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Final Year Project

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

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Abstract

Background: Children with Specific Language Impairment (CwSLI) demonstrate difficulties with verb knowledge, verb argument production and sentence structure. There is a lack of evidence around the processing and production of event structure by CwSLI and research is equivocal whether CwSLI demonstrate difficulty with verb alternations.

Aims: The study aimed to establish whether verb alternations and event structure complexity are contributing to the aforementioned difficulties in CwSLI, and whether verb knowledge has a role in event structure complexity. The study also aimed to investigate the usefulness of a Cinderella narrative for assessment.

Methods and Procedures: Secondary data analysis of Cinderella narratives from 65 typically developing children (TDC) (3; 02 – 10; 09) and 17 CwSLI (6; 05 – 10; 01) was undertaken. A between-groups comparison on verb alternations and the complexity of event structure produced was run between CwSLI and subgroups of younger and older TDC and a verb comprehension matched group.

Outcomes and Results: The number of alternations was insufficient to warrant statistical analysis. Older TDC used a significantly higher number of simple event structures than CwSLI, but there was no difference in complex event structures produced. No significant difference was found between CwSLI and the verb comprehension control group in event structure produced. All children used more simple event structure verbs overall.

Conclusions and Implications: The results of the event structure analyses indicate that all children may be using the most parsimonious way of describing events. The results support the idea that poor verb knowledge and event structure complexity are related in CwSLI. Difficulty with event conceptualisation may have a cascading effect onto the lexical representation of a verb and consequently limit the range of syntactic structures available. The Cinderella narrative is a useful clinical tool for investigating verb production, given the comparable samples in terms of number of utterances, but it is not considered a useful tool for eliciting data on verb alternations.

Keywords: Specific language impairment, narrative, Cinderella, verb, alternations, event structure

Introduction

Verbs, verb argument production and sentence structure represent areas of particular difficulty for children with specific language impairment (CwSLI). Consensus among the literature is that the difficulties do not fall neatly into syntactic or semantic categories (Thordardottir and Weismer 2002; Ebbels *et al* 2007). It is proposed that children need a detailed semantic representation of verbs (Pinker 1989) but syntax also plays a crucial role in learning verbs and their representations (Fisher *et al* 1994; Gleitman 1990). Research is equivocal whether CwSLI demonstrate difficulty with verb alternations (Ebbels *et al* 2012; Loeb *et al* 1998) and research into event processing in ways related to language is recently emerging. Black and Chiat (2008) pose an interesting question as to whether the complexity of event structure is contributing to the aforementioned difficulties present in CwSLI. This paper examines sentence production, event structure, and verb alternations for CwSLI. It also investigates the usefulness of a Cinderella narrative, which is often used in assessment of adults with aphasia, for assessment of CwSLI.

Sentence Production

Garrett's (1980, cited in Webster *et al* 2007) model of normal sentence production is a series of relatively independent levels of processing. The *message level* representation relates to a non-linguistic, conceptual representation of an event. The *functional level* representation relates to the thematic structure of the sentence. The *positional level* representation relates to the syntactic frame. Every sentence is built around a verb and the verb projects the structure of the sentence (Loeb *et al* 1998). Consensus among the models of language acquisition is that verbs play a vital role in syntactic development.

Sentence production is an area of difficulty for CwSLI. Thordardottir and Weismer (2002) found fewer argument types, argument structure types and verb alternations used by school-aged CwSLI in comparison to age controls in spontaneous speech. Verb alternations were coded when a child used the same verb with different argument structures (e.g. "the children play" / "the children play a game"). CwSLI also omit more obligatory arguments, especially subject arguments, in comparison to age and vocabulary

matched peers, when producing sentences with ditransitive verbs (Ebbels 2005, cited in Ebbels *et al* 2007; Grela 2003). Murphy (2011) obtained results consistent with the previous evidence on the data set used in this study. The CwSLI produced greater verb argument structure omissions than the typically developing children (TDC) and the TDC showed greater predicate argument structure complexity.

