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Verb alternations and event structure in children with SLI compared with typically developing children. What can we learn from the story of Cinderella?

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Verb alternations and event structure in children with SLI compared with typically developing children. What can we learn from the story of Cinderella?

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Research Report

Verb alternations and event structure in children with SLI compared with typically developing children. What can we learn from the story of Cinderella?

Katie Doyle, Dr. Carol-Anne Murphy

Abstract

Background: Children with specific language impairment (CwSLI) often present with difficulties in areas of language including verb knowledge and verb-argument production. Previous research has investigated verb diversity and verb-argument structure. There is limited knowledge on the processing of event structure by CwSLI and the research around verb alternations is inconclusive.

Aims: The research aimed to investigate verb alternations and the complexity of event structures produced by CwSLI compared to typically developing children (TDC).

Methods and Procedures: The procedure involved secondary data analysis of an existing data set comprising Cinderella narratives elicited from 65 TDC and 17 CwSLI. The narratives were analysed for verb alternations and event structures of verbs. The participants were compared with subgroups of younger and older TDC and a vocabulary-matched (verb comprehension) group.

Outcomes and Results: A total of 31 verbs which could alternate were identified across the dataset. Of these, only the verbs *turn into* and *transform* were alternated by two CwSLI and nine TDC. There was a significant difference between CwSLI and TD older children (aged >6; 05) on MLU-w ($p=.003$), number of verbs ($p=.004$) and simple event structures ($p=.013$).

Conclusions and Implications: Cinderella narratives are a useful method for comparing CwSLI to TDC given comparable samples in terms of number of utterances. It is not appropriate for examining alternations as few possible alternations were produced across groups. Event processing in CwSLI, should be examined further on a more extensive sample, given the low frequency count for each event variable. There was no difference in event

structure between groups when verb knowledge was controlled for, indicating a possible correlation between verb comprehension and verb event structures.

Keywords: Specific language impairment, event processing, event structure, verb alternation, Cinderella, narrative

What this paper adds

What is already known on this subject?

CwSLI present with difficulties in verb knowledge and verb-argument production. There is limited research on event processing in SLI and the literature on verb alternations is inconclusive.

What this paper adds

The research indicates that there is a relationship between early event processing and verb knowledge. Cinderella is not appropriate for examining alternations, but it is a useful method for comparing CwSLI to TDC on a variety of variables including event structures.

Introduction

CwSLI often present with difficulties in many areas of language including sentence structure, verbs and verb argument production. Verbs play a critical role in anchoring the sentence.

Previous research has investigated verb diversity and verb argument structure. No studies investigating event processing in CwSLI were identified and the research around verb alternations in SLI is limited. Previous research shows that the boundary between semantics and syntax is blurred and these difficulties cannot be categorised as just one or the other. Verbs provide a link between meaning and sentence structure as a verb's argument structure includes information about which participants in an event are obligatorily expressed and the syntactic positions in which they should appear.

The lack of agreement in the literature on how CwSLI acquire and process verbs may be linked to the use of various sampling methods, predominantly spontaneous speech and structured elicitation tasks and may also be due to sample differences, such as age and severity of language impairment. Narratives are a more ecologically valid method of gathering data than a structured task but also capture more than free conversation.

The present paper will investigate the literature on verb alternations and event processing of CwSLI compared to TDC and identify the gaps leading to the questions addressed by the current study.

Sentence Production

Every sentence is built around a verb which projects the structure of the sentence (Hadley 1998; Loeb et al. 1998; Ebbels 2008). Difficulties with verbs can be expected to have widespread consequences (Thordardottir and Weismer 2001; 2002).

CwSLI often omit obligatory verb arguments and use fewer optional arguments (Thordardottir and Weismer 2002; Grela 2003). Many studies have shown that CwSLI demonstrate difficulties with non-canonical sentences, such as passives, datives and reversibles (van der Lely 1996; Norbury et al. 2001; Ebbels et al. 2007).

Grela (2003) studied CwSLI compared to TDC matched for mean length of utterance (MLU) and chronological age (CA) and found that the CwSLI and the MLU-matched group omitted more subjects in sentences containing ditransitive verbs than transitive/intransitive verbs. Grela (2003) attributed these omissions to difficulty in processing complex linguistic information, that is, argument structure complexity. Thordardottir and Weismer (2002) documented that CwSLI produced fewer argument types and argument structures than age-matched TDC.

Furthermore, Thordardottir and Weismer (2001) investigated lexical diversity and the use of high-frequency 'general all purpose' (GAP) verbs in school-age CwSLI. They reported that neither were areas of difficulty for CwSLI.

As the difficulties CwSLI have with sentence structure are well documented, it is useful to examine sentence processing models to best understand the underlying deficits. Garrett's model (1988, cited in Marshall 2012) assumes that sentence production involves a number of processing levels. The first, *the message level* involves event conceptualisation, and is non-linguistic (Webster et al. 2007). *The functional level* involves the selection of the verb and creation of the predicate argument structure. The surface form of the sentence is constructed at *the positional level*. Finally *phonetic encoding* prepares the sentence for articulation (Marshall 2012). If a child has difficulty conceptualising the event at the message level, this could have a knock-on effect on subsequent levels. A child may process a verb inappropriately, for example, acquires *eat* and *devour* as having the same argument structure, however *eat* does not require a direct object, while *devour* does (**the man is devouring* is ungrammatical). Their inaccurate knowledge of a verb becomes ingrained and each time they produce that verb they choose inappropriate arguments. Therefore it is conceivable that a cause of difficulties in sentence production may be associated with impairment at the message level during event processing.

Event Structure

Many studies (Ebbels et al. 2007; Thordardottir and Weismer 2001; 2002; Grela 2003) investigated semantic-thematic roles and syntactic arguments. These do not capture the 'sub-eventual' structure of verbs (Levin and Rappaport Hovav 2005). Theoretical approaches for considering the event structure of verbs are proposed by Black and Chiat (2003) and Levin and Rappaport Hovav (2005). The current study will adopt Black and Chiat's (2003) approach, which identifies the sub-situations of events as '*act, process and state*'. Verbs correspond to a particular event structure, which is a conceptual 'frame' for the meaning of the verb. Consider the following examples:

- *The apples are on the floor*
- *The apples fell on the floor*
- *Bill dropped the apples on the floor*

The first sentence expresses a static situation. The verb in the second sentence conveys more information communicating the process of how the apples arrived at the state. The third corresponds to a more complex 'sub-eventual' structure involving an initial act by a participant (Bill) that triggers a process/cause of change in another participant (apples) in turn causing a state (apples are on the floor) (Black and Chiat 2003; 2008).

Event Processing and Typically Developing Children

Verbs often refer to transient events which make them difficult for children to learn (Ambalu et al. 1997). Adults do not usually label events as they are occurring in natural settings, as they do with nouns (Penner et al. 2003). Children must first conceptualize aspects of event structure and then map words onto those concepts (Pulverman et al. 2008). Even simple scenes may be viewed from different perspectives, involving different verbs, for example, a baby dropping a rattle can be viewed from the baby's viewpoint: *baby let go* or from the rattle's perspective: *rattle dropped* (Ambalu et al. 1997).

The acquisition of verb meanings involves several learning processes: child-driven (perceptual, cognitive or linguistic biases), environment-driven (frequency, timing and

variability) and language-driven (learning rules based on knowledge of the verb lexicon) (Penner et al. 2003). Ambalu et al. (1997) reported that the timing of the verb model can also affect the acquisition of the verb, as a movement verb (non-word *pog*) was learned better by TDC when presented before the event, while a result verb (non-word *bock*) was acquired better when presented after the event.

