# The role of morpho-phonological salience in tense marking: a comparison between Greek and Cypriot-Greek SLI children♦

Maria Mastropavlou[1], Kakia Petinou[2] and Ianthi Maria Tsimpli[3]
[1]*University of Ioannina,* [2]*European University Cyprus,* [3]*Aristotle University of Thessaloniki*
[1]*mariamst@gmail.com,* [2]*K.Petinou@euc.ac.cy,* [3]*imt@enl.auth.gr*

***Abstract:*** The current study investigates past formation in Standard Greek (SG) and Cypriot Greek (CYG) measuring the associated morphophonological salience and its effects on SLI grammars. Elicited production of real and pseudo verbs was carried out with SLI and TD groups from each variety. Results show that phonological salience of past formation affects SLI but not TD performance. Between varieties, the GR/SLI group performs better than CYG/SLI group with real verbs. We attribute this finding to the difference in the status of the augment in each variety.
***Key words:*** morpho-phonological salience, compensation, augment, contractibility

## 1. Theoretical Background

*1.1 Introduction*

Specific language impairment (SLI) is a developmental language disorder affecting about 7% of children (Tomblin, 1996). Children with SLI have unremarkable non-verbal cognitive skills, normal hearing status, no frank neurological problems or autistic-like characteristics (Leonard, 1998; Stark & Tallal, 1981). Despite the heterogeneity one encounters in the linguistic profiles of these children, a considerable bulk of research has indicated that SLI mainly affects the acquisition of morphosyntax, while phonology is also quite frequently affected.

Cross-linguistic evidence suggests that children with SLI face moderate to serious difficulties in the expression of past tense in German (Rice, Ruff Noll, & Grimm, 1997) and English (Rice & Wexler, 1996; van der Lely & Ullman, 2001). However, Greek children with SLI do not seem to encounter difficulties in producing past forms (Clahsen & Dalalakis, 1999; Stavrakaki, 1996; Tsimpli, 2001; Varlokosta, 2002), thus presenting a quite different linguistic profile from English and German SLI. Mastropavlou (2006, 2010) suggests that the better performance of Greek-speaking children with SLI is attributed to the increased morphophonological salience of the tense feature in Greek compared to English. In her study, the SLI children had difficulties in the use of past tense morphology when morphophonological salience was reduced, indicating that morphophonology plays a compensatory role for a deficit that actually exists in Greek SLI as well. Adopting the *Interpretability Hypothesis* (IH) on specific language impairment (Tsimpli & Stavrakaki, 1999; Tsimpli, 2001), Mastropavlou claims that the feature of grammatical Tense in Greek is affected in SLI, but the deficit is masked as SLI grammars tend to resort to morpho-phonological cues for compensation.

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Following Mastropavlou's (2006) study, this paper sets out to investigate the extent to which SLI impedes on the use of past tense formation in Standard Greek (SG) and Cypriot Greek (CYG), two systems where the formation of the past is characterised by increased morphophonological salience with respect to English, but also show differences in salience between the two varieties. The following sections provide a detailed description of the theoretical framework adopted as well as the way the two systems studied, SG and CYG, form the past.

*1.2 Interpretability and salience in SLI*

Few of the theoretical accounts on the nature of the disorder caused by SLI have acknowledged the role of morphophonology in determining linguistic profiles. Under the *Perceptual Deficit Hypothesis* (Leonard, 1989), children with SLI seem to face difficulties with morphemes of low perceptual salience due to a deficit that impedes on the perception of linguistic sounds. So, morphemes such as the plural {-s}, the 3rd person singular {-s} and the past tense {-d} and {-t} are not perceived by children with SLI in the same way they are by children of typical language development, leading to problematic acquisition patterns in SLI. These difficulties are milder in languages where morphemes bear higher phonetic substance, aiding the acquisition of grammatical morphology by children with SLI.

In a later attempt to account for the patterns exhibited in SLI profiles, Tsimpli and Stavrakaki (1999) proposed the *Interpretability Hypothesis* (IH), formulated under the principles of Chomsky's Minimalist framework (1995; 1998). The IH postulates that SLI affects children's ability to acquire grammatical features that are *uninterpretable* at LF (Logical Form). Uninterpretable features lack semantic content and as such they are invisible to the semantic/conceptual interface. While LF-interpretable features are associated with semantic/conceptual features in the mental lexicon, being in that sense non-modular, uninterpretable features are only present within the language module and serve a purely morphosyntactic function, which renders them less accessible to children with SLI (Tsimpli & Mastropavlou, 2007). Interpretability is also relevant to the phonetic interface; interpretable features at PF are those that bear phonetic substance (cf. Chomsky 1995; 1998). According to IH, LF-uninterpretable features lacking PF-interpretability should be harder to acquire than PF-interpretable ones. This is based on the morphophonological salience of the cues presented to the child learner which compensates for the deficient representation of the LF-uninterpretable feature in SLI (Tsimpli & Stavrakaki, 1999; Tsimpli & Mastropavlou, 2007).

Following this claim, Mastropavlou (2010) attempted to investigate the way morphophonological salience affects the way Greek-speaking children with SLI acquire the feature of tense by using two different expressions of the past tense rule, differing in morphophonological salience. It was found that children with SLI have significantly more difficulties forming the past form of verbs that do not require a prefixed vocalic augment (e.g. *trayuðáo – trayúðisa,* =sing-sang) compared to verbs that do (e.g. *tréχo – étreksa*, =run-ran). These difficulties were considerably more intense in the case of pseudo verbs, while none of the control groups exhibited such an effect. The findings were interpreted in the light of the IH hypothesis, leading to the conclusion that children with SLI face difficulties with the morphological component of the feature of tense, which is uninterpretable at LF (Pesetsky & Torrego, 2004), but are able to compensate for these difficulties by using morphophonological cues such as the stressed vocalic augment of the Greek past.

The present study aims to investigate the attested effects further by comparing two varieties of Greek language, namely Standard Greek (SG) and Cypriot Greek (CYG), as

the [+augment] rule of past formation is differently manifested in each variety. Details of the two systems are provided in the following section.

