistic analyses of this system that offer additional distinctions. According to Ralli (1988), Greek has three different types of past tense formation:

- a) A rule-based paradigm where *-s-* suffixation triggers either a phonological alternation, e.g. *graf-o* ('I write'), *e-grap-s-a* ('I wrote') or stem-final consonant deletion, e.g. *lin-o* ('I untie'), *e-li-s-a* ('I untied');
- b) A stored allomorph paradigm with stem-internal changes, e.g. *plen-o* ('I wash'), *e-plin-a* ('I washed'); and
- c) A mixed paradigm including verbs that combine both rule-based (by virtue of the aspectual marker *-s-*) and stored-allomorph mechanisms, e.g. *mil-o* ('I speak'), *mili-s-a* ('I spoke'), where *mili-* is the perfective allomorph of *mil-*.

However, for the purposes of the present study, we adopt the theoretical framework of the two-way analysis that distinguishes between sigmatic and non-sigmatic perfective past-tense forms in Greek.

#### 4 Previous studies on inflectional morphology in Down Syndrome

In contrast to several studies on Williams Syndrome (e.g. Clahsen and Almazan, 1998) and Specific Language Impairment (e.g. van der Lely and Ullman, 2001), there are only few studies on the past tense in Down Syndrome (DS). There are some studies investigating the acquisition of different types of grammatical morphemes, such as the 3<sup>rd</sup> person singular *-s*, plural *-s*, progressive *-ing* and past tense *-ed* (cf. Eadie et al., 2002; O'Neill and Henry, 2002; Fowler et al., 1994; Rutter and Buckley, 1994; O'Neill McGuckian, 2004; Brown, 2004, among others). Several studies have noted that people with DS encounter difficulties with the use of the regular past tense *-ed* whilst they seem to have spared abilities concerning the use of irregular past tense formation and they may even outperform children with normal development (e.g. Fowler et al. 1994).

A detailed investigation of the past tense in English-speaking children with DS was carried out by Ring and Clahsen (2005) who, adopting the procedure and materials from Ullman (1993), investigated the use of regular and irregular past tense formation in a group of 8 English-speaking adolescents with DS chronologically-aged from 12;0 to 14;3 years (mean: 13;0) and mentally-aged from 5;4 to 6;10 (mean: 5;11), and various groups of typically developing children matched for mental age. The experimental materials included existing regular and irregular verbs as well as novel verbs, which rhymed with existing irregulars and thus were predicted to take irregular forms. In addition, the experimental materials included novel non-rhyming verbs that were supposed to take the regular *-ed* suffixation. The data revealed that the participants with DS frequently omitted past-tense markers in obligatory contexts. However, when marked forms were produced, both the DS and control groups exhibited similar performance, showing no signs of any specific morphological deficit. Ring and Clahsen (*ibid.*) found the same pattern (= omission of obligatory markers, no sign of any morphological deficit) for a range of inflectional and derivational phenomena. Consequently, they suggested that unlike in children with Specific Language Impairment, who have been argued to exhibit particular problems with agreement and tense marking (e.g. Rice et al. 1995), the linguistic difficulties of children with DS include a broader range of grammatical phenomena.

## 5 The current empirical study

### 5.1 Participants

Eight Greek-speaking adolescents with DS (four young boys and four young girls), aged from 12; 1 to 18; 7 (mean CA: 15; 5), participated in the current study (Table 1). All participants were monolingual speakers of Greek. According to parental information, one participant has been diagnosed as mosaic, whereas the remaining seven participants have standard trisomy 21. Their mental age was calculated by using the Stanford-Binet (for seven subjects) and the WISC (for one subject). In addition, a control group comprised of 16 unimpaired children took part in the experiment. The chronological age of the control group was matched with the mental age of the DS individuals. All the participants were recruited from various schools in the area of Athens, Greece.

