Motion verbs in Greek and German:
Evidence from typically developing and SLI children[1]

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Abstract: In this paper we report on the findings from a Greek and German production
task which investigated the expression of constructions involving manner-of-motion
verbs with Greek and German adults as well as typically developing and SLI children at
the age of 5-6 years. The results showed that the typically developing children, when
describing motion events, differed from the adults in the integration of grammatical
information into motion predicates. The SLI children on the other hand displayed
problems with the use of grammatical aspect (Greek) and case marking (German) as
well as with ambiguous constructions (Greek).
Keywords: SLI, manner-of-motion verbs, aspect, case, telicity

1. Introduction
In the SLI literature there is a long lasting debate with respect to the nature and the
cause of SLI (see for example the papers in Levy & Schaeffer 2003). It has been argued
by some researchers that SLI is language specific (Crago & Paradis 2003; Leonard
2000) and, thus, one way to contribute to the debate on the characteristics of SLI is to
compare SLI data from different languages. In this paper, we investigated how Greek
and German typically developing (TD) and SLI children express (a)telic events with
manner-of-motion verbs. The two languages exhibit an interesting difference with
respect to the encoding of (a) telicity in structures with motion verbs, since the available
readings in German are constrained by grammatical means, i.e. Case, whereas in Greek
the equivalent structures are ambiguous and the preferred readings are constrained by
morphological aspect. The paper is organized as follows. In section 2 we give a brief
description of manner-of-motion verbs in both German and Greek. Sections 3 and 4
provide the method and the results of our study respectively. In section 5 we discuss our
results with respect to possible effects that cause the differences between adult and child
language but also between typically developing and SLI children.

2. Manner-of-motion verbs in Greek and German
Manner-of-motion verbs are activity predicates which can acquire an accomplishment
(telic) reading depending on the situation and the view point aspect of the verb itself as
well as on the properties of their PP complements (Talmy 1985). Zubizarreta & Oh
(2007) suggest that in English the PP combined with manner-of-motion verbs is a
complement when it denotes location (cf. (1)) while it is an adjunct when it denotes
direction (cf. (2)):

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(1)   He walked inside the room.
(2)   He walked into the room.

In Greek, constructions involving manner-of-motion verbs are ambiguous and the preferred interpretation is closely related to the aspectual form of the verb (see also Horrocks & Stavrou 2007). The imperfective verb forms may denote only atelic[2] events, i.e. location or direction, as shown in (3). On the other hand, perfective verb forms are ambiguous between the two atelic readings and the telic interpretation, which implies that the complement of the PP has been reached (cf. (4)).

(3)   O skilos etrehe ston kipo.
       the$_{NOM.S.M}$ dog$_{NOM.S.M}$ ran$_{IMP.3S}$ in-the$_{ACC.S.M}$ garden$_{ACC.S.M}$
       "The dog was running in/towards the garden.
(4)   O skilos etrekse ston kipo.
       the$_{NOM.S.M}$ dog$_{NOM.S.M}$ ran$_{PERF.3S}$ in-the$_{ACC.S.M}$ garden$_{ACC.S.M}$
       "The dog ran into/towards/inside the garden."

Contrary to Greek, in German the (a)telic interpretation of manner-of-motion verbs is captured by the case marking of the DP within the PP complement: accusative denotes direction, whereas dative denotes location[3]. Particle verbs allow only for one possibility. They may be combined either with dative or with accusative case:

(5)   Der Wurm <u>kriecht</u> in der Tasse <u>herum</u>.
       the worm crawls in the$_{DAT}$ cup around.
       "The worm crawls / is crawling in the cup."
(6)   Der Wurm <u>kriecht</u> in die Tasse <u>hinein/rein</u>.
       The worm crawls in the$_{ACC}$ cup into.
       "The worm crawls into in the cup."

The particles in (5) as well as in (6) incorporate PATH into the verb meaning (*herumgehen* = walking around; *hineingehen/reingehen* = to enter), but this PATH has a direction or goal only in (6). In (5), the verbal particle underpins that the motion is non-directed and thus the locative meaning of the preposition *in* + DPdat, and the PP denotes an adjunct. The particles in (6) incorporate PATH, and the PP (with DPacc) denotes the GOAL, and the PP is the complement. Nevertheless, simple verbs may be combined with PPs in which the DP is marked for accusative or dative and express location or direction (with GOAL) accordingly (see (7)). Following Maienborn (1990), we assume that, when the PP denotes direction or GOAL, it is an argument of the verb and a verb complement, whereas, when it denotes location, it is a modifier and an adjunct.