*1.3 The expression of the past in Standard Greek (SG) and Cypriot Greek (CYG)*

Beginning with Standard Greek (SG), the formation of the past involves application of a rule that employs both morphological and phonological means. Beginning with the morphological aspect of the rule, the past is expressed through suffixation which is distinct from that used in the non-past:

(1) *Inflectional paradigm of the verb tréχo (= run) in past and non-past*

| | | Singular ($1^{st}$,$2^{nd}$,$3^{rd}$ pers): | Plural ($1^{st}$,$2^{nd}$,$3^{rd}$ pers): |
|---|---|---|---|
| Non-past | | tréχ-***o***, /-***is***, /-***i***, | tréχ-***ume***, /-***ete***, /-***un*** |
| Past | *Imperfective* | étreχ-***a***, /-***es***, /-***e*** | tréχ-***ame, /-ate, /-an*** |
| | *perfective* | étreks-***a***, /-***es***, /-***e*** | tréks-***ame, /-ate, /-an*** |

The suffixation exemplified in (1) is syncretic in that it includes Tense and Agreement marking. The formation of the past also involves phonological changes. According to Spyropoulos & Revithiadou (2008) the antepenultimate (APU) stress pattern dictating stress-shift to the antepenultimate syllable in both perfective and imperfective past forms (as in (2) below) is "the surface manifestation of a segmentally empty prefix which bears lexically-encoded accentual properties" (ibid.)

(2) χor**é**v-o → χ**ó**rev-a, χ**ó**reps-a (= *dance*) Rule: +SS

In verbs with a monosyllabic stem, the APU rule applies through the realisation of a stressed vocalic augment, giving rise to a more salient version of the rule (i.e. stress-shift and augment), as shown in (3):

(3) γr**á**f-o → **é**-γraf-a, **é**-γraps-a (= *write*) Rule: +SS/+A

It is therefore claimed that the formation of the past in SG involves a morphological (syncretic suffix) and a phonological expression; the latter exhibits two variants differing in salience: the +stress shift / +augment version is the most salient one (Mastropavlou, 2010) as it involves a stressed augment serving as a cue to [past] and as a cue to the number of syllables of the verb (monosyllabic stem+suffix) (A. Revithiadou, p.c.):

(4) *Past tense formation rule*

a. Stress shift (+SS):
   +augment (+A): Vs with monosyllabic stems (e.g. ***é****γrafa*)
   -augment (-A):Vs with bi-/polysyllabic stems (e.g. *χ**ó**reva*)

b. Suffixation: *-a/-es/-e/-ame/-ate/-an*.

(Mastropavlou, 2010)

It should be noted at this point that, although no verbs deviate from the rule in (4) in the formation of the imperfective, numerous verbs employ *irregular* means of formation in the past perfective (Mastropavlou, 2010). For this reason, in the present study we opted for the investigation of the imperfect in SLI children with no further reference to the perfective.

Moving to Cypriot Greek (CYG), the formation of the past at the morphological level is similar to SG. At the phonological level, the APU rule is always active, as in SG, hence the stressed augment is obligatory with monosyllabic stems (e.g. *γrά**f**o – **é**γrafa*). Where the CYG system differs from that of SG is the presence of the augment in verbs with bisyllabic and polysyllabic stems. While no augment is required in these cases in SG, it optionally appears in CYG, its presence being considerably more frequent than its absence:

(5) thkiaváz-o (‘read’) → **e**-thkiávaz-a *or* thkiávaz-a
Rule: +SS/(A)

Moreover, the two systems also differ in the way ‘contractible’ verbs of the 2nd conjugation form the past. In SG, both the contracted and the non-contracted form of these verbs are used, each forming the past imperfective differently:

(6) *Past (imperfective) formation of miláo/miló (= speak) – SG*

| | | | | | |
|---|---|---|---|---|---|
| a. | Non-contracted: | milá-o | → | mila-γ-a | (+SS/-A) |
| b. | Contracted: | mil-ó | → | milús-a | (-SS/-A) |

As shown in (6), the non-contracted form of these verbs employs the APU rule in the past (+SS) while the contracted form does not (-SS).[1] In CYG, 2nd conjugation verbs are only used in their contracted form when in the present tense, while both variants presented in (6) are used in the past but with an optional vocalic augment. The third variant, namely *emílun* (‘I was speaking’), unavailable in SG, requires the vocalic augment (**mílun*):

(7) *Past (imperfective) formation of miló (= speak) – CYG*

| | | | |
|---|---|---|---|
| mil-ó | → | e-mila-γ-a | (+SS/(A)) |
| | *or* | e-milús-a | (-SS/(A)) |
| | *or* | e-mílun | (+SS/+A) |

As shown in (7) the uncontracted past form is subject to APU stress while the contracted form is not. Contrary to SG, where the +SS form is preferred (i.e. (6a)), the –SS one is mainly active in CYG (*emilúsa*). The augment is optionally present in these cases as well, as opposed to SG where it is always absent.

Summing up the above, the following table recapitulates the output of past formation in each variety:

Table 1 Past formation rules in Standard Greek (SG) and Cypriot Greek (CYG)

| Verb type | SG | | CYG | |
|---|---|---|---|---|
| Bisyllabic | +SS<br>+A | *γrά**f**o → **é**γrafa* | +SS<br>+A | *γrά**f**o →**é**γrafa* |
| Multisyllabic | +SS<br>-A | *χorέ**v**o → χ**ó**reva* | +SS<br>(A) | *χorέ**v**o → **e**χ**ó**reva* |
| Contractible | +SS/(-SS)<br>-A | *mil**á**o → m**í**laγa*<br>(*mil**ó** → mil**ú**sa*) | -SS/(+SS)<br>(A) | *miló → **e**milúsa-emilun*<br>(***e**m**í**laγa*) |

[1] However, although both forms are active in SG, the non-contracted version seems to be more frequent in the southern variety of Greek, including Athens, where the SG/SLI and TD participants live.

This difference in the use and role of the vocalic augment between the two systems is crucial as the presence of the augment in CYG is not as salient a cue as in SG; in the latter variety it is stressed and thus indicates the syllable length of the verb. In CYG, although the augment is highly frequent on past forms, it cannot be correlated either with syllable length or with stress.

*1.4 Rationale*

Based on the above, the aim is to investigate the effect of morphophonological salience of past tense marking on the performance of SG and CYG children with SLI, in order to determine whether SLI children are affected by the phonological realisation of grammatical features, claimed to be inaccessible under the Interpretability Hypothesis. Children with SLI are predicted to be more affected by salience variations than typically developing children. Furthermore, if children with SLI compensate for grammatical deficits through phonology, the performance of Cypriot Greek children with SLI should be poorer than that of their Greek peers in view of the increased salience of past formation in SG compared to CYG.