Children use *semantic bootstrapping* (Pinker 1989) and *syntactic bootstrapping* (Gleitman 1990) during early language development to comprehend and produce verb argument structures (Ambalu et al. 1997). Consider the following examples:

- *I filled the glass with water*
- *I poured water into the glass*

In order to use verb argument structure accurately, children require detailed semantic representations of verbs. Initially syntax plays a crucial role in the learning of semantic representations (Ebbels et al. 2012). The focus of an event may cue the child to the verb's focus, but the presence and order of arguments in the utterance describing the event aid this process (Chiat 2000). It is suggested that when a child utters **I filled water into the glass*, they are overgeneralising the syntactic structure of the verb *pour* (Ambridge and Lieven 2011). CwSLI may demonstrate "observational biases" relying on cues such as the salience of changes in the participants of an event (Ebbels et al. 2012). If children rely on these biases rather than syntactic bootstrapping, they are likely to be poorer on change-of-state verbs (*fill*) rather than change-of-location verbs (*pour*). These errors have not been investigated with event structure in mind and perhaps they reflect an entrenched, under-developed knowledge of verbs and events.

Event Structure and SLI

Acquiring verbs is a complex process and it is conceivable for a child to encounter difficulty processing events. CwSLI often present with poor attention, processing and play skills and sometimes have co-morbid motor difficulties (Paul and Norbury 2012). Their notion of a particular verb may become entrenched and they do not receive adequate input from the

environment to change this. This is plausible as the participants in Ebbels et al. (2007) only improved their verb argument structures through explicit teaching methods.

Andreu et al. (2013) investigated the effects of conceptual factors, such as event processing, on language production by comparing 11 CwSLI to TDC in an eye tracking experiment. While CwSLI omitted more obligatory arguments as verb argument complexity increased, there was no difference when the number of arguments increased. All children were faster describing one argument events than two and three argument events. CwSLI spent significantly less time looking at the event and thematic zones and did not process the scene as well as the TDC. They concluded that both processing limitations and deficits in the semantic representations of verbs play a role in the difficulties observed in CwSLI.

A single case study of a school-age child with SLI illustrated that the majority of his verb omissions occurred when a complex combination of 'sub-events' was involved (Chiat 2000). The child included only the end-point of the motion (state) suggesting that verbs with complex event structures are more difficult to process. By the time the child's attention is on the motion, the starting-point is no longer available, only the motion itself and the end-state (Black and Chiat 2008).

The language of CwSLI and their event structures have not been examined from a cognitive-semantic viewpoint. Semantics and syntax are inherently linked (Ebbels 2012; Ebbels 2007; Mok and Kipka 2009). When producing sentences, children must map thematic roles to syntactic positions. Verb argument structure is at the interface of syntax and semantics (Ebbels et al. 2012). Semantic bootstrapping (Pinker 1989) and syntactic bootstrapping (Gleitman 1990) may aid this process. Nonetheless, if early on, a child's concept of an event is processed inadequately, a particular verb and its arguments may be acquired erroneously, becoming entrenched in the lexicon. Verbs that have complex event structures encompassing more than one sub-event may be more difficult to acquire and could be a specific deficit for CwSLI. If this is the case, their difficulties may not be attributed solely to the number of arguments involved.

Verb Alternations

Verb alternations refer to verbs that can change their argument structure (Levin 1993; Levin and Rappaport Hovav 2005). The use of verb alternations indicates flexibility (Thordardottir and Weismer 2002). Some verbs allow just one argument structure, while others allow two or more different argument structure alternations. An example is the causative alternation which is the process of a verb's argument structure changing to signify cause, for example, *The vase broke* versus *I broke the vase* (Levin 1993).

Verb Alternations and Typically Developing Children

TDC produce the causative alternation at (1;11) (Bowerman 1974). Soon, children begin to make alternation errors such as overgeneralisations, for example, alternating a verb with fixed transitivity by producing: *I swam her* (Loeb et al. 1998). These errors are not attributed to limited syntactic knowledge as children produce them during the same period that they begin to acquire periphrastic clauses (*made + verb clauses*) (Bowerman 1974). They are attributed to limited knowledge of semantic representations (Loeb et al. 1998). The assumption that children “over-generalise” verb alternations is originating from a syntactic viewpoint. Ambridge and Goldberg (2008) and Goldberg (2009) posit a usage-based model stating that generalisations that appear to be syntactic are often better analysed in terms of a statistical process of pre-emption. Therefore, upon repeated exposures to one construction in lieu of another construction with loosely related meaning, the learner can infer that a construction is not conventional. This requires a given pattern occur with sufficient frequency. Some verbs are semantically similar, for example, *shudder* and *shake*, yet they have different argument structures (Loeb et al. 1998). During the language acquisition process, children are required to learn syntactic features of a verb along with semantic features (Loeb et al. 1998).

Verb alternations are complex because of the multiple argument structures involved. Alternation errors may be related to cognitive event processing and TDC receive environmental input throughout the acquisition period that facilitates them to amend the

concepts. Perhaps alternation errors or a reliance on one argument structure can be attributed to the complexity of event sub-situations. Consider the causative alternation:

The ball rolled

I rolled the ball (signifying cause)

The first sentence encompasses the process+state. The second encompasses the act+process+state, comprising a more complex event structure.

Verb Alternations and SLI

CwSLI were less likely to demonstrate a flexible use of verb alternations in spontaneous language, compared to TDC (Thordardottir and Weismer 2002). In contrast Loeb et al. (1998) reported that CwSLI were proficient in their use of the causative alternation, although there was variation amongst the participants as some children did present with difficulties. This study was based upon structured elicitation tasks. CwSLI did not differ from TDC on use of locative alternations, when describing video scenes (Ebbels et al. 2012). The over-generalisation of locative alternations to change-of-state verbs was noted among all groups.

Some studies reported that CwSLI present with difficulties with verb alternations (Thordardottir and Weismer 2002), while others refute this (Loeb et al. 1998; Ebbels 2012). The lack of agreement may be due to the various sampling methods used and the sample differences, that is, age and severity of language impairment. Alternations have been examined in structured elicitation tasks (Ebbels 2012; Loeb et al. 1998) and narrative samples involving prompting and revolving around a variety of personal narratives (Thordardottir and Weismer 2002). This method involved restricted consistency between the participants' samples. The inconclusive literature suggests that this is certainly an area in need of further research. Verb alternations of CwSLI have not been examined from the perspective of event structure. It would be interesting to investigate this notion while utilizing Cinderella narratives, as this could provide insight on the difficulties demonstrated.

Cinderella

To date, research on the difficulties that CwSLI have with verbs and sentence production is predominantly from spontaneous speech (King and Fletcher 1993; Mok and Kipka 2009) or structured elicitation tasks (Ingham et al. 1998; Owen and Leonard 2006; 2007). Narratives such as a familiar retell offer a method of gathering data that is more ecologically valid than structured tasks (Mok and Kipka 2009) but captures more information than spontaneous speech. Narratives, such as, Cinderella can be a good middle-ground (Webster et al. 2007). It should be noted that conversation elicits more high-frequency verbs, while narratives elicit more low-frequency verbs (Owen van Horne and Lin 2011). Cinderella may elicit low-frequency verbs, such as, scrub and turn into. School-age children's narratives are more developmentally robust than conversational samples (Leadholm and Miller 1992, cited in Heilmann et al. 2010). This study examines CwSLI's use of verb alternations and event structures in Cinderella narratives.

