Opening Doors and Sweeping Floors:
What Children with Specific Language Impairment Know about Telic and Atelic Verbs

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1. Introduction

It is well known that children with SLI show verb-related limitations (for an overview, see Hadley, 1998). Previous studies have focused on mastery of verbal morphology, verb complementation, and on patterns of verb use, while the mastery of verb semantics has not been the focus of much research. The goal of this study was to investigate SLI children's knowledge of the event-semantic representation of telic (e. g., *aufmachen* 'open') and atelic (e.g., *fegen* 'sweep') verbs in German. Our earlier studies indicated that up to age six children with SLI do not have an adult-like interpretation of the telic verb *aufmachen* 'open', while normally developing (ND) children interpret this verb correctly from early on (Schulz, Wymann & Penner, 2001; Schulz, Penner & Wymann, 2002; Wittek, 2002; Penner, Schulz & Wymann, in press). Furthermore, children with SLI – unlike ND children – do not exhibit a preference for change-of-state over motion scenes (Kelly & Rice, 1994). Schulz et al. (2001, 2002) propose that these deviations in children with SLI result from an event-semantic representation of complex events in which an endstate is not specified. This proposal predicts that children with SLI should misinterpret telic verbs in general while

interpreting atelic verbs in an adult-like manner. These predictions were tested in an act out version of the Truth-Value Judgment Task with atelic as well as with a wider range of telic verbs.

This paper is organized as follows. Section 2 sketches the event-semantic representation of telic and atelic verbs. In Section 3 we outline the acquisition task for the child and a learning strategy for ND and SLI children's verb acquisition. Section 4 presents our experimental comprehension study, and Section 5 discusses the findings. Section 6 concludes with implications of these findings for SLI children's verb use.

2. The event-semantic representation of telic and atelic verbs

Verbs generally designate events including situations and actions like *being in love, laughing, sweeping*, and *opening*. Verbs differ in terms of the temporal make-up of the event they designate (cf. Comrie, 1976). Events may have a terminal endpoint built into them leading to a natural culmination point or may be without such a terminal endpoint allowing the event to be continued indefinitely or stopped at any moment in time. Verbs designating events with terminal endpoints are traditionally referred to as telic verbs, and verbs designating events without such an endpoint are called atelic. Languages differ as to how event-types are marked in syntax and word formation. Apart from verbs with an inherently telic event-type (e.g., *open, find, arrive*), telicity of the predicate often depends on event-semantic properties of other elements in the sentence. Thus, telicity is either determined by the lexical semantics of the verb itself or compositionally via the interaction with the morpho-syntactic context the verb appears in (cf. Krifka, 1989; Schulz & Penner, 2002; van Hout, 1998, 2000). In what follows we will focus on inherently telic particle verbs such as *aufmachen* 'open' (for the acquisition of compositional telicity, see Schulz & Penner, 2002). In particle verbs the telicity marking is transparent because the particle (e. g., *auf* 'OPEN') denotes the endpoint.

Following Pustejovsky's (1991, 1995) model of event typology, verbs can be classified according to the type of event they designate. States like *be in love* are defined as a single event, processes like *laugh* as a sequence of similar events, and transitions are defined as complex events involving a transition from one subevent to another. *Open* and *sweep*, for example, both designate transitions from a process to a state. They differ with regard to the hierarchy of the two subevents. In endstate-oriented transitions the endstate subevent is more prominent than the process subevent. Thus, the endstate is specified as the head-of-event. In process-oriented transitions, on the other hand, the endstate subevent is not prominent and is therefore not specified as the head-of-event.[1]

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1. Pustejovsky (1995) assumes that verbs like *sweep* are assigned an event-semantic representation with the process subevent as the 'head-of-event'. It is a matter of debate, however, whether process-oriented transitions are specified for a head-of-event at all.

Endstate-oriented transitions are typically expressed by telic verbs. As illustrated in (1a), the endstate is entailed by the telic verb. (1b) shows that the endstate is not cancellable, i. e. it is not possible to cancel the entailment by adding some additional premises to the original ones (cf. Grice, 1975).

(1)   a. Jill opened the door. $\rightarrow$ door is open
        b. Jill opened the door, *but it is not open.