## 2 Methodology

*2.1 Participants*

Four groups of children (two from each variety) participated in the study: two groups of children with SLI (SLI/SG and SLI/CYG) and two control groups of age-matched children with typical language development (TD/SG and TD/CYG). The two SG groups were recruited in Athens. The experimental group (SLI/SG) included eight (8) monolingual children with SLI of preschool age (range 5;2-6) who meet the diagnostic criteria for SLI stated in the literature (Leonard, 1998) and had received a formal diagnosis by qualified speech and language therapists. The control group (TD/SG) included six (6) monolingual typically developing children aged between 5;5 and 5;10. The children of this group were recruited through private kindergartens in Athens and were selected on the criterion that no learning, language or communication disorders had been reported or observed by teachers, carers or parents.

The CYG groups were formed in a similar way. The experimental group (SLI/CYG) included eight (8) preschool children with SLI (range 5;0-6;0), formally diagnosed by speech therapists in two speech and language clinics in Nicosia, Cyprus, while the control group (TD/CYG) included eight (8) typically developing children (range 5;2-6;0). The TD/CYG children were recruited through private kindergartens in Nicosia and were selected based on the absence of any reported or observed language/communication problems. Detailed information on the participants is provided in

Appendix 1.

*2.2 Materials and procedure*

All the children that participated in the study went through a screening process that included the following assessments: their language development was assessed through the preschool version of the Diagnostic Verbal Intelligence Quotient (DVIQ) (Stavrakaki & Tsimpli, 2000). The children's non-verbal skills were assessed with two different tools: the Phonological Working Memory scale (PWM) (Maridaki-Kassotaki, 2002) and the Raven's Coloured Progressive Matrices (PCRM) (Raven, Raven, & Court, 1998). Following the screening stage, one experimental task was administered to all participants aiming to elicit past imperfective forms of real and pseudo verbs. Details on all screening and experimental materials are provided in the sections that follow.

*2.2.1 Screening materials*

All participants were assessed for verbal and non-verbal development as part of the screening process. The assessment of verbal language skills was completed with the use of DVIQ (Stavrakaki & Tsimpli, 2000)[2]. The test battery evaluates the development of different language skills such as expressive vocabulary, morphosyntactic development, meta-linguistic knowledge and sentence recall in comprehension and production through simple naming, sentence completion, sentence-picture matching and repetition tasks. Non-verbal assessments included an assessment of the children's phonological working memory through the PWM scale (Maridaki-Kassotaki, 2002) so as to eliminate differences between experimental and control groups. The PWM scale is a simple pseudo-word repetition task, which engages participants in repeating forty (40) 2 to 5-syllable pseudo-words of various syllabic structures (V, CV, CCV, CVC, CCVC and CCCV)[3]. Finally, the two experimental groups were also tested for non-verbal delays through the PCRM (Raven, Raven, & Court, 1998). Details on the participants' performance on the screening materials are available in
Appendix 1.

*2.2.2 Testing / experimental tools*

An elicited production task was used for the elicitation of past imperfective forms. The task engaged children in a sentence-completion activity and included two testing conditions, one with real verbs (RVs) and one with pseudo verbs (PVs). Each condition comprised 30 items – real or pseudo-verb forms – used in simple S-V or S-V-O structured sentences. Each of the 60 prompt sentences corresponded to a picture demonstrating either the action denoted by the verb (in the case of real verbs), or an imaginary action (in the case of pseudo verbs). The verbs used were equally distributed to the following testing categories:

- +SS,+A (e.g. *γráfo – éγrafa*) – 20 items (10RVs+10PVs),
- SG: +SS-A, CYG: +SS(A) (e.g. *χorévo – (e)χóreva*) – 20 items (10RVs+10PVs),
- SG: +/-SS-A, CYG: +/-SS(A) contractible (e.g. *miláo/miló – (e)mílaγa/(e)milúsa*) – 20 items (10RVs+10PVs).

Each prompt sentence described the activity depicted in the corresponding picture and was followed by the beginning of a sentence referring to the past, which the participants were then required to complete using the past imperfective form of the verb used in the prompt:

(8)
(a) Real Verbs (RVs)
Examiner: To koritsi *tréχi*. Xθes oli mera to koritsi...?
*= The girl is running. Yesterday all day the girl...?*
Target response: *étreχe*
*= was running*
(b) Pseudo Verbs (PVs)
Examiner: To koritsi *flízi*. Xθes oli mera to koritsi…?
*= The girl is flíz-ing. Yesterday all day the girl…?*
Target response: *éflize*

[2] The DVIQ tool was used with necessary adaptations for CYG.
[3] Minimum adjustments were made to the items of the PWM scale so as to ensure greater consistence with the phonotactics of Cypriot Greek (Petinou & Okalidou, 2006; Theodorou, 2007).

All verbs used in the sentences were 3rd singular forms ending in *–i* in the present and in *–e* in the past (imperfective or perfective), while pseudo verbs were created based on the phonotactic and syllable structure of Greek verbs. Finally, real and pseudo verbs were presented in random order. A list of the testing materials is provided in Appendix 2.

The testing procedure was simple; the examiner would present the prompt along with the corresponding picture and would instruct the child to complete the sentence using the same *'word'*. The question would be repeated once if the child gave no response or had difficulty recalling the pseudo-verb but no further help would be provided.

*2.3 Scoring, measurements and analyses*

The children's responses were analysed with respect to target (T) and non-target (NT) responses. All responses that included the past imperfective form of the verb given were considered target, while in the case of pseudo verbs, responses that involved application of the appropriate rule (+SS, +/-A) were considered target even if they included minor alterations in the pseudo verb stem. In the case of contractible pseudo verbs, application of any of the rule variants (see e.g. (6) and (7)) would be considered target. Non-target responses were coded under the following categories:

- NT[Perf]: use of perfective instead of imperfective,
- NT[Pres]: use of present instead of past,
- NT[+A,Pres]: use of the present form with an augment, e.g. ***e****ziréni* instead of *(e)zírene,*
- NT[+A,Stressed]: stem reanalysis and use of the stressed augment in –Augment verbs, e.g. *ézire* instead of *(e)zírene*,
- NT[other]: other kinds of errors, such as significant stem alterations, and
- NA: no response.

Multiple 2*2*2 analyses were performed on the results, aiming at the investigation of three main variables at a time: *augment effect* (+A vs. –A) * *verb condition* (real vs. pseudo verbs) * *group* (SLI vs. TD), and *contractibility* (contractible vs. non contractible) * *verb condition* * *group*.[4] Finally, the main effects found were also tested across varieties (SG vs. CYG). Statistical analyses of main effects and interactions were performed through two-way mixed ANOVAs, while post hoc analyses were performed where necessary for between-group and within-group effects through independent-samples and paired-samples *t* tests respectively. Finally, an error-analysis was also performed, looking for qualitative differences between the experimental and control groups.