Table 1: DS participants

	Number of participants	Mean Chronological Age (CA)	Mean IQ	Mean Mental Age (MA)	MA range
DS	8	15;5	46;88	5;9	5;0-7;6

### 5.2 Materials

We used the acceptability judgment task from Stavrakaki and Clahsen (2009). The experimental materials comprised 50 verbs that were divided into three main categories: 20 existing verbs, 20 novel verbs that rhyme with the existing ones, and 10 novel non-rhyming verbs. Rhyming novel verbs differ from the existing ones in their onsets (e.g. existing verb: *grafi* (writes), novel verb: *trafi*). There were 10 novel verbs that rhymed with existing sigmatic verbs and 10 that rhymed with existing non-sigmatic verbs, as well as 10 non-rhyming novel verbs that did not rhyme with any existing verb but were phonotactically legal words in Greek. Ten filler items were also included.

The category of existing verbs included 10 verbs with sigmatic perfective-past tense form and 10 verbs with non-sigmatic perfective-past tense form. The sigmatic class was comprised of three categories which, in addition to the regular segmentable past tense affix *-s*, included (i) consonantal changes in the coda of the verb-stem, e.g. *graf-o*, *e-grap-s-a* ‘I write, I wrote’, (ii) phonological change accompanied by a deletion of the stem-final consonant, e.g. *lin-o*, *e-li-s-a* ‘I untie, I untied’, and (iii) a



marked perfective stem, e.g. *mil-o mili-s-a* 'I speak, I spoke', where *mili-* is the perfective stem of *mil-*.

The non-sigmatic class also included three subclasses: (i) verbs with unpredictable (suppletive) perfective past tense forms, e.g. *tro-o, e-fag-a* 'I eat, I ate'; (ii) verbs with idiosyncratic stem-internal alterations plus the augment *e-*, e.g. *plen-o e-plin-a* 'I wash, I washed', where the perfective stem *plin-* is an allomorph of the imperfective stem *plen-*; (iii) verbs with idiosyncratic stem-internal alterations without the augment *e-*, e.g. *konten-o, kontin-a* 'I shorten, I shortened'. The existing verbs used for the construction of novel rhyming verbs (rhyming either with sigmatic or non-sigmatic verbs) also fell into one of the above-mentioned subclasses.

### 5.3 Procedure

Each participant was tested individually in his/her school or home. A training session preceded the actual experiment to familiarize the participants with the particular task. This training session included eight pairs of pictures the first of which depicted an action that was in progress whilst the second picture showed the same activity when it has been completed. Half of the pictures introduced existing verbs and the other half novel verbs. For the existing verbs, the experimenter explained to each participant that s/he is going to see a number of pictures depicting people who live on earth and are engaged in various activities. For the novel verbs, on the other hand, the experimenter stated that some of the pictures depict people who live on a different planet and speak a strange language. The experimenter clarified that she is going to describe those activities to the child by pointing to the appropriate picture.

When the training session was completed, the experimenter proceeded to the main task that was comprised of 50 picture pairs plus 10 filler items that were presented in pseudo-randomised order, making sure that the appearance of existing, novel (both rhyming and non-rhyming) and filler items was not predictable. Pairs of two pictures were depicted on the same page, illustrating the same action, one occurring in the present as an ongoing activity whilst the other occurred in the past and had been completed. The experimenter pointed to the first picture that showed an ongoing activity whilst two puppets, a boy named 'Yannis' and a girl named 'Maria', manipulated by the experimenter described the second picture, which showed that the activity had been completed by giving one sentence each with a different past-tense form. Children were asked to choose one of the two responses by pointing to one of

the puppets, namely either ‘Yannis’ or ‘Maria’, or to provide an alternative past-tense form if they did not agree with the past tense forms produced by the two puppets. For existing verbs, one puppet provided the perfective past tense form whilst the other puppet provided a corresponding imperfective past tense form of the same verb. For novel verbs, one of the puppets gave a sigmatic past tense form and the other a non-sigmatic one. The participants’ answers were recorded by the experimenter on an answer sheet.

## 5.4 Results

The following graph shows the mean rates of responses for existing verbs produced by the DS and control groups in the sigmatic and non-sigmatic conditions.