(7)   Der Wurm kriecht in die / der Tasse.
       the worm crawls in the$_{ACC}$ / the$_{DAT}$ cup
       "The worm crawls into / inside the cup."

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[2] Notice that imperfective manner-of-motion verbs may denote telic events when they are used to express habituality (cf. Tsimpli & Papadopoulou 2009).

[3] There is one exception, i.e. the use of the preposition *zu* (to), which governs a DP marked for the dative case, and which incorporates the meaning of PATH.

The unmarked option for the expression of location is the use of particle rather than simple verbs, whereas simple motion verbs are preferred when expressing direction.

In this paper, we investigate (a) how (a)telic motion events are expressed by Greek and German adults, monolingual TD and SLI children, (b) whether our participant groups used Case and Aspect to encode (a)telicity in German and Greek respectively and (c) whether there are any quantitative and/or qualitative differences between the language-impaired (SLI) and the typically developing children.

3. Method
3.1 Materials
The Greek and the German versions consisted of twenty-six short videos: two practice, eight filler and sixteen critical videos. The critical videos involved eight motion events presented in two different conditions: in one condition one entity was performing a motion event (i.e. walking) in a certain location (atelic video), whereas in the other condition the same entity was shown to perform the same motion activity and to arrive at a certain endpoint (telic video). For instance, a video showing a dog running in a garage represented the atelic condition. On the other hand, a video depicting a dog running towards and arriving at the garage represented the telic condition. The eight motion activities employed in this task were supposed to be illustrated by manner of motion verbs such as *to walk* (twice), *to run*, *to fly* (twice), *to crawl*, *to drive* and *to jump*. Moreover, the participants were expected to use prepositions such as *in, on, into, onto* and *behind* to express the motion events. The filler videos described various kinds of (non)-motion actions.

3.2 Procedure
The experimental items (short videos) were compiled into one movie file and were presented to the participants through a movie-player software (e.g. Windows Media Player). The videos were presented on a computer screen and the participants were instructed that they would watch a series of short videos and then they would be asked to describe what they saw. There was a small pause after each short video, during which the screen turned black. At that point, the experimenter paused the video and asked the question "What did the … do?". Each participant's response was taken down by a second experimenter on an answer sheet. All participants were tested individually in a quiet room.

3.3 Participants
Overall forty-eight subjects participated in the production experiment, twenty-three in the German test and twenty-five in the Greek test. Details about the participant groups are provided in Table 1:

Table 1. Participant groups

Groups	Number		Age	
	German	Greek	German	Greek
Adults (AD)	8	10	19-33	20-31
TD children	7	7	5;0-5;11	5;1-6;0
SLI children	8	8	5;2-6;4	5;1-6;2

4. Results
All irrelevant responses, i.e. responses that did not involve motion events, have been eliminated. For the Greek test, this resulted in the elimination of 4% (6 out of 160

responses) of the adult, 11% (12 out of 112 responses) of the TD child and 20% (25 out of 128 responses) of the SLI child data. The TD and the SLI children produced significantly more irrelevant responses than the adults (TD children: $\chi^2=6.502$, p<0.02; SLI children: $\chi^2=21.683$, p<0.001). In addition, the SLI children produced more irrelevant responses than the TD children, even though this difference only approached significance ($\chi^2=3.561$, p=0.059). For the German test, this resulted in the elimination of 3% (4 out of 128 responses) of the adult, 14% (16 out of 112 responses) of the TD child and 17% (22 out of 128 responses) of the SLI child data. The two child groups produced significantly more irrelevant responses than the adults (TD children: $\chi^2=9.740$, p<0.01; SLI children: $\chi^2=13.870$, p<0.001). Moreover, the SLI children performed worse than the TD children, even though the difference between the two child groups was not statistically significant. In all subsequent analyses only relevant responses have been counted. In sections 4.1 and 4.2 we present the Greek and the German versions of the production experiment respectively.