## 3 Results

The results obtained are presented in this section, first with respect to the two main variables tested, the *augment effect* and the *contractibility effect* (contractible vs. non-contractible) for each variety separately. Between-groups and between-varieties comparisons follow and an error analysis is presented at the end of this section.

*3.1 Within-groups and between-groups effects*

*3.1.1 Augment effect*

Beginning with the effect of the vocalic augment on the children's performance, a general presentation of all groups' mean scores is provided in Table 2, while individual scores are available in Appendix 3.

[4] Note that [+A] verbs were excluded from the contractibility analyses so as to eliminate the augment confound from these analyses.

Table 2 All groups' mean target responses (TRs) in the +A and –A/(A) categories

| | | SG | | CYG | |
|---|---|---|---|---|---|
| | | SLI/SG | TD/SG | SLI/CYG | TD/CYG |
| RVs | +A | 98.8% *SD=3.54* | 96.7% *SD=5.16* | 85% *SD=14.14* | 97.5% *SD=4.63* |
| | -A/(A) | 91.9% *SD=3.73* | 95% *SD=3.16* | 74.4% *SD=16.57* | 96.3% *SD=5.82* |
| PVs | +A | 62.5% *SD=14.89* | 88.3% *SD=7.53* | 72.5% *SD=21.21* | 83.8% *SD=18.47* |
| | -A/(A) | 43.8% *SD=14.08* | 82.5% *SD=9.35* | 56.9% *SD=19.63* | 85% *SD=11.95* |

The findings were tested through a two-way mixed ANOVA for each variety, testing the variables augment*verb condition*group (SLI/TD). For the SG variety, the analysis revealed a significant effect of *augment*, $F_{(1,12)} = 12.683$, $p = .004$, and *verb condition*, $F_{(1,12)} = 101.365$, $p = .000$, and a significant interaction between *verb condition* and *group*, $F_{(1,12)} = 36.975$, $p = .000$.

For the CYG variety, on the other hand, only the *verb condition* effect was found to be significant, $F_{(1,14)} = 13.286$, $p = .003$. The *augment* effect as well as the *augment*group* interaction were close to but not within significance levels, $F_{(1,14)} = 689.063$, $p = .066$. Given that these preliminary analyses revealed significant (or nearly significant) effects, further comparisons were made for within-groups effects.

As Table 2 demonstrates, the two SLI groups appear to have been affected by the augment as their performance is clearly higher in the +A categories than in the –A/(A) ones in both real and pseudo verbs. As expected, this effect seems to be stronger in pseudo verbs than in real verbs, while the two control groups did not differentiate between the +A and –A/(A) categories. Statistical analyses, however, revealed a significant augment effect in real verbs only for the SLI/SG group, $t = 3.274$, df = 7, $p = .014$, while the SLI/CYG performance did not differ significantly between +A and (A) categories, $t = 2.229$, df = 7, $p = .068$. Both experimental groups were significantly affected by the augment in the pseudo verb condition (SLI/SG: $t = 2.311$, df = 7, $p = .051$, SLI/CYG: $t = 2.903$, df = 7, $p = .023$), while none of the control groups exhibited significant differences between the +A and –A/(A) conditions. Finally, all groups exhibited significant differences between real and pseudo verbs in the –A/(A) condition (SLI/SG: $t = 8.162$, df = 7, $p = .000$; SLI/CYG: $t = 3.176$, df = 7, $p = .016$; TD/SG: $t = 2.521$, df = 5, $p = .53$; TD/CYG: $t = 3.211$, df = 7, $p = .015$), while only the SLI/SG group presented a significant RVs – PVs difference in the +A condition as well ($t = 6.416$, df = 7, $p = .000$).

Commenting on the findings described here, the increased salience of the vocalic augment in the formation of the past seems to affect the performance of SG-speaking children with SLI to a greater extent than CYG children, who only seem to be affected by the augment in the pseudo verb condition. The fact that the SLI/CYG group does not differentiate between +A and (A) categories in the real verb condition could be attributed to the fact that the vocalic augment is found in both categories, rendering the difference between them less salient.

Between-groups analyses were also performed in order to evaluate group and dialect effects. First, the two experimental groups were compared with the two control groups in each variety separately (SLI/SG–TD/SG, SLI/CYG–TD/CYG), while comparisons between the two experimental groups (SLI/SG–SLI/CYG) and the two control groups

(TD/SG–TD/CYG) across the two varieties followed. Interestingly, the two SG groups did not differ significantly in the RV condition ([+A]: $t = .899$, df = 12, $p = .386$; [-A]: $t = 1.654$, df = 12, $p = .124$), but the SLI/SG group showed significantly lower performance than the TD/SG group in both categories of the PV condition ([+A]: $t = 3.870$, df = 12, $p = .002$; [-A]: $t = 5.818$, df = 12, $p = .000$). The CYG groups differed in both RV conditions ([+A]: $t = 2.376$, df = 14, $p = .032$; (A): $t = 3.523$, df = 14, $p = .003$) and only in the low salience category of pseudo verbs, $t = 3.462$, df = 14, $p = .004$.

Comparing the two varieties, the SLI/SG group performed better than the SLI/CYG group in both RV conditions ([+A]: $t = 2.668$, df = 14, $p = .018$; [-A/(A)]: $t = 2.915$, df = 14, $p = .011$), but the reverse pattern was found in the PV condition, with the CYG group showing higher performance than the SG group, without reaching significance though. Finally, there were no significant differences between the two control groups, as expected.

### *3.1.2 Contractibility effect*

A comparison of the children's performance between contractible and non-contractible verbs also produced interesting results. The table that follows contains an overall presentation of the four groups' mean performance with respect to contractibility, while individual scores are again available in Appendix 3.