Figure 1. Existing verbs: DS vs. Controls

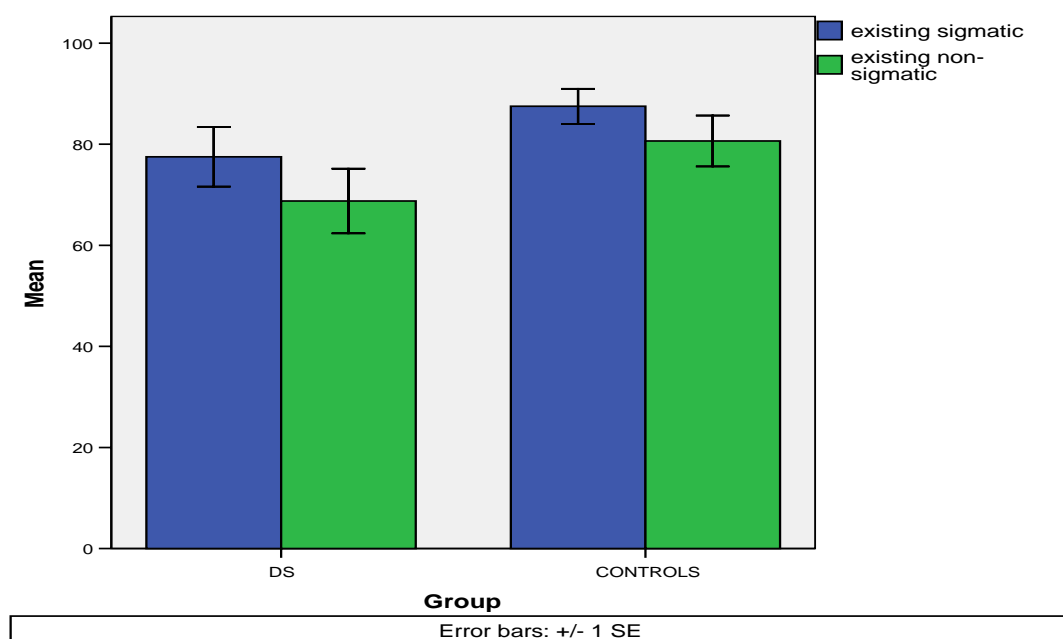


Figure 1 shows that both groups performed in a similar manner, namely they achieved higher scores on the sigmatic condition than on the non-sigmatic one. This observation was also statistically confirmed. A 2x2 ANOVA for Group (DS, controls) and Verb Category (sigmatic vs. non-sigmatic) revealed a significant main effect of Condition ( $F(1, 22) = 7.48, p < .05$ ) whilst there were no other significant main effects or interactions. Hence, for existing verbs the performance of DS participants as a group resembled that of typically developing children.

The results for novel rhymes are set out in Figure 2, which shows the percentages of sigmatic choices for novel verbs that rhymed with existing sigmatic verbs and of non-sigmatic choices for novel verbs that rhymed with existing non-sigmatic verbs.