4.1 The Greek production task

First, we present the target and non-target responses per video condition and participant group (see Graph 1). Any utterances that unambiguously denoted telic motion events in the atelic video condition and atelic motion events in the telic video condition were considered as non-target. For example, the predicate in sentence (8) describes an unambiguously telic event, since the verb *beno* (enter) incorporates the PATH and the PP *stin kuzina* (into the kitchen) is necessarily a complement. Such a response is non-target, when the video describes an atelic motion event, and target, when the video illustrates a telic motion event.

(8)   I jineka bike stin kuzina.
        the woman entered$_{PERF.3S}$ *s*-the kitchen
   "The woman entered the kitchen."

In addition, sentence (9) denotes an atelic, locative, motion event, because the manner-of-motion verb is in the imperfective. Such an utterance was considered as non-target for the telic videos and as target for the atelic videos.

(9)   To aeroplanaki petuse se mia ethusa.
        the airplane flew$_{IMP.3S}$ in a room
        "The airplane was flying in a room."

Consider, finally, sentence (10):

(10) I petaludha petakse mesa sto vazo.
        the butterfly flew$_{PERF.3S}$ in *s*-the vase
        "The butterfly flew inside/towards/into the vase."

As already discussed in section 2, the predicate in (10) is ambiguous with respect to the description of (a)telic motion events. In other words, as far as the grammatical representation is concerned, there are two possible structures. In one, the PP denotes the GOAL and is the complement of the verb, whereas in the other the PP denotes the PATH and is an adjunct. Therefore, such utterances have been counted as target responses in both the telic and the atelic video conditions.

Graph 1. Greek test: (Non)Target responses per group and condition
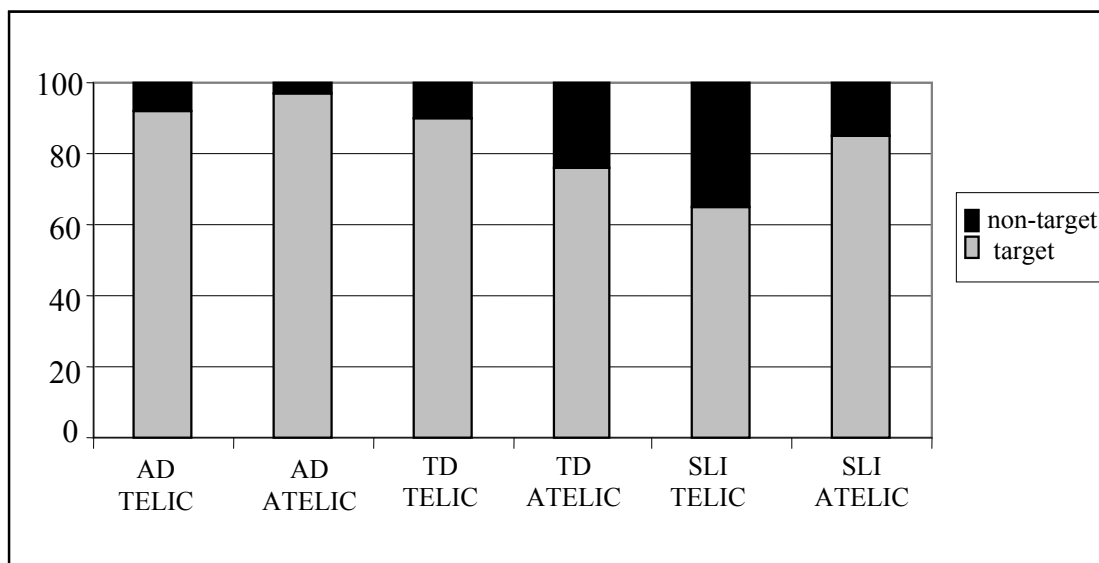
As is obvious from Graph 1, the TD children performed better on the telic than the atelic videos, whereas the reverse pattern has been attested in the SLI children. These observations have been confirmed statistically. Namely, in the telic video condition there were no statistically significant differences between the adults and the TD children, while the SLI children performed significantly worse than the adults (χ^2=15.232, p<0.001) and the TD children (χ^2=8.883, p<0.01). On the other hand, in the atelic condition, the two child groups did not differ from each other, whereas the adults performed significantly better than both child groups (TD children: χ^2=13.799, p<0.001; SLI children: χ^2=7.097, p<0.01).