Table 3 All groups' mean target responses (TRs) in Contractible and Non-contractible Verbs

| | | SG | | CYG | |
|---|---|---|---|---|---|
| | | SLI/SG | TD/SG | SLI/CYG | TD/CYG |
| RVs | + Contr. | 88.8%<br>*SD=8.35* | 95%<br>*SD=5.48* | 68.8%<br>*SD=22.32* | 96.3%<br>*SD=7.44* |
| | - Contr. | 95%<br>*SD=5.35* | 95 %<br>*SD=5.48* | 80%<br>*SD=14.14* | 96.3%<br>*SD=5.18* |
| PVs | + Contr. | 35%<br>*SD=9.26* | 70%<br>*SD=16.73* | 40%<br>*SD=21.38* | 70%<br>*SD=23.9* |
| | -Contr. | 52.5%<br>*SD=21.88* | 95%<br>*SD=5.48* | 73.8%<br>*SD=22.64* | 100%<br>*SD=0* |

Two separate analyses of variance on contractibility*verb condition*group were performed (one for each variety), which revealed the following significant effects and interactions: for the SG variety, a significant effect of *contractibility*, $F_{(1,12)} = 22.543$, $p = .000$, and *verb condition*, $F_{(1,12)} = 56.332$, $p = .000$, and significant interactions between *contractibility* and *group*, $F_{(1,12)} = 19.452$, $p = .001$, and *contractibility* and *verb condition*, $F_{(1,12)} = 9.262$, $p = .010$. For the CYG variety, analyses revealed significant effects of *contractibility*, $F_{(1,14)} = 30.288$, $p = .000$, *verb condition*, $F_{(1,14)} = 19.387$, $p = .001$, and a *contractibility*verb condition* interaction, $F_{(1,14)} = 19.916$, $p = .001$. Further within-groups comparisons were also performed and are analysed below.

As table 3 demonstrates, both SLI groups seem to have performed better in non-contractible verbs than in contractible ones in real and pseudo verb conditions. However, the difference was found to be significant only in the pseudo verb condition for both groups (SLI/SG: $t = 2.701$, df = 7, $p = .31$; SLI/CYG: $t = 4.784$, df = 7, $p = .002$). The same pattern was found in the two control groups' performance, which only differed between contractible and non-contractible verbs in the pseudo verb condition (TD/SG: $t = 3.727$, df = 5, $p = .014$; TD/CYG: $t = 3.550$, df = 7, $p = .009$). The children's difficulty with contractible pseudo verbs, which is rather notable as the four groups' low scores indicate, could be attributed to the fact that there is more than one

output of the past formation rule available. Although there is no problem with producing one of the variants of real verbs, the fact that there are no stored lexical entries for pseudo verbs combined with the fact that more than one possible options are available contributes to the more demanding status of past formation for these verbs.

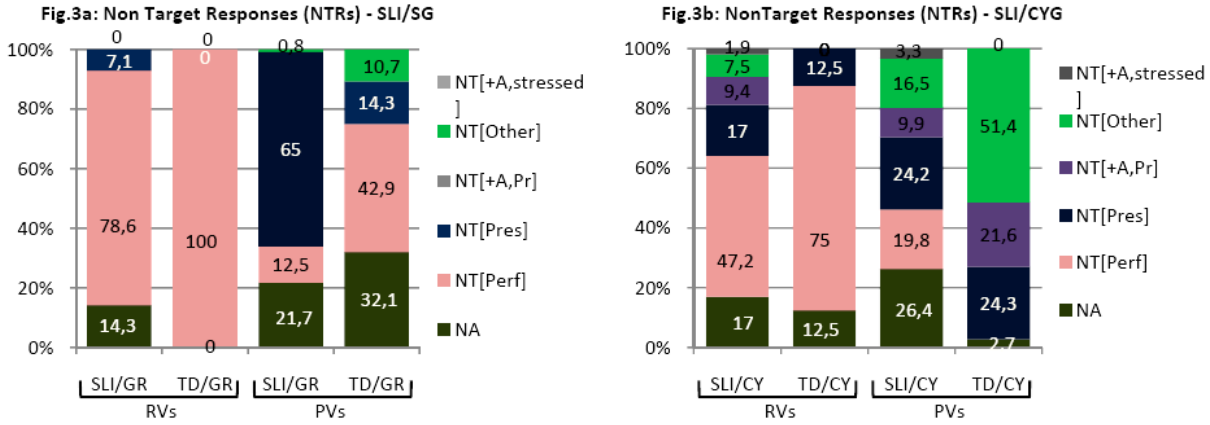
Between-groups comparisons revealed that the SG children with SLI do not seem to differ from the TD group in the real verb condition but their performance is significantly lower than TD in the pseudo verb condition, both in contractible, $t = 4.608$, df = 12, $p = .001$, and non-contractible verbs, $t = 5.020$, df = 12, $p = .000$. The SLI/CYG group, on the other hand, exhibited significantly lower performance than the TD/CYG in both contractible, $t = 3.306$, df = 14, $p = .005$, and non-contractible real verbs, $t = 3.053$, df = 14, $p = .009$, as well as in contractible, $t = 2.646$, df = 14, $p = .019$, and non-contractible pseudo verbs, $t = 3.280$, df = 14, $p = .005$.

Comparing the results across varieties, the two SLI groups differ significantly in the two RV conditions, with the SLI/SG performance being significantly higher than SLI/CYG in the contractible, $t = 2.374$, df = 14, $p = .032$, and the non-contractible RVs, $t = 2.806$, df = 14, $p = .014$. Although their difference marked the reverse pattern in the pseudo verb condition, it was not found to be statistically significant. Finally, the two TD groups only differed in non-contractible pseudo verbs, but the difference is probably due to the fact that all CYG children performed at ceiling.

### *3.2 Error analysis*

It was shown in the previous section that no significant differences were found between the two SLI groups in the pseudo verb categories. This was expected as children with SLI are known to face difficulties with processing grammatical information (Leonard et al., 1988; Gopnik, 1994). However, given the different versions of the past formation rule in each variety, qualitative differences could emerge in the type of non-target responses given by the two SLI groups as well as the two TD ones. The following graphs illustrate this comparison.