Furthermore, as illustrated in (2), the endstate is not detachable, i. e. the entailment cannot be detached by replacing the telic verb with a synonym.

(2)   a. Jill opened the present. $\rightarrow$ present is open
        b. Jill unwrapped the present. $\rightarrow$ present is open

In short, telic verbs can only designate events with their terminal endpoint reached, henceforth referred to as completed events. Process-oriented transitions, on the other hand, are typically expressed by atelic verbs. The example below shows that an endstate if often implicated by atelic verbs (3a), but not entailed (3b).

(3)   a. Joe swept the floor, and the floor is clean.
        b. Joe swept the floor, but it is not clean.

In sum, atelic verbs can designate events with the implicated endpoint reached or not reached. In case the endpoint is not reached, we refer to the event as incomplete.

3. The acquisitional perspective

The acquisition task for the language learner is multifold. First, she has to master the lexical event-semantic properties of the individual verbs. She has to learn the difference between telic and atelic verbs and between inherently telic verbs and verbs that can alter their event-type. Put differently, the child has to find out whether the endstate in the verb's event-semantic representation is entailed, or implicated or altogether absent and how this representation can be modified. Second, the language learner has to recognize the possible mappings between events and types of predicates. While atelic verbs, for example, are used to designate completed and incomplete events, telic verbs only designate events with their terminal endpoint reached.

Previous studies on children's verb interpretation revealed that ND children exhibit an adult-like interpretation of telic verbs such as *aufmachen* (open) starting at age three. Wittek's (1998, 2002) studies indicated that four- and five-year-old children correctly accept the inherently telic particle verbs *aufmachen* (open), *zumachen* (close), *abmachen* (remove), and *ausmachen* (extinguish) for

completed events only.[2] In a study with younger children, we found that already at age 2;10 children correctly interpret the particle verb *aufmachen* (open) as telic (Schulz et al., 2001, 2002). These results indicate that inherent telicity expressed by particle verbs is acquired very early. Furthermore, four-year-old ND children exhibit a preference for change-of-state over motion scenes when asked to match a novel verb to one of two scenes (Kelly & Rice, 1994).

Our case study of SLI children's interpretation of the telic verb *aufmachen* (Schulz et al., 2002; Penner at al., in press) indicated that children with SLI do not possess an adult-like interpretation of this telic verb up to age six. In the novel verb matching task, Kelly & Rice (1994) found that five-year-old LI children, unlike their age-matched peers, did not show any preference in applying a novel verb to either a motion or a change-of-state scene.

To account for these findings in a general way, we have suggested a learning strategy of (no) endstate-orientation that guides children's verb learning (for details, see Penner et al., in press; Schulz et al., 2001, 2002). The strategy of endstate-orientation assumed to guide ND children's learning of verbs works as follows. The language learner focuses first on the endstate component of events. As a default she assumes an event-semantic representation of transitions in which the endstate is marked as the head-of-event. A child who follows this learning strategy is expected to correctly interpret telic verbs from early on. Moreover, the child should initially show an overgeneralization of atelic verbs as telic, before achieving an adult-like understanding of atelic verbs.

SLI children's verb learning is assumed to follow a 'no endstate-orientation' strategy. It is hypothesized that unlike ND children they do not focus on the endstate component of events. A language learner with SLI assumes as a default an event-semantic representation of transitions in which the endstate is not specified as a head-of-event. As a result, SLI children are expected to misinterpret telic verbs in general. Under this account, atelic verbs are predicted to receive an adult-like interpretation, since the event-semantic representation of atelic verbs corresponds to the default representation employed by SLI children. In short, our hypothesis is that unlike ND children, children with SLI lack an endstate orientation, resulting in an incorrect interpretation of telic verbs, but in an apparently target-like understanding of atelic verbs.

To date, the study of SLI children's understanding of telic verbs has been limited to the verb *aufmachen* (open). What is more, to our knowledge the question of how ND and SLI children master the properties of atelic verbs has not been addressed. Therefore, we designed a comprehension experiment to investigate atelic as well as a wider a range of telic verbs.