The following graph presents the percentages of ambiguous (cf. (10)) and unambiguous target responses in each video condition. Notice that unambiguous target responses in the telic condition were utterances including a perfective motion verb that inherently denotes PATH, i.e. *go, enter* (e.g. (8)). In the atelic videos, utterances containing imperfective manner-of-motion verbs (e.g. (9)) and responses in which lexical means or inherently atelic verbs are used to express location (cf. (11) and (12) respectively) were counted as unambiguous:

(11) Enas antras ekane voltes stin apothiki.
      a man did$_{3S}$ rounds *s*-the loft
      "A man was walking back and forth in the utility room."

(12) To koritsi horopidhise mesa stis laspes.
      the girl bounced$_{PERF.3S}$ in *s*-the mud
      "The girl was jumping up and down in the mud."

The adults and the TD children produced more ambiguous responses in the telic than in the atelic videos (AD: χ^2=11.588, p<0.01; TD: χ^2=5.660, p<0.02), whereas this was not attested in the SLI data set. Turning to the between-group comparisons, the adults produced significantly more ambiguous responses than the SLI children in the telic (χ^2=7.697, p<0.01), but not in the atelic video condition. The comparisons between the adults and the TD children one hand and between the two child groups on the other revealed no significant differences in either condition.

Graph 2. Greek test: (Un)Ambiguous responses per group and condition
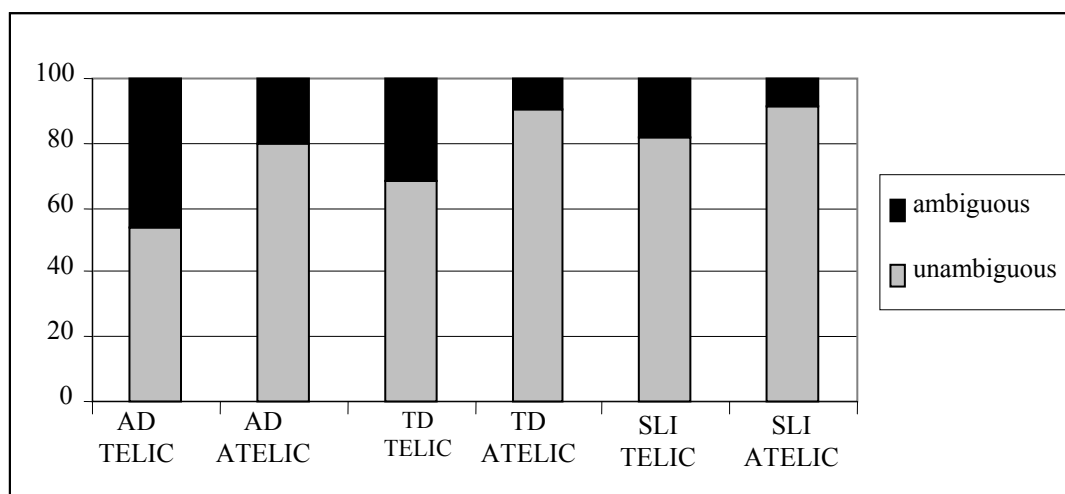
An additional analysis has been performed for the unambiguous target responses in the atelic video condition, in order to investigate whether the participants relied more on grammatical means, i.e. morphological aspect, or on lexical means, i.e. light verbs with nouns showing atelic locative events (e.g. (11)) and inherently locative verbs marked for perfective (e.g. (12)).

Graph 3 presents the frequency of grammatical and lexical responses:

Graph 3. Greek test: Analysis of unambiguously target responses in the atelic video condition (%)
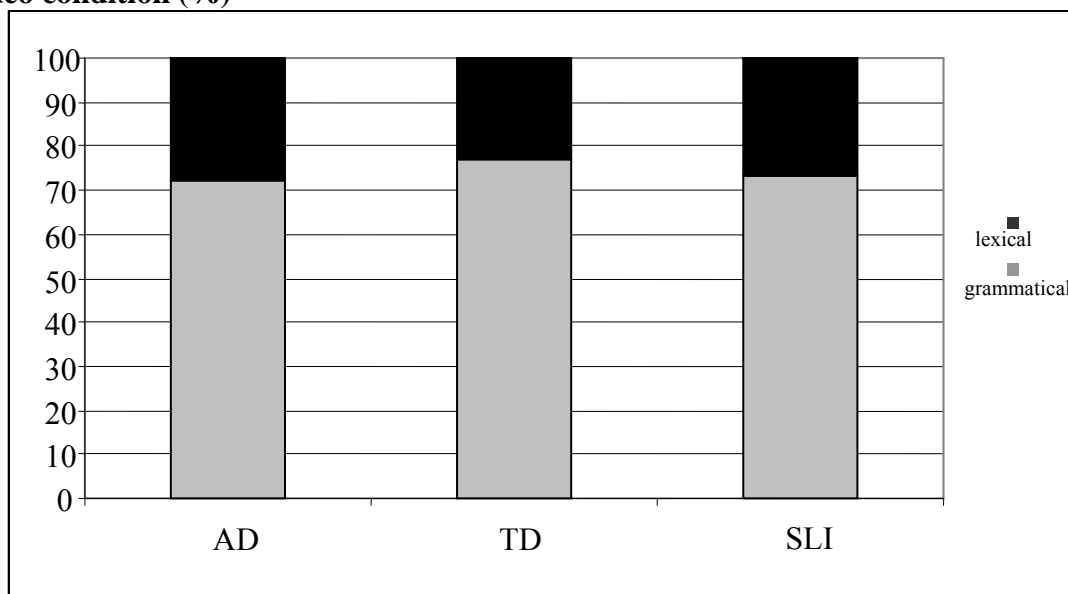
Graph 3 shows that all three groups relied more on the aspectual form of the verb, i.e. imperfective, to describe an atelic motion event rather than on lexical means (AD: $\chi^2=11.267$, $p<0.01$; TD children: $\chi^2=10.314$, $p<0.01$; SLI: $\chi^2=8.100$, $p<0.01$). Moreover, the three groups did not significantly differ from each other with respect to the way they expressed an atelic motion event.

4.2 The German production task
As in the Greek part, we present target and non-target responses per video condition and participant group (see Graph 4). As in the Greek test, any utterances that unambiguously denoted telic events in the telic video condition and vice versa for the atelic condition were considered as target. This means that all constructions with simple or particle motion verbs with a PP denoting the goal or the location of the event used to describe a telic and an atelic motion event respectively were considered as target responses.

(13) Der Wurm kriecht in die Tasse (rein/hinein).
       the worm crawls in the$_{ACC}$ cup (into-$_{PART}$)
       "The worm crawls into the cup."
(14) Der Wurm kriecht in der Tasse (rum/herum).
       the worm crawls in the$_{DAT}$ cup (around-$_{PART}$)
       "The worm is crawling in the cup."

As can be seen from the examples in (13) and (14) the crucial difference is the use of a dative or accusative marked DP complement of the preposition. Recall from section 2 that for the telic condition the unmarked option is the use of simple motion verbs with directional PPs (= PP$_{ACC}$), whereas for the atelic condition the unmarked option is the use of particle verbs with locative PPs (= PP$_{DAT}$).

Responses with errors relevant for the telic or atelic interpretation are considered as non-target. These are utterances in which case marking is wrong (dative for accusative or vice versa, or use of nominative case), case marking is missing (because of article omission) and also responses without spatial PPs.

Semantic mismatches of the relevant prepositions which especially occur in the SLI data, are not considered here since these errors predominantly affect the locational specificity (e.g. *in* vs. *behind*), but not the differentiation between telic and atelic event.