Figure 1 Types of non-target responses produced by the four groups




*Raw numbers of non-target responses (NTRs):*

| | RVs | PVs |
|---|---|---|
| SLI/SG | 13/160 | 90/160 |
| TD/SG | 6/120 | 21/120 |

| | RVs | PVs |
|---|---|---|
| SLI/CYG | 41/160 | 69/160 |
| TD/CYG | 6/160 | 24/160 |

Looking at the two graphs above, the similarities concern the RV condition in which both TD groups mainly produced past perfective forms, although the CYG group also

gave few present forms. The SLI groups mostly gave perfective responses but the CYG group also produced the vocalic augment in non-past forms in 5 instances (e.g. 9a), as well as forms with a stressed augment on multisyllabic verbs (e.g. 9b).

| | | | | |
|---|---|---|---|---|
| (9) | (a) | *évafi* | instead of | *évafe* |
| | (b) | *évutse* | instead of | *vúrtsize* |

In the PV condition, the two SLI groups showed an important difference: most SLI/SG non-target responses involved repetition of the present form of the pseudo verb (the prompt), while SLI/CYG responses also involved 7 instances of use of the augment in non-past forms (10a) and 3 cases of a stressed augment in multisyllabic forms (10b):

| | | | | |
|---|---|---|---|---|
| (10) | (a) | *eχavá* | instead of | *(e)χavúse* |
| | | *etuná* | instead of | *(e)tunúse* |
| | | *estraɣiná* | instead of | *(e)straɣinúse* |
| | (b) | *éχave* | instead of | *(e)χavúse* |

Finally, it is also interesting that the TD groups gave noticeably more 'other' non-target responses than the SLI ones in the PV condition. These other responses mainly involved considerable stem changes, as the examples below illustrate.

| | | | | | |
|---|---|---|---|---|---|
| (11) | (a) | TD/SG: | *éχuve* | instead of | *χavúse* |
| | | | *éstrage* | instead of | *straɣinúse* |
| | | | *éklule* | instead of | *kulikúse* |
| | (b) | TD/CYG: | *enenúse* | instead of | *énene* |
| | | | *ezupúse* | instead of | *ézupe* |
| | | | *etrázize* | instead of | *étrane* |
| | | | *strágize* | instead of | *straɣinúse* |

It is interesting, however, that the two groups appear to have used a different strategy in these errors. While the SG children use the stressed augment in forms of the [-A] category (multisyllabic forms), the CYG group did the opposite, namely they overused the –SS rule used in contractible verbs on forms of the [+A] category.

## 4 Discussion

The findings from the elicited production task largely appear to support our predictions. First, TD children speaking the SG or the CYG variety do not differ from each other, despite the salience differences found in the status of the vocalic augment or number of variants with contractible verbs. This result is expected on the grounds that TD children do not need to rely on compensatory strategies for the application of a morpho-phonological rule but also possibly because the children tested were already old enough to have attained the adult-state of grammatical knowledge of past tense formation. Younger TD children might have evinced salience effects in earlier stages of acquisition.

Second, the SLI group performance in each variety was poorer than the respective of the TD groups, supporting the cross-linguistic claim that Tense is affected in SLI grammars. However, salience differences between SG and CYG did show effects in the performance of the respective SLI groups, showing higher rates of accuracy in the SLI/SG than in the SLI/CYG group. The salience of the stressed vocalic augment as a cue to past formation and to the syllable length of the verb in the SLI/SG led to their

better performance compared to the SLI/CYG group. Moreover, the reduced salience of the vocalic augment in CYG is presumably responsible for the attested difference between the SLI and the TD groups in the real verb condition. Such a difference was not found in the SG groups in the same condition.

Finally, contractibility has been shown to negatively affect performance of TD and SLI groups in the pseudo verb condition. Contractible verbs are associated with more than one potential output forms and this is more so in the CYG variety than in the SG variety. Moreover, contractible verbs may 'violate' the APU stress pattern in forming the past, thus being less salient than non-contractible verbs. As a result, all groups showed poorer performance in this condition, with SLI/CYG children being most vulnerable.

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## Appendix 1: Subject information for language impaired and typically developing children in Cypriot Greek and Standard Greek

**SLI/CYG**

| Child | Age | DVIQ | PWM% | RCPM |
|---|---|---|---|---|
| AA | 5;10 | 90 | 80 | 17 |
| MM | 5;6 | 84 | 90 | 21 |
| FV | 6;0 | 96 | 92.5 | 23 |
| OA | 5;2 | 78 | 87.5 | 22 |
| ALA | 5;2 | 92 | 100 | 19 |
| KM | 5;3 | 90 | 85 | 17 |
| XS | 6;0 | 88 | 87.5 | 25 |
| SP | 6;0 | 81 | 87.5 | 19 |
| Mean | 5;7 | 87.4 | 88.8 | 20.4 |
| *SD* | | *5.97* | *5.82* | *2.88* |

**TD/CYG**

| Child | Age | DVIQ | PWM |
|---|---|---|---|
| KS | 6;0 | 143 | 95 |
| AL | 6;0 | 148 | 95 |
| IX | 6;0 | 147 | 95 |
| PP | 5;10 | 150 | 100 |
| KL | 5;05 | 145 | 92.5 |
| IA | 5;10 | 152 | 90 |
| MS | 5;02 | 136 | 90 |
| EV | 5;0 | 145 | 100 |
| Mean | 5;8 | 145.8 | 94.7 |
| *SD* | | *4.89* | *3.88* |

**SLI/SG**

| Child | Age | DVIQ | PWM% | RCPM |
|---|---|---|---|---|
| CP | 5;8 | 87 | 85 | 19 |
| RF | 5;11 | 92 | 75 | 18 |
| AS | 5;3 | 78 | 80 | 20 |
| PP | 5;8 | 88 | 75 | 19 |
| ES | 6;0 | 87 | 67.5 | 17 |
| KS | 5;10 | 84 | 77.5 | 21 |
| RS | 5;2 | 80 | 80 | 23 |
| GF | 5;5 | 82 | 70 | 22 |
| Mean | 5;6 | 84.8 | 76.3 | 19.9 |
| *SD* | | *4.62* | *5.67* | *2.03* |

**TD/SG**

| Child | Age | DVIQ | PWM |
|---|---|---|---|
| DF | 5;7 | 103 | 90 |
| VV | 5;7 | 100 | 80 |
| SR | 5;5 | 97 | 92.5 |
| RL | 5;9 | 109 | 100 |
| PR | 5;10 | 110 | 75 |
| CC | 5;10 | 106 | 77.5 |
| | 5;8 | 104.2 | 85.8 |
| | | *5.12* | *9.83* |