Figure 2. Novel rhymes: DS vs. Controls

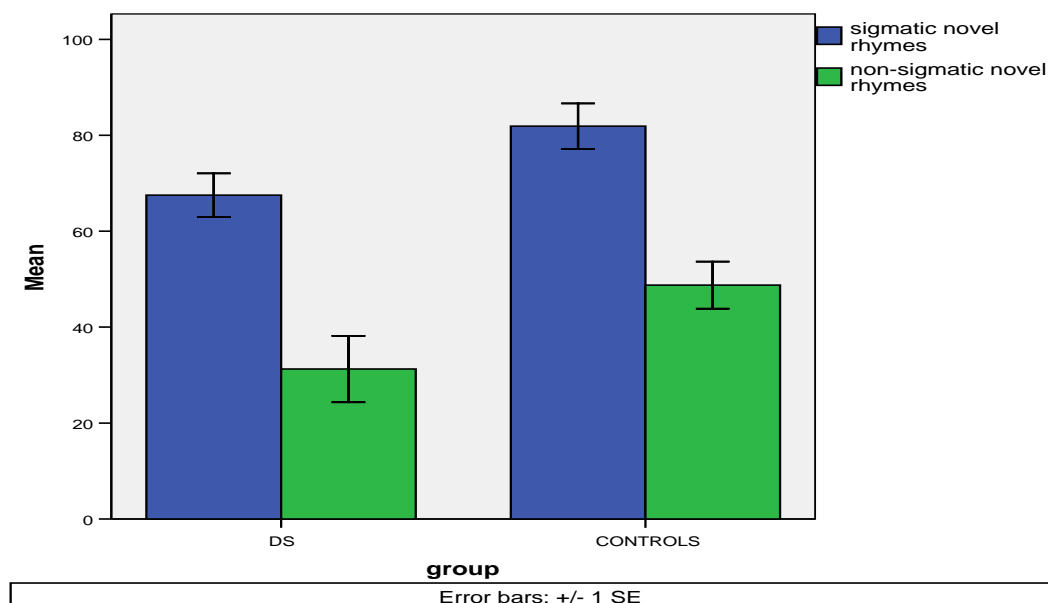


Figure 2 shows that both groups had a preference for sigmatic past tense forms for novel verbs that rhyme with existing sigmatic ones, even though this preference was less pronounced for the DS group (67.5% vs. 81.88%). Furthermore, for novel verbs that rhyme with existing non-sigmatic ones, the DS participants showed a clear preference for sigmatic forms (= 68.75%), whilst the control group did not exhibit any clear preference in this condition. These observations were confirmed by a 2x2 ANOVA (Group x Condition) which revealed a main effect of Group ( $F(1, 22) = 8.65, p < .01$ ) and a main effect of Condition (sigmatic vs. non-sigmatic) ( $F(1, 22) = 34.58, p < .01$ ) whilst no interaction between Group and Condition was attested ( $F(1, 22) < 1$ ).

Finally, the results on novel are shown in Figure 3, where ‘mean response’ refers to the proportion of sigmatic responses in the two groups.

Figure 3. Novel non-rhyming verbs: DS vs. Controls

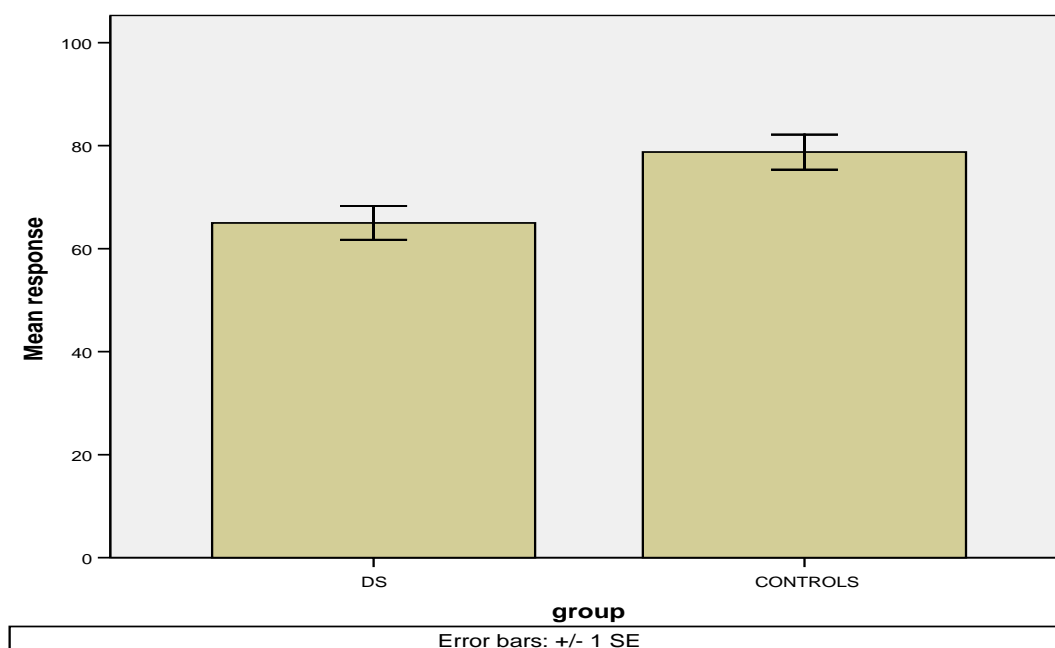


Figure 3 shows that for novel non-rhymes both groups had a preference for sigmatic forms, even though this preference was more pronounced in the controls. A one-way ANOVA revealed a main effect of Group ( $F(1, 22) = 6.57, p < .05$ ) confirming this between-group difference.

Consider, finally, a comparison of the rate of sigmatic choices in the three novel verb conditions; see Table 2.