As shown in Graph 4, all groups performed better on the telic than on the atelic video condition. However, this difference was statistically significant only for the SLI group (χ^2=22.047, p<0.001). Furthermore, in the telic condition the adults produced significantly more target responses than both child groups (TD children: χ^2=14.536, p<0.001; SLI children: χ^2=30.049, p<0.001), but there was no difference between the TD and the SLI children. On the other hand, in the atelic condition all between-group comparisons were significant (adults *vs* TD children: χ^2=18.182, p<0.001; adults *vs* TD children: χ^2=69.466, p<0.001; TD children *vs* SLI children: χ^2=20.408, p<0.001), showing that the adults performed better than the two child groups and that the TD children performed better than the SLI children.
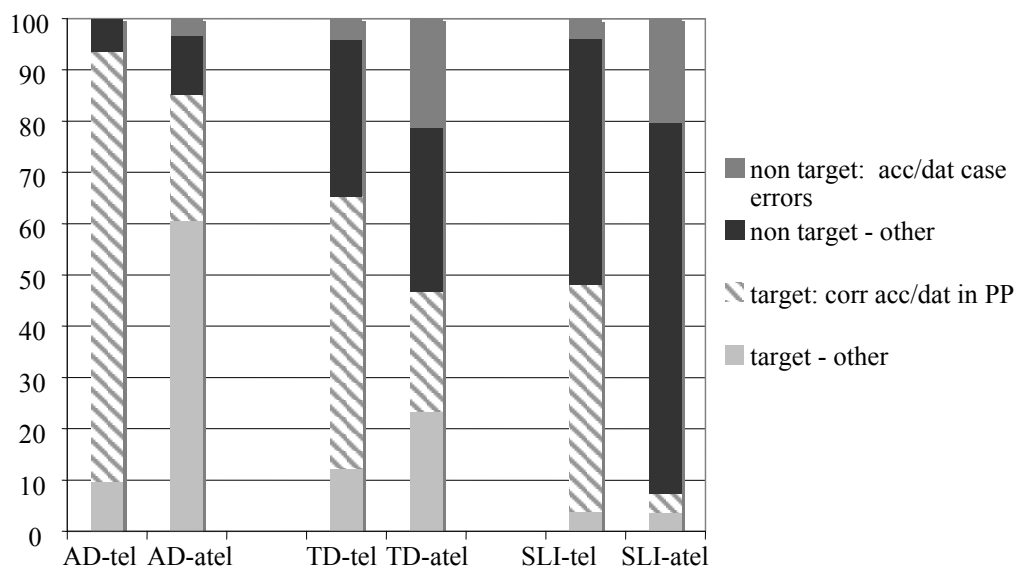
Graph 4. German test: (Non)Target responses per group and condition
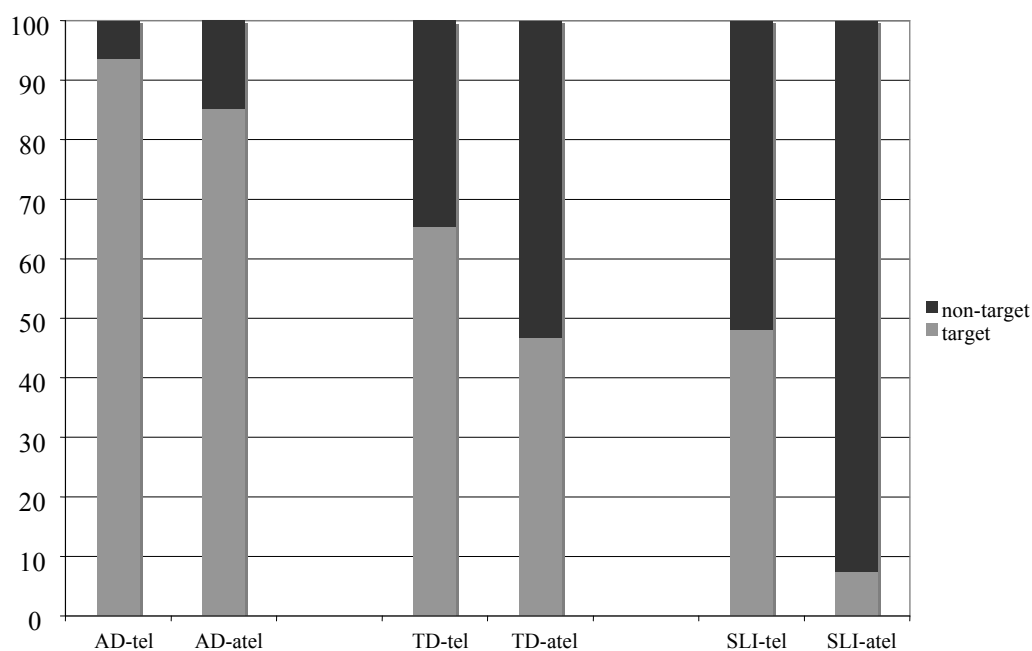
A more detailed analysis of the target and non-target responses of the three groups is given in Graphs 5 and 6.
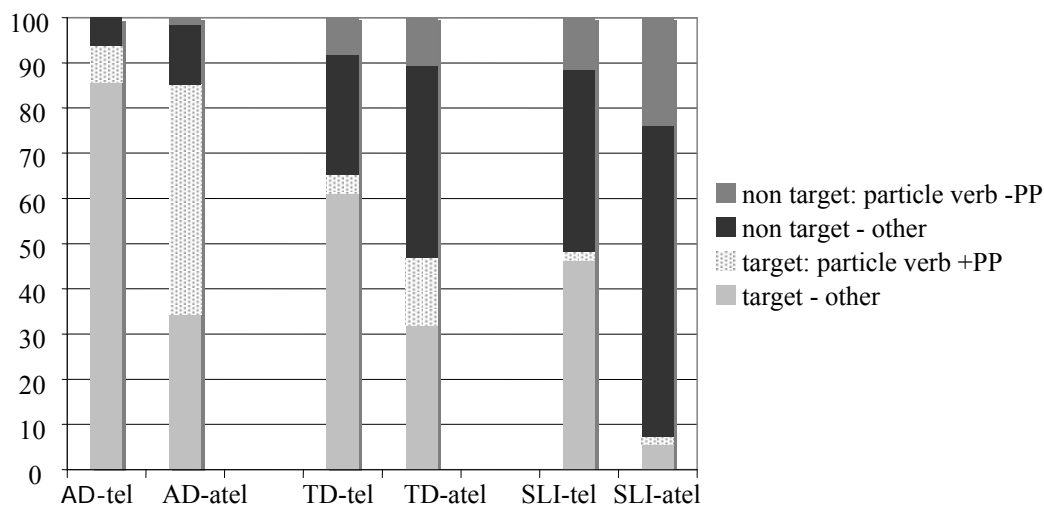
Graph 5 illustrates the analysis of target and non-target answers in more detail. First, we concentrate on the telic condition. An analysis of the target responses in this condition reveals that using a simple motion verb and correct accusative case in the PP is the prominent means to mark a telic event. Other target answers are responses with prepositions not allowing for case alternation between accusative and dative (i.e. *zu*, see fn. 2) and some rare particle verbs (cf. Graph 6). The adults produce significantly more constructions with simple motion verbs and P+DP$_{ACC}$ than the TD (χ^2=12.799, p<0.001) and the SLI group (χ^2=20.231, p<0.001), whereas the two child groups do not differ significantly from each other (p>0.1). Like the age-matched children, the SLI children use P+DP$_{ACC}$ correctly to mark direction and they seem not to have more problems to produce the PP complement in the telic construction than the age-matched group. The analysis of the non-target answers in the telic condition underpins this result. There is no difference between the two child groups with respect to the error type "case change", i.e. use of P+DP$_{DAT}$ in the telic condition. Furthermore, this error type accounts only for a small part of all errors.