Having reviewed the literature surrounding sentence production difficulties of children with SLI, it was noted that event conceptualisation is a crucial early-processing stage. No study examining event processing and use in CwSLI were identified. This cognitive viewpoint is emerging in the literature. Complex processing demands are placed on children as they acquire verb meanings and it is plausible that CwSLI may have difficulties at this level. The literature, although limited, suggests that verb alternations may cause difficulties and requires further investigation. This study will take a semantic-syntactic stance and will examine both aspects of verb use of CwSLI compared to TDC.

Current Study

The aims of the present study were:

- To investigate the production of verb alternations by CwSLI in comparison to TDC.
- To investigate the production of event structure by CwSLI in comparison to TDC.
- To explore the relationship between verb knowledge and event processing.
- To investigate the usefulness of Cinderella narratives as a sampling method.

It is hypothesised that CwSLI may use fewer verb alternations and less verbs with complex event structures than TDC.

Methods

Participants

The data were collected by researchers undertaking previous research projects (O'Doherty et al. 2010; Hogan and Janicova 2011; Murphy 2008; Murphy et al. 2010). The recruitment methods varied from cold calling local schools, to schools where the principal was known to the researcher, to following up suggestions made by speech and language therapists.

The SLI data were gathered in one health centre in the Midwest, three language classes in the Midwest and three language classes in the Midlands. The TD data were gathered in schools in Limerick, Tipperary, Cork, Carlow, Meath and Wexford, and a crèche in Limerick.

Each research project obtained ethical approval from the appropriate ethical committees, that is, University of Limerick Research Ethics Committee (REC) and the Education and Health Sciences REC for the TDC; the UL REC, Midwest Regional hospital REC and the Midlands HSE REC for CwSLI. Ethical approval for the current study was obtained from the UL EHS REC. Parental consent was obtained prior to data collection (Murphy 2011).

The participants of the present study comprised 65 TDC (CA range 3;02-10;09) and 17 school-age CwSLI (CA range 6;05-10;01). The inclusionary criteria for the CwSLI were: (1) to be at least 6 years old, (2) English as their first language, (3) present with sentence production difficulties, (4) non-verbal IQ to be within the average range. Exclusionary criteria for SLI diagnosis included: (5) language impairment not attributed to neurological, sensory, physical or cognitive disabilities, (6) children with pure phonological or pragmatic disorders were not included.

Inclusionary criteria for the TDC were: (1) normally developing speech and language, (2) hearing within normal limits, (3) English as their first language. Exclusionary criteria included: (4) no identified additional needs, such as, physical, intellectual or sensory disabilities, (5) no identified special educational requirements.

The CwSLI were compared to two groups of TDC. TD younger (TDY) ($n= 30$; CA range 3;02- 6;04) and TD older (TDO) ($n= 35$; CA range 6;05- 10;09).

Each child with SLI was also individually matched to a TD child on the basis of a single verb comprehension test developed for the previous studies. The TDC were required to have scored within the average range for their age (i.e. 16th-84th percentile) and their raw scores were matched within 1 raw score point.

Design and Materials

The present study involved a between-groups experimental design, comparing CwSLI to TDC for alternation and event structure variables discussed below.

It involved detailed secondary data analysis of an existing data set, comprising Cinderella narratives. The Cinderella narrative was taken from *The Usborne Book of Fairy Tales* (Cartwright and Amery 2004). The text on each page was covered over with strips of paper to ensure that the children could not read the story.

Procedure

The narratives were obtained by previous researchers. Most of the narratives were spontaneous elicitations with the support of the pictures. However, some looked at the pictures while listening to the narrative read aloud first. The youngest participants were required to tell the story to a puppet and older children to pretend they were telling it to a young relative.

The transcripts were divided into utterances, by previous researchers, using the following segmenting rules (Owens 2004, cited in Paul 2007):

- A sentence or command as one utterance.
- Run on sentences containing more than one 'and' should be segmented at the second 'and'.
- Pauses, inhalations and falling intonation mark the end of an utterance.
- Sentences with conjoining 'and' should be separated into utterances if the second part contains its own subject, e.g. He sat down and then he ate his toast (Murphy 2008).

- For reported speech, boundaries were placed as above, that is, if the speech had occurred without the preceding 'said' comment (Bishop 2004).

The authors of the current study used the guidelines provided by Bishop (2004) to obtain MLU-w scores for each participant. Incomplete utterances and ambiguous utterances were omitted.

The analysis procedure excluded utterances containing: questions, imperatives, copula complements (e.g. *is allowed*), modals, relative clauses, auxiliaries, semi auxiliaries (e.g. *have to* and *used to*), cognitive state verbs (e.g. *think* and *know*) and single verbs with no accompanying arguments. It also excluded learned phrases such as *lived happily ever after*. It included all copula verbs, which were categorised as one verb.

The framework for linguistic analysis comprised two parts: alternations and event structures.

Analysis of Alternations

A list of all different lexical verbs used across the samples was compiled. Verbs with two or more different meanings were treated as separate verbs, for example, *go* and *go out*; *run* and *run out (of time)*; or *get*, *get ready* and *get excited*.

Subsequently, the MLU-w scores, verb comprehension scores and number of utterances of each child were noted. Next, the number of different lexical verbs produced by each child was noted. The number of verbs that each child used more than once was recorded.

Levin's theoretical approach (1993) was used to determine if verbs can alternate in the English language. Each verb alternation produced by a participant was recorded. A list of possible alternations was also compiled (Appendix A). This comprised verbs that were listed as an alternation by Levin (1993) and were used more than once by a child, but were not alternated, for example *walk* is an induced action alternation: *I walked down the street* versus *I walked the dog down the street*.

Analysis of Event Structure

The second half of the analysis framework related to the event structure of all the lexical verbs. This framework was built on a theoretical approach proposed by Black and Chiat (2003). To avoid missing any information about how the children were using event structures, each sample was analysed individually using the context of the sentence that the verb was within. This was important as some verbs could have two event structures, for example, *The mice turned into horses* (process+state) and *She turned her into a princess* (act+process+state). Examples of each of the variables are presented in Table 1.

Variable	Example
1. act (A)	She <i>is sleeping</i>
2. process (P)	She <i>ran</i> home
3. state (S)	There <i>is</i> Cinderella
4. act+process (A+P)	She <i>said</i> "oh it's midnight"
5. process+state (P+S)	The fairy godmother <i>appears</i>
6. act+process+state (A+P+S)	She <i>turned</i> the mouses <i>into</i> horses

Table 1: Examples of event structure variables

Two extra variables were created: (I) total number of simple and (II) total number of complex event structure verbs. The total number of simple events included the three variables: A, P and S compiled together for each individual child. The total number of complex events comprised the three variables: A+P, P+S and A+P+S.

Statistical Analyses

SPSS, v20 was utilized to analyse the data. The dependent variables were interval scale of measurement and basic descriptive statistics and histograms were obtained. CwSLI ($n=17$) were compared to TDY ($n=30$), TDO ($n=35$) and VCM ($n=17$). The Shapiro-Wilks test of normality was used throughout for each analysis ($n<50$). ANOVAs (one-way between-groups analysis of variance) were used to compare SLI to TDY and TDO on MLU-w, number of different lexical verbs, number of utterances and verb comprehension scores. Kruskal-Wallis and Mann-Whitney U tests were utilized to compare SLI to TDY and TDO on number of verbs used more than once and the event structure variables and to compare SLI to VCM on all event structure variables. Independent Samples T-Tests were conducted to compare SLI to VCM on each of the alternations variables, except verb comprehension scores. The frequencies of the alternations and possible alternations used by the children were too low to warrant statistical analysis and were examined qualitatively.