**Appendix 2: List of test items**

| **REAL VERBS** | **PSEUDO VERBS** |
|---|---|
| **+SS/+A** | |
| 1. βλέπει – έβλεπε (=*see*) | 1. κράβει – έκραβε |
| 2. τρέχει – έτρεχε (=*run*) | 2. φλίζει – έφλιζε |
| 3. πλέκει – έπλεκε (=*knit*) | 3. τράνει – έτρανε |
| 4. πίνει – έπινε (=*drink*) | 4. χλαίνει – έχλαινε |
| 5. βάζει – έβαζε (=*put*) | 5. νένει – ένενε |
| 6. πλένει – έπλενε (=*wash*) | 6. νείρει – ένειρε |
| 7. γλείφει – έγλειφε (=*lick*) | 7. χνάζει – έχναζε |
| 8. σκάβει – έσκαβε (=*dig*) | 8. βούζει – έβουζε |
| 9. γράφει – έγραφε (=*write*) | 9. λέντζει – έλεντζε |
| 10. δίνει – έδινε (=*give*) | 10. ζούπει – έζουπε |
| **+SS/–(A)** | |
| 1. γυαλίζει – (ε)γυάλιζε (=*shine*) | 1. χολένει – (ε)χόλενε |
| 2. βουρτσίζει – (ε)βούρτσιζε (=*brush*) | 2. παχάβει – (ε)πάχαβε |
| 3. φουσκώνει – (ε)φούσκωνε (=*blow up, pump*) | 3. ζιραίνει – (ε)ζίραινε |
| 4. πηγαίνει – (ε)πήγαινε (=*go*) | 4. φουδίζει – (ε)φούδιζε |
| 5. σκουπίζει – (ε)σκούπιζε (=*wipe*) | 5. ληραίνει – (ε)λήραινε |
| 6. φωνάζει – (ε)φώναζε (=*yell*) | 6. ζουλίζει – (ε)ζούλιζε |
| 7. μαλώνει – (ε)μάλωνε (=*tell sb off*) | 7. καμίζει – (ε)κάμιζε |
| 8. μπαλώνει – (ε)μπάλωνε (=*patch*) | 8. κουλίζει – (ε)κούλιζε |
| 9. ξαπλώνει – (ε)ξάπλωνε (=*lie down*) | 9. σουφαίνει – (ε)σούφαινε |
| 10. κλειδώνει – (ε)κλείδωνε (=*lock*) | 10. λαμίζει – (ε)λάμιζε |
| **+/–SS/(A) (contractible)** | |
| 1. πηδά(ει) – (ε)πηδούσε/(ε)πήδαγε (=*jump*) | 1. χαβά(ει) – (ε)χαβούσε/(ε)χάβαγε |
| 2. γελά(ει) – (ε)γελούσε/(ε)γέλαγε (=*laugh*) | 2. δαζά(ει) – (ε)δαζούσε/(ε)δάζαγε |
| 3. χτυπά(ει) – (ε)χτυπούσε/(ε)χτύπαγε (=*hit*) | 3. ταμπά(ει) – (ε)ταμπούσε/(ε)τάμπαγε |
| 4. τραβά(ει) – (ε)τραβούσε/(ε)τράβαγε (=*pull*) | 4. μαγκά(ει) – (ε)μανγκούσε/(ε)μάγκαγε |
| 5. κλωτσά(ει) – (ε)κλωτσούσε/(ε)κλώτσαγε (=*kick*) | 5. τουνά(ει) – (ε)τουνούσε/(ε)τούναγε |
| 6. ξεκινά(ει) – (ε)ξεκινούσε/(ε)ξεκίναγε (=*start*) | 6. ναζικά(ει) – (ε)ναζικούσε/(ε)ναζίκαγε |
| 7. σταματά(ει) – (ε)σταματούσε/(ε)σταμάταγε (=*stop*) | 7. στραγινά(ει) – (ε)στραγινούσε/(ε)στραγίναγε |
| 8. περπατά(ει) – (ε)περπατούσε/(ε)περπάταγε (=*walk*) | 8. κουλλικά(ει) – (ε)κουλλικούσε/(ε)κουλλίκαγε |
| 9. κολυμπά(ει) – (ε)κολυμπούσε/(ε)κολύμπαγε (=*swim*) | 9. ραφινά(ει) – (ε)ραφινούσε/(ε)ραφίναγε |
| 10. κουβαλά(ει) – (ε)κουβαλούσε/(ε)κουβάλαγε (=*carry*) | 10. μοριβά(ει) – (ε)μοριβούσε/(ε)μορίβαγε |

## Appendix 3: Individual raw and % scores

### a. Augment effect

**SLI/SG**

| Child | SLI +A RVs | SLI -A RVs | SLI +A PVs | SLI -A PVs |
|---|---|---|---|---|
| CP | 10/10 – 100% | 18/20 – 90% | 5/10 – 50% | 10/20 – 50% |
| RF | 10/10 – 100% | 19/20 – 95% | 5/10 – 50% | 5/20 – 25% |
| AS | 10/10 – 100% | 19/20 – 95% | 8/10 – 80% | 4/20 – 20% |
| PP | 9/10 – 90% | 19/20 – 95% | 7/10 – 70% | 8/20 – 40% |
| ES | 10/10 – 100% | 18/20 – 90% | 4/10 – 40% | 11/20 – 55% |
| KS | 10/10 – 100% | 17/20 – 85% | 6/10 – 60% | 11/20 – 55% |
| RS | 10/10 – 100% | 18/20 – 90% | 8/10 – 80% | 10/20 – 50% |
| GF | 10/10 – 100% | 19/20 – 95% | 7/10 – 70% | 11/20 – 55% |
| Mean | 79/20 - 98.8 | 91.9 | 62.5 | 43.8 |
| *SD* | *3.54* | *3.73* | *14.89* | *14.08* |

**TD/SG**

| Child | TD +A RVs | TD -A RVs | TD +A PVs | TD -A PVs |
|---|---|---|---|---|
| DF | 10/10 – 100% | 19/20 – 95% | 8/10 – 80% | 16/20 – 80% |
| VV | 10/10 – 100% | 20/20 – 100% | 9/10 – 90% | 13/20 – 65% |
| SR | 9/10 – 90% | 19/20 – 95% | 9/10 – 90% | 17/20 – 85% |
| RL | 9/10 – 90% | 18/20 – 90% | 10/10 – 100% | 18/20 – 90% |
| PR | 10/10 – 100% | 19/20 – 95% | 8/10 – 80% | 18/20 – 90% |
| CC | 10/10 – 100% | 19/20 – 95% | 9/10 – 90% | 17/20 – 85% |
| Mean | 96.7% | 95.0% | 88.3% | 82.5% |
| *SD* | *5.16* | *3.16* | *7.53* | *9.35* |