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2. Wittek (2002) showed that verbs that are typically used to refer to events in which an endstate is reached gradually (e. g., *vollmachen* 'fill') are problematic for these children.

4. Experimental study

In this comprehension experiment, subjects were asked to match their interpretation of sentences containing telic and atelic verbs with completed or incomplete events. Rather than using video clips or picture sequences as in our earlier studies we designed scenes that were acted out by a puppet. This way we sought to reduce the demands of the task for the child and at the same time avoid ambiguities regarding the end of a scene (for details cf. Wittek & Schulz, 2001).

4.1. Subjects

Thirty-two German-speaking children between the ages of 4;3 and 6;3 participated in the experiment: 16 children with SLI (11 boys, 5 girls, MEAN = 5;3; SD = 6.8 months), and 16 chronologically age-matched normally developing children (11 boys, 5 girls, MEAN = 5;3, SD = 7 months). 16 university educated adults served as a control group. All of the subjects were native German speakers, with no known history of physical, socio-emotional, or mental impairments. The children were drawn from several daycare centers in Stuttgart and Leipzig. The children were tested in the daycare centers and the sessions were video-taped for later transcription.

The children with SLI met the following criteria: a) they were diagnosed by speech therapists as suffering from receptive and expressive language deficits, b) their cognitive functioning was reported to be within normal limits for age, and c) there was no report of hearing impairments. All children with SLI were enrolled in a preschool program for children with language disorders. None had received any therapy focusing specifically on verb meanings.

The chronologically age-matched children were matched so that for each child in the first group of children with language impairment there was a child in the age-matched group within one month of age. All normally developing children exhibited age-appropriate social and cognitive functioning according to preschool teacher reports. To ensure that the normally developing children had age-appropriate language skills, they were tested on language comprehension, production, and memory tasks, using the SETK 3-5 (Grimm, 2001). One child had to be excluded because he obtained scores in the lowest 20 % in all four subtests.

4.2. Method

A version of the Truth-Value Judgment Task was used. Each subject saw 16 scenes acted out by a puppet. Eight scenes tested telic verbs (two scenes each involving *aufmachen* 'open', *zumachen* 'close', *abmachen* 'take off', *anmachen* 'turn on'). Eight scenes probed children's understanding of atelic verbs (*fegen* 'sweep', *malen* 'draw', *wischen* 'wipe', *bauen* 'build', *schneiden* 'cut', *bürsten*

'brush', *pusten* 'blow, *puzzeln* 'do a puzzle').[3] In half of the trials the event was depicted as not reaching an endpoint, e.g., manipulating a container without opening it or sweeping the floor halfway ('incomplete event condition'). These served as the test trials. The other half of the trials, structured like the test trials, served as controls. For the telic verbs, the control trials consisted of demonstrations of completed events (e. g., a light is turned on). For the atelic verbs, the control trials consisted of demonstrations of events showing a non-target action (e. g., a broom is thrown up in the air). These control trials were added to ensure that children paid attention to each item until the end and to provide an equal number of *yes* and *no* responses. After each scene a yes/no question was asked to test whether subjects accepted the verb for the kind of event depicted. The following example illustrates a scene testing a telic verb in the incomplete event condition.

(4) Example telic verb (incomplete event)

E1:	Guck, hier ist die Tür. Mal sehn was das Mädchen jetzt macht.
	'Look, here is the door. Let's see what the girl does now.'
Act out:	Girl closes door halfway
Test question:	Hat das Mädchen 'se zugemacht?
	has the girl her.Cl ZU-made.Part
	'Did the girl close it?'

When asked to match a telic predicate such as in (4) with an incomplete event, the answer should be *no*. With a completed event, the answer should be *yes*. An example of an atelic test item is given in (5) below.

(5) Example atelic verb (incomplete event)

E1:	Guck, hier ist der Besen. Mal sehn, was das Mädchen jetzt macht.
	'Look, here is the broom. Let's see what the girl does now.'
Act out:	Girl sweeps some of the confetti from the floor
Test question:	Hat das Mädchen gefegt?
	has the girl swept.Part
	'Did the girl sweep?'