Reliability

The student researchers consulted with the principal investigator regarding aspects of coding. To ensure reliability of the analysis methods, 24% of the samples (10 CwSLI, 5 TDY and 5 TDO) were chosen randomly and scored by two student researchers independently. Results indicated 94% agreement for presence and type of alternations and 97% agreement of event structure.

Results

Initially, the groups SLI ($n=17$), TDY ($n=35$) and TDO ($n=30$) were compared on basic elements of the sample: *number of utterances, number of different lexical verbs, number of verbs more than once, MLU-w and verb comprehension scores*. Subsequently, they were compared on verb alternations and event structures of verbs.

The SLI group ($n=17$) was compared to the VCM control group ($n=17$) on all of the above variables, except *verb comprehension*.

SLI Compared to TDY and TDO

Number of Utterances

The data were reasonably normally distributed across all groups. The TDY (figure 1a, $M=24.77$, 5% trimmed mean= 24.65 , $SD=8.27$), TDO (figure 1b, $M=38.26$, 5% trimmed mean= 38.09 , $SD=12.13$) and SLI data (figure 1c, $M=37.94$, 5% trimmed mean= 37.88 , $SD=10.65$) did not violate Shapiro-Wilks' test of normality ($p=.902$, $p=.086$, $p=.314$ respectively). The histograms were relatively symmetrical. The range of scores (TDY=34, TDO=45, SLI=41) showed that TDY was the tightest packed around the mean.

An ANOVA revealed a statistically significant difference at the $p<.05$ level: $F(2, 79) = 15.3$, $p=.000$, with a very large effect size (calculated using eta squared =.28). The large F ratio revealed more variance between groups than within. Post-hoc comparisons indicated that the mean score for TDY was significantly lower than TDO ($p=.000$) and SLI ($p=.000$). The mean score for TDO was not significantly different to SLI ($p=.994$).

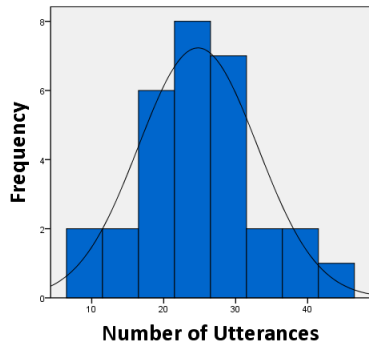


Figure 1a: Distribution of number of utterances-TDY

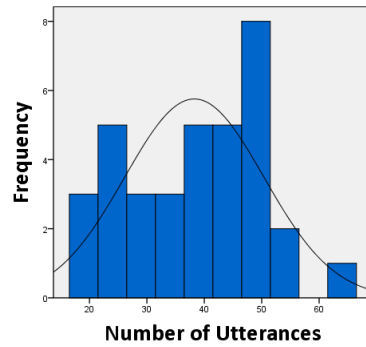


Figure 1b: Distribution of number of utterances-TDO

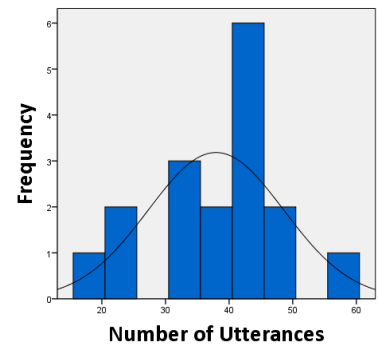


Figure 1c: Distribution of number of utterances-SLI

Number of Different Lexical Verbs

The data were normally distributed. The TDY group (figure 2a, $M=15.27$, 5% trimmed mean= 15.15 , $SD=4.98$) used fewer different lexical verbs than the TDO group (figure 2b, $M=26.43$, 5% trimmed mean= 26.16 , $SD=9.03$) and the SLI group (figure 2c, $M=19.53$, 5% trimmed mean= 19.53 , $SD=5.30$). The SLI group data was tightest packed around the mean (ranges: TDY=24, TDO=31, SLI=19). The data did not violate Shapiro-Wilks' test of normality ($p=.679$, $p=.062$, $p=.627$ respectively).

An ANOVA indicated a statistically significant difference at the $p<.05$ level in the number of different verbs used by the three groups: $F(2, 79) = 20.596$, $p=.000$, with a very large effect size (eta squared =.34). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for TDY was significantly lower from TDO ($p=.000$), but not significantly different from SLI ($p=.122$). The mean score for TDO was significantly higher than SLI ($p=.004$).

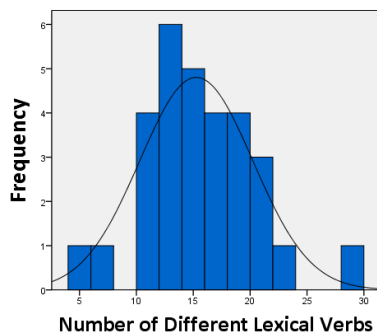


Figure 2a: Distribution of number of different verbs-TDY

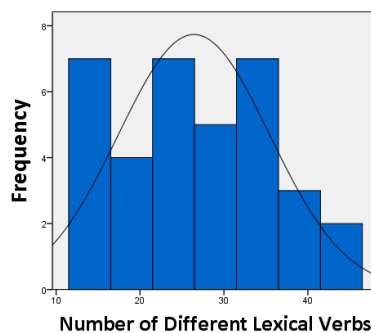


Figure 2b: Distribution of number of different verbs-TDO

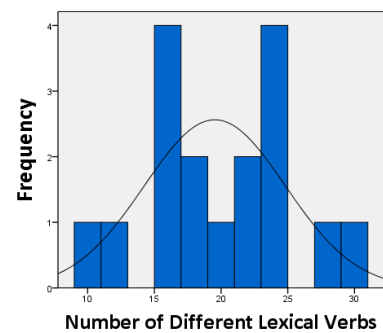


Figure 2c: Distribution of number of different verbs-SLI

Verbs Used More than Once

The TDY (figure 3a, $Md=4$, $IQR=2$) and the SLI data (figure 3c, $Md=8$, $IQR=2$) did not violate Shapiro-Wilks' test of normality ($p=.121$ and $.076$ respectively). TDY was tightest packed around the mean (range: TDY=6, TDO=12, SLI=13). The TDO data were not normally distributed (figure 3b, $Md=10$, $IQR=7$) and violated Shapiro-Wilks' test of normality ($p=.039$). Three outliers were identified as having used 2, 3 and 15 verbs more than once. Non-parametric testing was conducted.

A Kruskal-Wallis Test revealed a statistically significant difference across the three groups ($p=.000$).

A Mann-Whitney U Test indicated a statistically significant difference between TDY<TDO (where < indicates using less than), $U=97.5$, $z= -5.654$, $p=.000$ 2-tailed, $r=.70$ (indicating a very large sample effect size). There was a significant difference between TDY<SLI ($Md=8$, $n=17$), $U=57.5$, $z= -4.409$, $p=.000$ 2-tailed, $r=.64$ (very large sample effect size). There was no significant difference between TDO and SLI, $U=229$, $z= -1.345$, $p=.179$ (2-tailed), $r=.19$ (small sample effect size).