Table 2: Sigmatic choices (means & standard deviations) for novel verbs

	DS group	Control group
Sigmatic choices for sigmatic rhymes	67.50% (12.8)	81.88% (19)
Sigmatic choices for non-sigmatic rhymes	68.75% (19.5)	51.25% (19.6)
Sigmatic choices for non-rhymes	65% (9.2)	78.75% (13.6)

The DS participants had approximately the same rates of sigmatic choices in the three novel verb conditions irrespective of whether or not the novel verb rhymed with an existing sigmatic or non-sigmatic verb or whether it did not rhyme with any existing verb. By contrast, the group of typically developing children had considerably higher rates of sigmatic choices for sigmatic rhymes and novel non-rhymes than for non-sigmatic rhymes. In other words, their preference for sigmatic forms was reduced by analogies, i.e. by novel verbs that rhymed with an existing non-sigmatic verb. Interestingly, an analogical generalisation effect of this kind is absent from the DS

group. This contrast between the two groups was also statistically confirmed, by a 2x3 ANOVA (Group x Condition) that showed a main effect of Condition  $F(2, 44) = 4.63, p < .05$  and a *Condition by Group* interaction ( $F(2, 44) = 6.33, p < .005$ ).

## 6 Discussion

In summary, we found that perfective past tense formation of existing verbs in our DS participants was parallel to that of typically developing control children. There were no statistical between-group differences, both participant groups achieved high accuracy rates, and performance on the sigmatic perfective past tense was significantly better than on the non-sigmatic one, in both participant groups. For novel verbs, however, the DS group behaved differently from controls. Whilst the controls exhibited different performance patterns in the three novel verb conditions, with sigmatic forms strongly preferred in the sigmatic rhyme and the non-rhyme conditions and no preference in the non-sigmatic rhyme condition, the DS group had a less clear preference (of between 65% and 68.75%) for sigmatic forms, which (unlike in the controls) was not modulated by a novel verb's similarity to existing verbs.

If one assumes that sigmatic perfective past-tense forms in Greek are rule-based forms, the overall preference for sigmatic forms of novel verbs could be taken as an indication of rule-based generalisation processes. However, sigmatic forms are also highly (type)-frequent in the Greek language. Thus, it is also possible that children rely on sigmatic forms, because they represent the most common perfective past-tense pattern they encounter in the language. Since frequency and regularity are confounded in the Greek perfective past-tense system, these two possibilities are difficult to tease apart.

Perhaps the most interesting finding from the present study was that the DS participants' choices of perfective past tense forms were unaffected by rhyme similarity. Consider for comparison the control children who exhibited relative low scores of sigmatic choices for non-sigmatic rhymes compared to high proportions of sigmatic choices for sigmatic rhymes and non-rhymes (51.25% vs. 81.88% and 78.75%). These contrasts are indicative of analogical generalizations, that is, perceived similarities between a novel non-sigmatic verb and a rhyming existing one, by which the overall preference for sigmatic choices decreases in favour of non-sigmatic choices. Our data suggest that, at least in the domain tested, people with DS

rely less on analogical generalizations of this kind than typically developing control children.

We can think of two reasons as to why the DS participants' performance differed from the controls in this domain. One possibility might be reduced activation of existing word forms in the DS lexicon, possibly resulting from memory limitations, which are known to be 'a part of the phenotype of DS' (Nadel, 1999). Thus, due to impaired memory operations, people with DS might be less likely to associate a novel word with an existing one, even if the two are similar to each other, resulting in relatively limited use of analogical generalizations as seen in the present study. Alternatively, we may consider a narrower linguistic explanation. Consider phonological difficulties which have been widely documented for people with DS (e.g. Roberts et al., 2008). A specific proposal comes from Dodd and Thompson (2001) who argued that inconsistencies in DS speech production are due to phonological representations that are less specified than normal. Applying this account to the present set of findings, it is possible that the reduced role of similarity-based generalisations in DS is due to underspecified phonological representations for existing verbs, rather than due to a more general inability of forming analogies. More research is needed to decide between these possibilities and to determine how the apparent inability of the DS participants to associate the phonological form of a novel verb to an existing one in the present experiment patterns with other aspects of their linguistic and non-linguistic performance.

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