When asked to match an atelic predicate such as in (5) with an incomplete event, the answer should be *yes*. With a non-target action the expected answer is *no*. A block design was used for the telic and atelic verbs with the order counterbalanced across subjects. In addition, order of test items and controls was con-

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3. All verbs have been attested in the spontaneous speech of German-speaking three-year-old normally developing children and also of children with SLI (with the exception of 'do a puzzle', 'blow', and 'wipe'). Note that for reasons of consistency, all atelic verbs were chosen to designate events in which an action is carried out by using a specific instrument, e. g. sweeping is done with a broom.

trolled for by using eight different orders, thus arriving at 16 different lists to which subjects were assigned randomly.

4.3. Procedure

Each subject was tested individually in one or two sessions. Before the actual experiment two pretests were administered. One pretest served to ensure that both ND and SLI children were able to respond to yes/no questions appropriately. While children were engaged in exploring and manipulating the objects used in the act out scenes, they were asked eight simple yes/no questions about the objects (e.g., *Is that a door?*). Only those children who answered three out of four *yes* questions and three out of four *no* questions correctly, participated in the main test. All children passed this pretest. Since the comprehension of atelic verbs has not been investigated previously, a second pretest was designed to examine whether ND and SLI children know the core meaning of the atelic verbs. Using a forced object choice task, we tested whether children – when prompted with an atelic verb such as *sweep* – are able to pick the appropriate instrument out of an array of four instruments (e. g., puzzle, book, broom, comb). Only those children who responded correctly to seven out of eight pretest trials participated in the main test. No child had to be excluded.

Followed by two practice trials for the atelic and two for the telic test items, each subject was presented with the 16 test items. As in the practice trials, the experimenter introduced the scene and then the puppet acted out the event, while the subject and a second hand puppet, which was introduced as learning the language, watched the scene. After the performance, the 'act out' puppet was seated away from the scene to clearly indicate that the action had stopped. The yes/no questions were then asked by the hand puppet.

4.4. Predictions

We predicted that the ND children should interpret telic and atelic verbs adult-like. SLI children, on the other hand, should interpret atelic verbs adult-like, while interpreting telic verbs non-target-like. More specifically, SLI children should accept telic verbs also for events in which the endstate is not reached, since they allow a process-oriented interpretation for inherently telic verbs. Performance on the control items was predicted to be high for all subjects.

4.5. Results

Responses to the test questions were coded as a yes- or no-response. If an answer other than *yes* or *no* was given, it was classified as a positive or negative response depending on whether it expressed rejection or acceptance of the sentence for the type of event displayed in the story. This classification was carried out independently by three researchers. Disagreements were resolved by discus-

sion. Figure 1 shows the mean percentages of correct responses for adults, ND children, and SLI children for the control items.
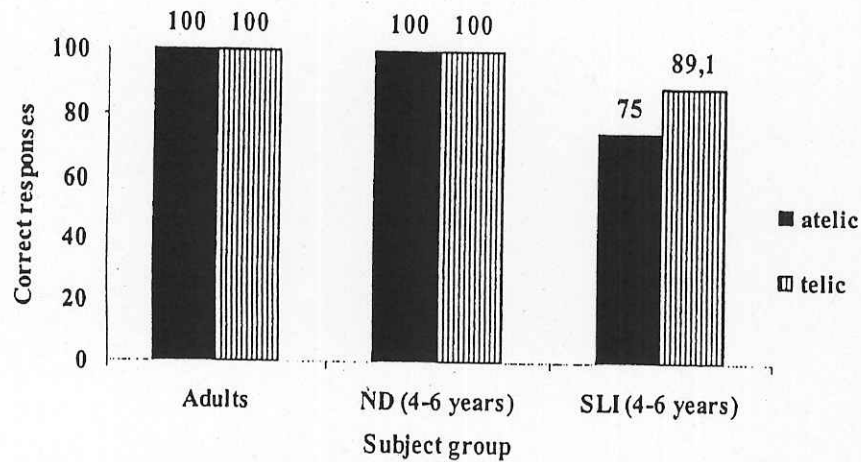

Figure 1. Correct responses by subject group and verb type to the controls

As can be seen in Figure 1, performance on the control items was at ceiling for the adults and the ND children. SLI children's performance, while not at ceiling, was well above chance, with no significant difference between telic and atelic verbs ($t(15) = -1.429, p = .983$).