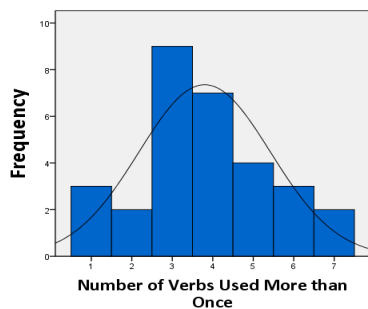


Figure 3a: Distribution of number verbs used more than once-TDY

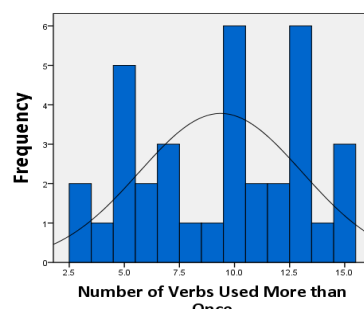


Figure 3b: Distribution of number verbs used more than once-TDO

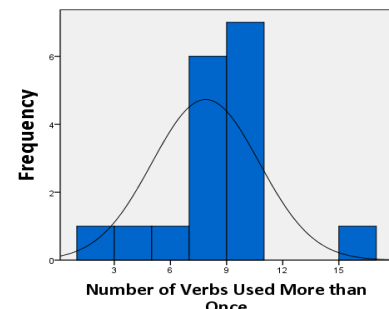


Figure 3c: Distribution of number verbs used more than once-SLI

MLU-w

The TDY (figure 4a, $M=5.82$, 5% trimmed mean=5.82, $SD=1.47$), TDO (figure 4b, $M=8.14$, 5% trimmed mean=8.1, $SD=1.66$) and SLI data (figure 4c, $M=6.53$, 5% trimmed mean=6.47, $SD=1.63$) did not violate Shapiro-Wilk's test of normality ($p=.563$, $.496$ and $.259$

respectively). The data were reasonably normally distributed, although the histogram for SLI data indicated a slight positive skew (figure 4c). There was one high scoring outlier (10.23) identified. The mean and 5% trimmed mean showed little variation.

An ANOVA revealed a statistically significant difference at the $p < .05$ level for the three groups: $F(2, 79) = 18.147, p = .000$, with a very large effect size (eta squared = .32). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for TDY was significantly lower than TDO ($p = .000$), but not significantly different from SLI ($p = .302$). The mean score for TDO was significantly higher than SLI ($p = .003$).

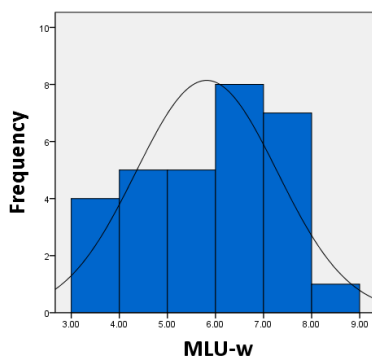


Figure 4a: Distribution of MLU-w scores-TDY

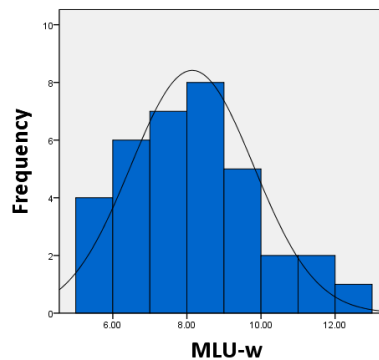


Figure 4b: Distribution of MLU-w scores-TDO

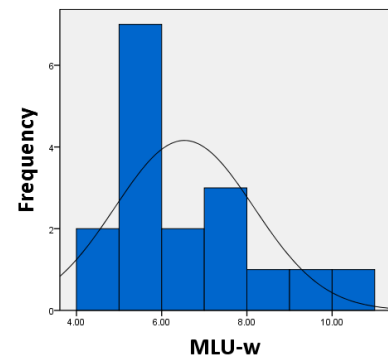


Figure 4c: Distribution of MLU-w scores-SLI

Verb Comprehension Score

The TDY (figure 5a, $M = 27.37$, 5% trimmed mean = 27.52, $SD = 4.06$), TDO (figure 5b, $M = 33.14$, 5% trimmed mean = 33.21, $SD = 1.64$) and SLI data (figure 5c, $M = 27.06$, 5% trimmed mean = 27.01, $SD = 3.27$) did not violate Shapiro-Wilks' test of normality ($p = .483, p = .058, p = .496$ respectively). TDO were tightest packed around the mean (ranges: TDY=17, TDO=7, SLI=11). The data were reasonably normally distributed across all groups, with minor negative skew for TDY and TDO (figures 5a and 5b).

There was a significant difference at the $p < .05$ level on verb comprehension scores for each of the three groups: $F(2, 79) = 37.063, p = .000$, with a very large effect size (eta squared = .48). Post-hoc comparisons revealed that the mean score for TDY was significantly lower

than TDO ($p=.000$), but not significantly different from SLI ($p=.941$). The mean score for TDO was significantly higher than SLI ($p=.000$).

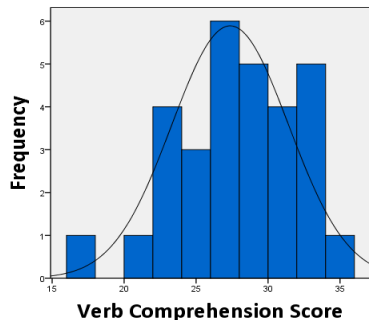


Figure 5a: Distribution of verb comprehension scores-TDY

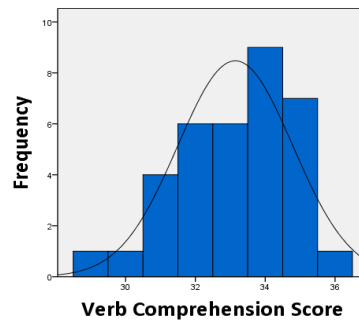


Figure 5b: Distribution of verb comprehension scores-TDO

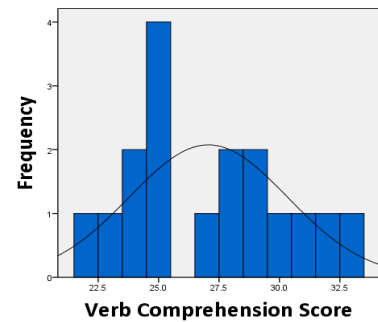


Figure 5c: Distribution of verb comprehension scores-SLI

SLI compared to Verb Comprehension Matched group (VCM)

Results above indicated that TDO scored significantly higher than SLI on verb comprehension. The CwSLI were compared to a verb comprehension matched (VCM) group, to control for verb knowledge.

Number of Utterances

The data were reasonably normally distributed. The VCM (figure 6a, $M=28.53$, 5% trimmed mean= 28.14 , $SD=13.90$) and SLI data (figure 6b, $M=37.94$, 5% trimmed mean= 37.88 , $SD=10.65$) did not violate Shapiro-Wilks' test of normality ($p=.251$ and $p=.314$ respectively).

An independent samples t-test indicated a significant difference between VCM < SLI ($t(32) = -2.216$, $p=.034$, 2-tailed).

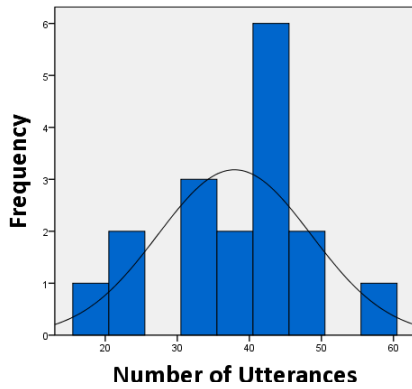


Figure 6a: Distribution of number of utterances-SLI

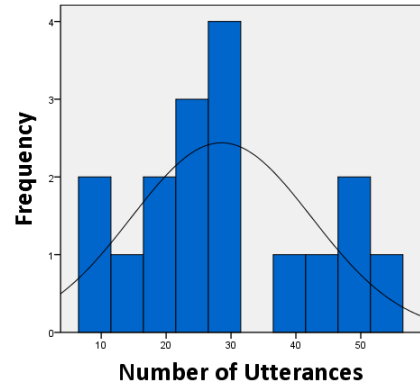


Figure 6b: Distribution of number of utterances-VCM

Number of Different Lexical Verbs

The data were relatively normal across all groups. The VCM (figure 7a, $M=18.35$, 5% trimmed mean= 17.84 , $SD=9.74$) and the SLI data (figure 2c, $M=19.53$, 5% trimmed mean= 19.53 , $SD=5.30$) did not violate Shapiro-Wilks' test of normality ($p=.093$ and $p=.627$ respectively). Three high scoring outliers were identified in the VCM data, accounting for the slight variation between the mean and 5% trimmed mean. The VCM histogram indicated slight positive skew.