Graph 6 reveals that omission of the locative PP is more prominent than dative-for-accusative errors, but most non-target responses are counted as such because of article omissions in the PP and nominative case instead of accusative marking. Graph 6 reveals no difference between the groups in the frequency of particle verbs in the telic condition; particle verbs are clearly the non-preferred option in the telic condition. The only difference is that the two child groups omit the PP in particle verb constructions, while none of the adult group omits the PP in the telic condition.

Graph 5. German test: (Non)target responses – accusative vs. dative case

Legend:
- non target: acc/dat case errors
- non target - other
- target: corr acc/dat in PP
- target - other

(x-axis: AD-tel, AD-atel, TD-tel, TD-atel, SLI-tel, SLI-atel)

Graph 6. German test: (Non)target responses – particle verbs ± PP

Legend:
- non target: particle verb -PP
- non target - other
- target: particle verb +PP
- target - other

(x-axis: AD-tel, AD-atel, TD-tel, TD-atel, SLI-tel, SLI-atel)

Comparing the results of the telic condition to those of the atelic condition, we observe that the rate of inappropriate case changes from dative to accusative in the non-target responses is almost identical in the TD and the SLI group. However, the two child groups differ in that the SLI group produced significantly fewer simple motion verbs with P+DPdat ($\chi^2=7.231$, $p<0.01$). The TD group is similar to the adult group in this respect, and the adult group also differs significantly from the SLI group ($\chi^2=7.877$, $p<0.01$). Moreover, in the atelic condition the adult group exhibits a preference to produce particle verbs with locative PPs more often than simple motion verbs. In this respect, the adult group differs significantly from the TD ($\chi^2=15.024$, $p<0.001$) and the SLI group ($\chi^2=34.199$, $p<0.001$). Furthermore, the SLI children use particle verb constructions with PPs significantly less often than the TD children ($\chi^2=5.860$, $p<0.02$). The SLI children, when they use particle verbs, typically omit the locative PP, which is not the case for the TD children. More specifically, in the atelic videos the PP omission is more frequent in the SLI than in the TD data ($\chi^2=7.949$, $p<0.01$), while this difference is not significant in the telic video condition. As in the telic condition, most non-target responses which are not categorized as errors of accusative instead of dative case or

omission of the prepositional phrase are article omission and nominative case instead of dative marking.

5. Discussion

Let us first summarize the main findings from the Greek and the German production tests. In Greek, it has been attested that TD children at the age of 5-6 years have an adult-like behavior when describing telic events, while they differ from the adults when describing atelic events. Turning to the comparison between the two child groups, the SLI group was found to experience more difficulties than the TD children when expressing telic events. In this condition, the SLI group relied more on lexical means (unambiguously telic verbs, i.e. *go, enter*) than on the aspectual form of the verb (i.e. perfective aspect) to express telic events. However, the two child groups did not exhibit any differences with respect to the production of atelic motion events. In this condition, all three groups preferred to employ morphological aspect, imperfective verb forms, rather than lexical means to express atelicity.

In German, all three groups performed better in the telic (direction) than in the atelic (locative) condition. This might be due to the fact that the directional PP is a complement of the verb, whereas the locative PP is an adjunct. The differences between the adult and the child groups reflect preferences of certain constructions. In the telic condition, the SLI group patterns with the TD group, so we assume that the syntactic representations in the SLI children are intact. On the other hand, in the atelic condition the SLI children display more problems than the TD children. The more frequent errors they produce are omission of the PP, article omissions in the PP and case errors (nominative). In contrast, the TD and the SLI group do not differ with respect to the errors involving case alternation, accusative *vs* dative, which would result in interpretation a change of telic versus atelic interpretation. So, for German, we find no evidence for a specific problem in the production of telic and atelic motion events. The SLI children produce more "in-construction-errors" than the TD children, thus revealing the language deficit (article omissions, other case errors).

The comparison between the Greek and the German findings shows certain parallelisms but also divergences. Both data sets show that TD Greek and German children at the age of 5-6 years do not have an adult-like behavior when describing (a)telic events. However, the differences between the adult and the TD child groups in both languages do not reflect so much problems in grammatical means, i.e. case marking or morphological aspect, but rather problems in the integration of grammatical means into motion predicate structures. Therefore, the grammaticalization of telicity seems to be a late acquired notion.

Furthermore, the Greek and the German SLI groups differ from the TD children in the production of (a)telic events. In particular, the Greek SLI children were found to have problems with the encoding of telicity, in particular with the use of perfective aspect, and relied more on lexical means rather than on morphological aspect to express telic events. Recall, however, that the perfective manner-of-motion verbs are ambiguous in Greek and the telic interpretation is the preferred, but not the only available, one for adult native speakers of Greek (see also Papadopoulou 1996). This implies that the SLI children may have a preference for unambiguous constructions, verbs that inherently show directed motion in this case, which involve one-to-one form-meaning correspondence[4].

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[4] See also Tsimpli & Papadopoulou 2009 for a similar argument with respect to adult second language acquisition.

On the other hand, the German SLI group produced "in construction" errors that predominantly shaped the results in the atelic condition, which requires dative case marking in the DP complement of the preposition. Therefore, the German SLI children appear to experience problems with marking the dative case in the atelic condition which is the last acquired case marking in unimpaired children.

Taking together the findings from both languages, we conclude that the SLI children do not differ from the TD children at the conceptual level, i.e. in the expression of (a)telicity per se, but rather at the linguistic level. The differences between the two child groups may be accounted for by grammatical problems and a delay with case marking and morphological aspect. The Greek data also indicate that the SLI children exhibit a preference for unambiguous constructions, an issue that requires further investigation.

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