Figure 2 below shows the mean percentages of correct responses for adults, ND children, and SLI children for the responses to the incomplete event condition.
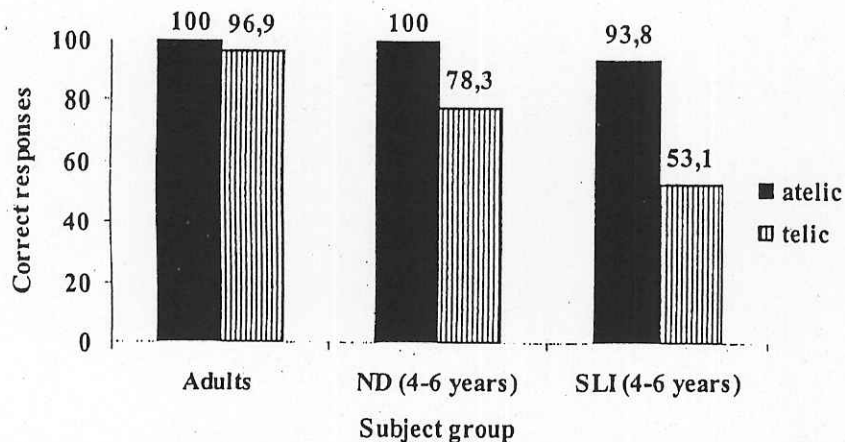

Figure 2. Correct responses to the incomplete event condition

As can be inferred from Figure 1 and 2, adults performed very well on both conditions. Hence only children's data was analyzed further. A (2) subject group × (4) condition ANOVA was performed with subject group (ND or SLI) as the between subject factor and condition (telic verb incomplete event or control, atelic verb incomplete event or control) as the within subject factor, with the last factor as repeated measures (α level .05). The analysis yielded a significant main effect of subject group (F $[1,29]=13.41, p=.001$) and of condition (F$[3,27]=8.83, p<.001$). The interaction of subject group and condition was significant as well (F $[3,27]=3.27, p = .036$). *Post hoc* comparisons of means (using the Bonferroni test, α level .05) were employed to examine possible differences between the four conditions. Looking at the ND children's responses, *post hoc* comparisons of means revealed that they performed equally well on atelic and telic verbs in the incomplete event condition ($t(14)=1.98, p=.345$). The other pairwise comparisons did not yield significant effects either. A one-sample t-test, tested against 2 (i. e. corresponding to chance performance), confirmed that performance on telic verbs (*MEAN* = 78.3) was significantly different from chance ($t(14)=3.52, p=.003$). Turning to the SLI children, *post hoc* comparisons of means revealed that in the incomplete event condition there was a highly significant difference between performance on telic and atelic verbs ($t(15)=3.83, p=.004$), due to the low mean for telic verbs (*MEAN* =53.1). Moreover, there was a significant difference between performance on telic verbs in the incomplete event condition and in the control condition, showing the completed event ($t(15)=-3.17, p=.022$). A one-sample t-test, tested against 2, confirmed that performance on telic verbs in the incomplete event condition did not differ significantly from chance ($t(15)=.32, p=.757$).

An analysis of individual responses confirmed the group patterns. Focusing on the incomplete event condition, a child was considered to have mastered this condition with atelic and telic verbs, respectively, if she gave at least three out of four correct responses to each of the verb types. All ND children and 15 out of 16 (93.75%) of the children with SLI responded as though they had mastered the atelic verbs in the incomplete event condition. The telic verbs in the incomplete event condition were mastered by 12 out of 15 (80%) ND children. In contrast, only eight out of 16 (50%) of the children with SLI mastered telic verbs in this condition. Six (37.5%) SLI children responded as though they interpreted telic verbs as atelic by responding with *yes* to the test question, and two (12,5%) of the SLI children treated telic verbs in half of the cases as telic and in the other half as atelic.