An independent-samples t-test revealed no significant difference between VCM and SLI ($t(32) = -.438$, $p=.665$, 2-tailed).

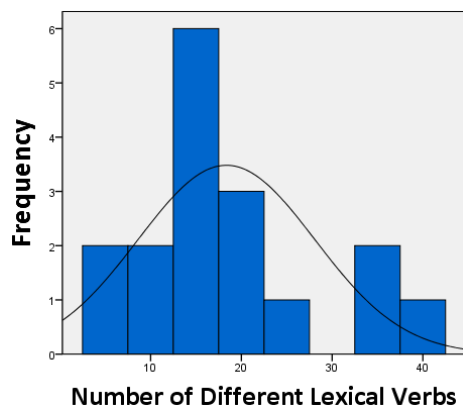


Figure 7a: Distribution of different verbs -VCM

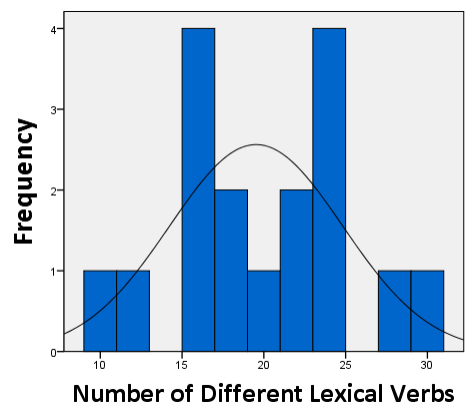


Figure 7b: Distribution of different verbs -SLI

Verbs Used More than Once

The VCM (figure 8a, $M=5.71$, 5% trimmed mean= 5.51 and $SD=4.03$) and the SLI data (figure 8b, $M=7.88$, 5% trimmed mean= 7.81 and $SD=2.87$) did not violate Shapiro-Wilks' test of normality ($p=.085$ and $.076$ respectively). The data were reasonably normal, although SLI demonstrated some positive skew.

An independent samples t-test revealed no significant difference between VCM and SLI ($t(32) = -1.825$, $p=.079$, 2-tailed).

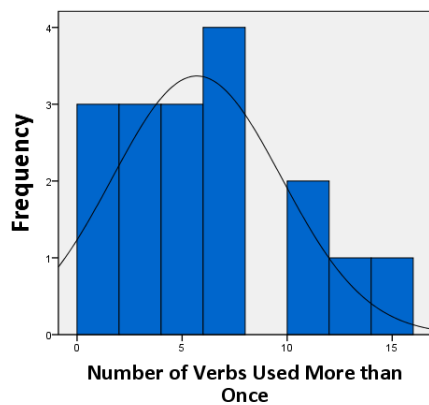


Figure 8a: Distribution of number of verbs used more than once-VCM

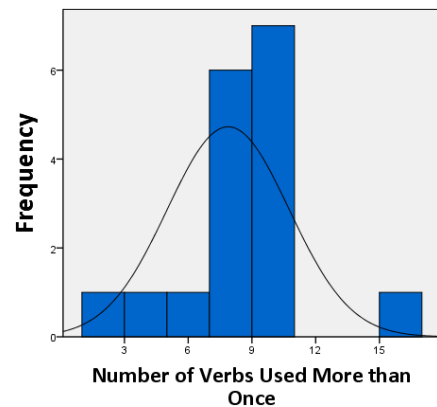


Figure 8b: Distribution of number of verbs used more than once-SLI

MLU-w

The data were reasonably normally distributed across all groups. The VCM data (figure 9a, $M=6.40$, 5% trimmed mean= 6.41 , $SD=1.90$) and SLI data ($M=6.53$, 5% trimmed mean= 6.47 , $SD=1.63$) did not violate Shapiro-Wilk's test of normality ($p=.340$ and $.259$ respectively).

An independent-samples t-test indicated no significant difference between VCM and SLI ($t(32) = -.215$, $p=.831$, 2-tailed).

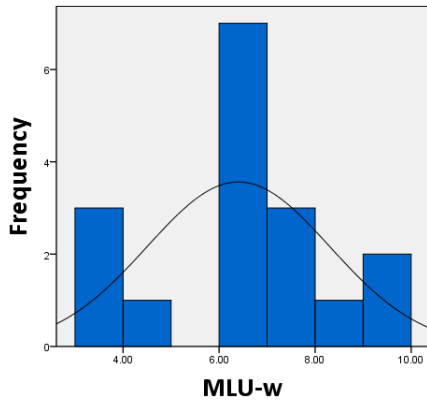


Figure 6a: Distribution of MLU-w-VCM

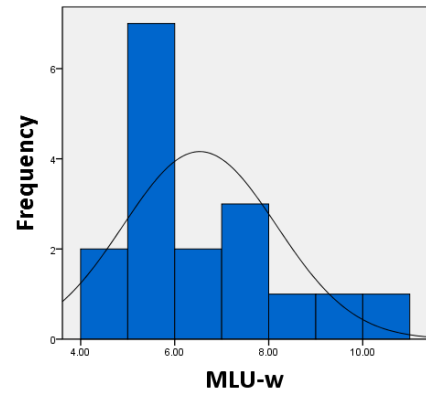


Figure 6b: Distribution of MLU-w-SLI

Alternations

The frequencies of alternations were too low to warrant statistical analysis. There were 217 different lexical verbs identified across the samples. Thirty one were identified as potentially alternating (Appendix A). From this, two verbs were alternated by 11 children (2 SLI and 9 TD). Each of these children used one alternation each. Two CwSLI and 8 TDC alternated the verb *turn into* and one TD child alternated the verb *transform* – both causative alternations. The total list of alternations produced is outlined in Table 2. Some adjuncts were also identified which will be considered in the discussion (e.g. *She sat down* versus *She sat down on the bench*).

Group	Age	Alternation
TDY	3;11	The horses and mice turn into a pumpkin The fairy godmother turns Cinderella into a dress
TDY	5;10	The mice turned into horses Cinderella's godmother turned her clothes into lovely clothes
TDY	6;0	The pumpkin was transformed into a carriage She transformed into the loveliest girl
TDY	6;02	The pumpkin turned into a carriage The fairy godmother turned the dress into a good dress
TDY	6;03	She turns them into the little horses The lizards turn into men
TDO	6;05	She turned her into a princess The mice turned into horses
TDO	7;03	The fairy godmother turned the pumpkin into a carriage They turned into a beautiful ball gown
TDO	9;03	The fairy godmother turned the pumpkin into a chariot Cinderella turned into her old rags
TDO	10;01	I will turn you into a beautiful princess She turned back into rags
SLI	8;03	He go turn him to horse The rat turn into man
SLI	9;01	The pumpkin turned into a carriage She turned the mouses into horses

Table 2: Alternations identified across samples

Event Structure Data

SLI compared to TDY and TDO

The event structure dependent variables data were analysed for the three groups: SLI, TDY and TDO. The Shapiro-Wilks test of normality revealed a mixture of normal and non normal data. The median and IQR scores for each group and variable are listed in Table 3. Non-parametric statistical tests were conducted. A Kruskal-Wallis indicated that there were significant differences between the groups on all variables except P+S ($p=.001$ (A), $p=.000$ (P), $p=.000$ (S), $p=.000$ (A+P), $p=.526$ (P+S), $p=.005$ (A+P+S), $p=.000$ (total simple) and $p=.000$ (total complex)).