**SLI/CYG**

| Child | SLI +A RVs | SLI (A) RVs | SLI +A PVs | SLI (A) PVs |
|---|---|---|---|---|
| AA | 9/10 – 90% | 15/20 – 75% | 7/10 – 70% | 10/20 – 50% |
| MM | 7/10 – 70% | 13/20 – 65% | 7/10 – 70% | 10/20 – 50% |
| FV | 6/10 – 60% | 13/20 – 65% | 10/10 – 100% | 14/20 – 70% |
| OA | 8/10 – 80% | 9/20 – 45% | 4/10 – 40% | 5/20 – 25% |
| ALA | 10/10 – 100% | 15/20 – 75% | 10/10 – 100% | 15/20 – 75% |
| KM | 9/10 – 90% | 17/20 – 85% | 5/10 – 50% | 12/20 – 60% |
| XS | 10/10 – 100% | 20/20 – 100% | 8/10 – 80% | 17/20 – 85% |
| SP | 9/10 – 90% | 17/20 – 85% | 7/10 – 70% | 8/20 – 40% |
| Mean | 85 | 74.4 | 72.5 | 56,9 |
| *SD* | *14.14* | *16.57* | *21.21* | *19.63* |

**TD/CYG**

| Child | TD +A RVs | TD (A) RVs | TD +A PVs | TD (A) PVs |
|---|---|---|---|---|
| KS | 10/10 – 100% | 20/20 – 100% | 6/10 – 60% | 20/20 – 100% |
| AL | 10/10 – 100% | 20/20 – 100% | 6/10 – 60% | 18/20 – 90% |
| IX | 9/10 – 90% | 20/20 – 100% | 8/10 – 80% | 14/20 - 70% |
| PP | 9/10 – 90% | 20/20 – 100% | 7/10 – 70% | 17/20 - 85% |
| KL | 10/10 – 100% | 17/20 – 85% | 10/10 – 100% | 13/20 - 65% |
| IA | 10/10 – 100% | 19/20 – 95% | 10/10 – 100% | 18/20 - 90% |
| MS | 10/10 – 100% | 18/20 – 90% | 10/10 – 100% | /1720 - 85% |
| EV | 10/10 – 100% | 20/20 – 100% | 10/10 – 100% | 19/20 – 95% |
| Mean | 97.5 | 96.3 | 83.8 | 85 |
| *SD* | *4.63* | *5.82* | *18.47* | *11.95* |

**b. Contractibility effect**

**SLI/SG**

| Child | SLI Contr RVs | SLI N.contr RVs | SLI Contr PVs | SLI N.contr PVs |
|---|---|---|---|---|
| CP | 9/10 – 90% | 9/10 – 90% | 4/10 – 40% | 6/10 – 60% |
| RF | 9/10 – 90% | 10/10 – 100% | 2/10 – 20% | 3/10 – 30% |
| AS | 9/10 – 90% | 10/10 – 100% | 3/10 – 30% | 1/10 – 10% |
| PP | 9/10 – 90% | 10/10 – 100% | 3/10 – 30% | 5/10 – 50% |
| ES | 9/10 – 90% | 9/10 – 90% | 4/10 – 40% | 7/10 – 70% |
| KS | 7/10 – 70% | 10/10 – 100% | 5/10 – 50% | 6/10 – 60% |
| RS | 9/10 – 90% | 9/10 – 90% | 3/10 – 30% | 7/10 – 70% |
| GF | 10/10 – 100% | 9/10 – 90% | 4/10 – 40% | 7/10 – 70% |
| Mean | 88.8 | 95.0 | 35.0 | 52.5 |
| *SD* | *8.35* | *5.35* | *9.26* | *21.88* |

**TD/SG**

| Child | TD Contr RVs | TD N.contr RVs | TD Contr PVs | TD N.contr PVs |
|---|---|---|---|---|
| DF | 10/10 – 100% | 9/10 – 90% | 7/10 – 70% | 9/10 – 90% |
| VV | 10/10 – 100% | 10/10 – 100% | 4/10 – 40% | 9/10 – 90% |
| SR | 9/10 – 90% | 10/10 – 100% | 7/10 – 70% | 10/10 – 100% |
| RL | 9/10 – 90% | 9/10 – 90% | 8/10 – 80% | 10/10 – 100% |
| PR | 10/10 – 100% | 9/10 – 90% | 9/10 – 90% | 9/10 – 90% |
| CC | 10/10 – 90% | 10/10 – 100% | 7/10 – 70% | 10/10 – 100% |
| Mean | 95.0 | 95.0 | 70 | 95.0 |
| *SD* | *5.48* | *5.48* | *16.73* | *5.48* |

**SLI/CYG**

| Child | SLI Contr RVs | SLI N.contr RVs | SLI Contr PVs | SLI N.contr PVs |
|---|---|---|---|---|
| AA | 7/10 – 70% | 8/10 – 80% | 2/10 – 20% | 8/10 – 80% |
| MM | 7/10 – 70% | 6/10 – 60% | 4/10 – 40% | 6/10 – 60% |
| FV | 5/10 – 50% | 8/10 – 80% | 6/10 – 60% | 8/10 – 80% |
| OA | 3/10 – 30% | 6/10 – 60% | 2/10 – 20% | 3/10 – 30% |
| ALA | 6/10 – 60% | 9/10 – 90% | 5/10 – 50% | 10/10 – 100% |
| KM | 9/10 – 90% | 8/10 – 80% | 5/10 – 50% | 7/10 – 70% |
| XS | 10/10 – 100% | 10/10 – 100% | 7/10 – 70% | 10/10 – 100% |
| SP | 8/10 – 80% | 9/10 – 90% | 10% | 7/10 – 70% |
| Mean | 68.8 | 80.0 | 40.0 | 73.8 |
| *SD* | *22.32* | *14.14* | *21.38* | *22.64* |

**TD/CYG**

| Child | TD Contr RVs | TD N.contr RVs | TD Contr PVs | TD N.contr PVs |
|---|---|---|---|---|
| KS | 10/10 – 100% | 10/10 – 100% | 10/10 – 100% | 10/10 – 100% |
| AL | 10/10 – 100% | 10/10 – 100% | 8/10 – 80% | 10/10 – 100% |
| IX | 10/10 – 100% | 10/10 – 100% | 4/10 – 40% | 10/10 – 100% |
| PP | 10/10 – 100% | 10/10 – 100% | 7/10 – 70% | 10/10 – 100% |
| KL | 8/10 – 80% | 9/10 – 90% | 3/10 – 30% | 10/10 – 100% |
| IA | 10/10 – 100% | 9/10 – 90% | 8/10 – 80% | 10/10 – 100% |
| MS | 9/10 – 90% | 9/10 – 90% | 7/10 – 70% | 10/10 – 100% |
| EV | 10/10 – 100% | 10/10 – 100% | 9/10 – 90% | 10/10 – 100% |
| Mean | 96.3 | 96.3 | 70 | 100 |
| *SD* | *7.44* | *5.18* | *23.9* | *0* |