5. Discussion

As predicted performance on the control items was high for all subjects. Both ND and LI children had no general difficulty understanding yes/no questions containing telic and atelic verbs. Thus, we can conclude that children's performance on the test items, which were also worded as yes/no questions with

telic and atelic verbs, is not impeded by general problems with this question format.

The analysis of the ND children's data revealed that both telic and atelic verbs are interpreted adult-like. ND children correctly rejected telic verbs for incomplete events in 78.3% of the cases, and correctly accepted atelic verbs for incomplete events in 100% of the cases. These findings corroborate the hypothesis that at age four ND children can correctly interpret telic and atelic verbs. Analysis of the SLI children's data indicated a different interpretation pattern. While children with SLI correctly accepted atelic verbs for incomplete events in 93.8% of the cases, rejection of telic verbs for incomplete events was at chance (53.1% correct responses). Analysis of the individual responses confirmed this difference between ND and SLI children. Only 50% of the children with SLI had mastered the telic verbs, compared to 80% of their ND age-matched peers. Atelic verbs were mastered by 93.8% of the children with SLI and by all ND children. Taken together, these results confirm that – unlike ND children – children with SLI lack an endstate orientation, resulting in a target-like interpretation of atelic and an incorrect interpretation of telic verbs.

6. Conclusion and Implications

The findings from this comprehension study corroborate and extend results from our previous studies (Schulz et al. 2001, 2002; Wittek, 1998, 2002), which indicated an adult-like understanding of telic verbs for ND children starting around age three, while children with SLI were found to show a non-adult-like interpretation of the telic verb *aufmachen* (open) until age six or seven.

The present study moreover provided first evidence that atelic verbs are correctly interpreted by both four-to six-year-old ND and SLI children. Further research is needed to examine whether this adult-like understanding of atelic verbs is preceded by a phase of overgeneralizing telic interpretations, as predicted for the ND children as a result of their adherence to an endstate-orientation strategy.

From our present study we can conclude that SLI children between the ages of four and six possess an instable representation of endstate-oriented transitions. The SLI group data indicate chance performance, suggesting that an endstate is not altogether absent from their event-semantic representation. An analysis of the individual data revealed that only two out of 16 children with SLI allowed both a process-oriented and an endstate-oriented interpretation of telic verbs, corresponding to an event-semantic representation in which a head-of-event is optionally specified. The remaining children interpreted the telic verbs either as endstate-oriented or as process-oriented, and may be representing different developmental stages. Atelic verbs were correctly interpreted by children with SLI as designating events in which an implicated endpoint may not be reached. This dissociation between adult-like performance on atelic but not on telic verbs shows that children with SLI do not have general verb comprehen-

sion deficits, but that event-semantic representations can appear target-like for particular verb-types.

Assuming a close connection between comprehension and production, the specific verb comprehension deficits found in SLI children imply that their verb production is affected in a specific way as well. Our longitudinal case studies of four ND and three SLI children (Penner et al., 1998, in press) are compatible with this prediction. The first verbal expressions of children with SLI were non-telic, while ND children logged into the verb lexicon with telic verbal expressions. The first results from an ongoing longitudinal study of 200 children, using spontaneous speech recordings and a newly developed parental questionnaire (cf. Schulz, 2002), corroborate the hypothesis that telic expressions are among the first verbal expressions used by ND children (Schulz & Vetter, 2002; this study is part of a larger project on *Early Language Development and SLI*, headed by J. Weissenborn, FOR No 381). SLI children's limitations in acquiring the semantics of telic verbs may affect their capacity to learn new verbs in general. Children with SLI have been found to predominantly use General All-Purpose (GAP) verbs (cf. Rice & Bode, 1993). A reanalysis of the types of GAP verbs used by SLI children in terms of telicity could reveal whether the lack of use of semantically specific verbs follows from the lack of an explicit event-semantic representation. Cross-linguistic research could help to clarify the relationship between mastery of telicity and verb acquisition in general. While telicity acquisition in normally developing children has been studied in several languages, including German, Dutch (cf. van Hout, 1996, 1998), English (cf. van Hout, 1998), and Russian (e. g., Kazanina & Philipps, 2002), to our knowledge telicity acquisition in children with SLI has been limited to German.

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