Variable	Group	Median	IQR
Act (A)	TDY	2	2
	TDO	4	2
	SLI	3	3
Process (P)	TDY	4	2
	TDO	5	4
	SLI	5	3
State (S)	TDY	2	1
	TDO	5	4
	SLI	4	2
Act + Process (A+P)	TDY	3	1
	TDO	5	5
	SLI	4	2
Process + State (P+S)	TDY	2	2
	TDO	2	2
	SLI	2	1
Act + Process + State (A+P+S)	TDY	1.5	2
	TDO	2	2
	SLI	2	2
Total Simple	TDY	8	4
	TDO	15	10
	SLI	11	5
Total Complex	TDY	6	4
	TDO	10	7
	SLI	7	4

Table 3: Median and IQR scores for groups on event structure variables

Mann-Whitney U Tests were conducted for each dependent variable to investigate where the differences lay.

A Mann-Whitney U Test indicated significant differences between TDY<TDO on all variables, except P+S (results are reported in Table 4).

	Act Verbs (Simple)	Process Verbs (Simple)	State Verbs (Simple)	Act + Process (Complex)	Process + State (Complex)	Act + Process + State (Complex)	Total Simple	Total Complex
SMann-Whitney U	262.5	258.5	167.5	202.5	469	297	144.5	234
Z	-3.509	-3.576	-4.747	-4.312	-.761	-3.193	-5.023	-3.84
Asymp. Sig. (2-tailed)	.000*	.000*	.000*	.000*	.447	.002*	.000*	.000*

Table 4: Results from Mann-Whitney U Test for TDY and TDO.

*Significant difference at the $p=.017$ level

There were significant differences between TDY<SLI on process, state, A+P and total simple verbs and there was no significant difference on act, P+S, A+P+S and total complex (results are recorded in Table 5).

	Act Verbs (Simple)	Process Verbs (Simple)	State Verbs (Simple)	Act + Process (Complex)	Process + State (Complex)	Act + Process + State (Complex)	Total Simple	Total Complex
Mann-Whitney U	239.5	131.5	123.5	136.5	208	178	137.5	172
Z	-.353	-2.789	-2.972	-2.675	-1.074	-1.777	-2.623	-1.853
Asymp. Sig. (2-tailed)	.724	.005*	.003*	.007*	.283	.076	.009*	.064

Table 5: Results from Mann-Whitney U Test for TDY and SLI.

*Significant difference at the $p=.017$ level

There were significant differences between SLI<TDO on the three variables: act, state and total simple. There was no significant difference on process, A+P, P+S, A+P+S and total complex (results presented in table 6). Using the alpha level $p=.05$, there was a significant difference in state verbs. When a Bonferroni adjustment was applied to control for type 1 errors the alpha level was reduced to $p=.017$ and there was no longer a significant difference in state verbs.

	Act Verbs (Simple)	Process Verbs (Simple)	State Verbs (Simple)	Act + Process (Complex)	Process + State (Complex)	Act + Process + State (Complex)	Total Simple	Total Complex
Mann-Whitney U	173.5	264	185.5	220	273	234.5	170	210
Z	-2.457	-.662	-2.214	-1.525	-.497	-1.267	-2.495	-1.717
Asymp. Sig. (2-tailed)	.014*	.508	.027**	.127	.619	.205	.013*	.086

Table 6: Results from Mann-Whitney U Test for TDO and SLI.

*Significant difference at the $p=.017$ level **Significant difference at the $p=.05$ level

SLI compared to VCM Control Group

The Shapiro Wilks test of normality demonstrated a variety of normal and skewed distributions, indicating that non-parametric tests were required. The median and IQR scores for each group are presented in Table 7. A Mann-Whitney U was carried out on the variables. The results (outlined in Table 8), indicate that there was no significant difference on any of the variables.

Variable	Group	Median	IQR
Act	VCM	3	3
	SLI	3	3
Process	VCM	4	2
	SLI	5	3
State	VCM	3	4
	SLI	4	2
Act and Process	VCM	3	4
	SLI	4	2
Process and State	VCM	2	3
	SLI	2	1
Act + Process + State	VCM	2	3
	SLI	2	2
Total Simple	VCM	9	7
	SLI	11	5
Total Complex	VCM	7	7
	SLI	7	4

Table 7: Median and IQR scores for groups on event structure variables

	Act Verbs (Simple)	Process Verbs (Simple)	State Verbs (Simple)	Act + Process (Complex)	Process + State (Complex)	Act + Process + State (Complex)	Total Simple	Total Complex
Mann-Whitney U	140.5	96.5	101	117	141	138.5	103.5	135
Z	-.141	-1.686	-1.520	-.959	-.124	-.216	-1.420	-.331
Asymp. Sig. (2-tailed)	.888	.092	.128	.337	.901	.829	.156	.741

Table 8: Results from Mann-Whitney U Test for TDO and SLI

Discussion

Number of Utterances, Lexical Verbs and Verbs More than Once

CwSLI used a similar number of utterances as TDO, suggesting that number of utterances is not a confounding variable. This indicates the usefulness of Cinderella as a comparison tool for variables, such as, number of verbs and verbs used more than once. The TDO children have greater verb diversity. They used more lexical verbs than the CwSLI, which is consistent with the literature (Jones and Conti-Ramsden 1997). In contrast, there was no difference between the groups on verbs used more than once. This is explained by TDO children producing low-frequency verbs that would not be expected to be produced more than once, for example, *cast*, *fetch*, *flee* and *strike*. The lexical verbs from this study were compared qualitatively to a list of verbs produced by Thordardottir and Weismer (2001) to determine the frequency of a verb. The CwSLI produce mostly high-frequency verbs. TDO children also utilize these high-frequency verbs, but they have an extended development of low-frequency verbs that are not produced by the CwSLI. This finding contradicts Thordardottir and Weismer (2001), who found no difference in verb diversity and use of high-frequency verbs between CwSLI and TDC. This discrepancy may be due to the different sampling methods used, as they utilized spontaneous language samples, which are not as structured as Cinderella narratives.

Alternations

It was hypothesised that CwSLI would use fewer verb alternations than TDC. Evidence to address this question is inconclusive based on the findings of the current study. There were too few examples of alternations within the samples to warrant statistical analyses. However, 9/65 (14%) TDC and 2/17 (12%) CwSLI did alternate a verb, supporting the suggestion that CwSLI do not present with specific difficulty with alternations compared to TDC (Loeb et al. 1998; Ebbels et al. 2012).

TDC chose not to alternate the majority of possible alternations. Whether alternations are used in a given sample depends on the intended message and pragmatic factors, such as Grice's maxims, related to the need to be informative yet concise (Thordardottir and

Weismer 2002). Although these verbs were not alternated, some did include adjuncts, for example, “*She’s bringing in the pets*” and “*She’s bringing in a pumpkin from the field*” (adjunct underlined). This is an unexpected but interesting finding as adjuncts are important elements of sentence production that typically hold information about time and location (Levin and Rappaport Hovav 2005). A number of resultative verb phrases were also noted throughout the sample, for example, “*She got an invitation*” and “*It was Cinderella who got this*”; “*The other stepsister tried on the shoe*” and “*Cinderella tried it on*”. Ingham et al. (1998) took a generativist perspective noting that CwSLI produce fewer resultative verb phrases. Although the possibility of alternations in Cinderella is limited; it may provide a useful dataset to explore the use of adjuncts and resultative phrases in SLI.

Event Structure

TDO children used more simple and complex event structures than TDY children. They used significantly simpler events than CwSLI but not more complex events. This finding refutes the hypothesis that CwSLI use less verbs with complex event structures than TDC. Nonetheless, it supports the finding that CwSLI focus less on the event zones and do not process events as well as TDC (Andreu et al. 2013). There were differences between TDY and TDO on all event structure variables, except P+S verbs. This suggests a progression in event structures with age, by TDC, at least up to 10;09.

There is no difference between any groups on the use of P+S verbs, some of which include: *fall, get invited, make, marry, turn into* and *vanish*. These verbs are generally associated with Cinderella and although they are a mixture of low and high-frequency verbs they are generally among the most commonly used. Another possible explanation is that the medians for P+S are low for each group ($Md=2$ for all groups). It is more meaningful to focus on total simple and complex events which yielded higher medians.

Verb Comprehension

CwSLI present with lower verb comprehension scores than TDO children, while there is no difference between CwSLI and TDY, suggesting a distinct progression with age for TDC, at least up to 10;09. When verb knowledge is controlled for, there is no difference between the VCM control group and CwSLI on event structure variables.

This indicates a distinct relationship between verb knowledge (as derived from a picture-pointing comprehension task with semantically related distracters) and event processing, but the direction of this correlation remains unknown. It is possible that CwSLI may encounter difficulties processing an event and develop inaccurate verb knowledge that becomes entrenched and may only be remediated through explicit teaching methods (Ebbels et al. 2007). CwSLI may not receive adequate environmental input to amend this ingrained underdeveloped knowledge. They may also not experience the adequate frequency of this verb in context (Goldberg 2009). Due to a restriction on their linguistic expression processing, in the moment, they express a simpler set of events. As with bootstrapping theories, there is a possibility that stored language knowledge could also bias a child towards focusing on certain aspects of the event. To the author's knowledge, this is the first study conducted investigating this concept.

All children produced more simple events than complex, suggesting that TDC will generally choose the most efficient way to describe an event, which relates to Grice's maxims (Thordardottir and Weismer 2002). The results show a developmental effect that TDO children are developing in terms of their production/processing of more complex events. This is similar to Ebbels et al. (2012) who found that TDC up to age 14 presented with alternating errors. The acquisition of verb semantic features is ongoing (Ambridge and Goldberg 2008).

Cinderella

The results show that Cinderella narratives do have many benefits as sampling methods and are valuable assessment approaches. There were a substantial total number of verbs produced across the samples (217) and they consisted of both high and low-frequency verbs. Cinderella can be used to compare CwSLI to TDC on a variety of variables, including event structure. It can also be used to examine children's use of adjuncts and resultative phrases. In light of the limited scope for elicitation, Cinderella is not appropriate for the investigation of alternations. The mean number of utterances across all groups was 33.26, which is consistent with Owen van Horne and Lin's (2011) finding that narratives elicit approximately 40 utterances. Narratives elicit more advanced syntactic structures (Sealey and Gilmore 2008). Cinderella is a low cost and widely available, ecologically valid tool that provides greater contextual support for the listener than spontaneous language samples (Murphy 2011).

Limitations

This was an exploratory study and had design limitations. The mean number of utterances produced was below the recommended 100 utterances (Miller 1981; Paul and Norbury 2012). The sample sizes were small and uneven (SLI=17, TDY=30, TDO=35), which may have affected statistical analyses, such as ANOVAs. There was a lack of standardisation of the elicitation procedure for the narratives with varying levels of support given to some of the children, which has an implication for the reliability and validity of the results (Murphy 2011).

Clinical Implications

One of the main implications from the current study is the usefulness of Cinderella narratives, discussed above.

The relationship between verb knowledge and event processing suggests that CwSLI have an ingrained underdeveloped knowledge of verbs. An intervention programme with an explicit semantic component, such as, the shape coding procedure (Ebbels et al. 2007) may be an effective approach to amend and advance these entrenched concepts.

Verbs are difficult to learn because adults don't label them in the naturalistic setting as they do with nouns (Ambalu et al. 1997). CwSLI may have difficulties in the early stages of event processing and mapping that meaning to the verb. Therefore, intervention could also be based on the explicit labelling of verbs described by Ambalu et al. (1997).

This study focused on semantic and syntactic properties of verbs and both elements should be examined when choosing targets for therapy when working with a child who has difficulty in this area.

Recommendations

In light of the limited scope for elicitation of verb alternations in Cinderella across all groups, it would be worthwhile to explore using alternative samples such as spontaneous speech, other narratives or structured elicitation tasks, for example, the video description tasks utilized by Ebbels et al. (2012).

This study has shown a relationship between verb knowledge and event processing, however little is known beyond this. It would be interesting to investigate this relationship further to attempt to pinpoint its direction. Further research in this area is essential and it would be exciting to see the results of a similar study combined with an eye-tracking experiment, similar to that described by Andreu et al. (2013). Likewise it would be useful to conduct a comparable study using different samples, such as, spontaneous language samples.

Conclusion

CwSLI produced fewer simple events than TDC. When verb knowledge was controlled for there were no differences, implying a relationship between event processing and verb knowledge. All children used simpler than complex event structures, indicating that TDC may choose the most efficient way to describe events. CwSLI produced the same number of utterances as TDO children. Cinderella can be a useful comparison tool for these groups. It did not elicit many alternations and therefore is not a useful assessment method for verb alternations. CwSLI produced fewer lexical verbs than TDC but the same number of verbs more than once, suggesting that CwSLI had lower verb diversity. Qualitatively, CwSLI used mainly high frequency verbs.

The current study undertook a novel linguistic analysis based on a theoretical framework of event structure, which has not been done before. It has moved analysis beyond the traditional semantic-syntactic features and its findings encourage further exploration of these recently emerging theories.

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Appendix A: Possible Verb Alternations

Verb	Possible Alternation Type
Ask	Dative
Bring	Dative
Change	Causative
Choose	Benefactive
Clean	Benefactive
Dance	Unspecified Object Alternation
Finish	Causative
Fit	Locative Subject Alternation
Fly	Induced Action Alternation
Get	Benefactive
Get dressed	Causative
	Understood Reflexive Object Alternation
Get ready	Understood Reflexive Object Alternation
Give	Dative
Hold	Body Part Possessor Ascension Alternation
Kiss	Body-Part Possessor Ascension Alternation
	Understood Reciprocal Object Alternation
Make	Material/Product Alternation
	Benefactive
Marry	Understood Reciprocal Object Alternation
Meet	Simple Reciprocal Alternation
	Understood Reciprocal Object Alternation
	'With' Preposition Drop Alternation
Need	Possessor-Attribute Factoring Alternation
Offer	Reflexive of Appearance Alternation
Ride	Induced Action Alternation
Run	Induced Action Alternation
Scrub	Locative Alternation
	Unspecified Object Alternation
	Unspecified Object Alternation plus Locative PP
See	Attribute-Object Possessor – Attribute Factoring Alternation
Show	Dative
	Reflexive of Appearance Alternation
Take	Dative
Tell	Dative
Transform	Causative
Turn into	Causative
Walk	Induced Action Alternation
	Locative Preposition Drop Alternation
Want	Possessor-Object Possessor-Attribute Factoring Alternation