Additionally, low verb diversity and extensive reliance on high frequency General All Purpose (GAP) verbs, such as *go, make* and *do*, has been reported for pre-school CwSLI (Rice and Bode 1993). In contrast, Thordardottir and Weismer (2001) failed to find a significant difference in the verb diversity or use of GAP verbs between CwSLI and TDC. They point out the shared characteristics of GAP verbs as 'non-specific meaning', which permits semantic and syntactic simplifications. But how GAP verbs simplify sentence production remains a matter of speculation. Differences may exist in the extent of the children's knowledge of verbs. An alternative way to investigate GAP verbs would be sub-eventual analysis, discussed below.

The disparity in verb diversity findings is related in large part to differences in age, sampling method, sample size, analysis metrics, and confounding variables such as utterance length. These factors critically influence results, making direct comparisons across studies difficult. The current study looks at verbs and verb argument structure production from a different angle. The focus is directed beneath the surface of transitivity. It may be the type of situation (message level) each verb expresses that is at the root of the differences in syntactic possibilities (Black and Chiat 2008).

Event Structure

Thompson (2003) put forward the 'argument complexity hypothesis' which stated that verbs with more arguments were more complex. The semantic content was downplayed. However, evidence from Thompson's own work and that of Kegl (1995) showed that verbs with the same number of arguments were not equally difficult. For example, some two-argument verbs such as *kiss* were easier than one-argument verbs such as *fall*. The reason for this difference may arise from the complexity of conceptual processes

of message generation; determining main entities, respective roles, aspects of prominence, and timing (Dipper *et al* 2005). Impairment at the conceptual level manifests as difficulty in forming event structures, which subsequently has a cascading effect on sentence structure (Cairns *et al* 2007). Levin and Rappaport Hovav (2005) believe that a lexical semantic representation that explicitly encodes the sub-eventual structure of events is necessary.

The perspective on event structure in this paper is based on the theoretical model of Black and Chiat (2003). Events are built up of different sub-situations (act, process, state), which make up a particular action or lead up to a particular result. Verbs that encompass more than one sub-situation are semantically more complex as they involve connected situations and causative connections.

The 'state' sub-situation focuses narrowly on a static component of a situation (verbs of location and verbs of psychological state).

- The apples **are** on the floor

The 'process' (motion verbs) and 'act' (no change in another participant e.g. touch) sub-situations are also narrow in focus.

A situation wider in focus is process + state (endpoint):

- The apples **fell** on the floor

Act + process + state (act that causes the process of change in location or state) is as wide as language can get.

- Bill **dropped** the apples onto the floor

There is limited research on the development of event structures in early language development. Penner *et al* (2003) believe that difficulty learning the meaning of verbs is what distinguishes language impaired children from TDC. They further propose that acquisition of verb meaning requires 3 learning processes; child-driven (non-linguistic biases), environment-driven (frequency, timing, real world verb usage), and language-driven (knowledge of event structure, argument structure, and reverse linking). Additionally,

Ambalu *et al* (1997) investigated the effects of timing and focus on verb models for children's learning of verbs with 30 preschool children. The timing of the verb form was found to act as a cue to the likely focus of the event to which it referred. The impending condition model was best for movement verbs, where the experimenter modelled the verb before carrying it out, for example, "Look, I am going to *pog* the ring". The completed condition model was best for the result verbs, where the experimenter commented after carrying out the action, for example, "Look, I *bocked* the paper". The findings suggest an interaction between different aspects of event processing in verb learning. Penner *et al* (2003) found TDC at the one-word stage used wide-focused event structures 2.86 times more frequently than other verb types, while CwSLI at the same stage demonstrated no such orientation to wide-focus verbs.

So what can go wrong for CwSLI? Cognitive event schemas serve as the initial scaffolding for language learning (Black and Chiat 2008). Chiat (2001) proposed that if non-linguistic biases interfered with linguistic distinctions to be learned, children may show difficulty with processing and storage of events. CwSLI can have poor play, processing, attention and working memory skills (Andreu *et al* 2013). CwSLI may have a "non-linguistic conceptual bias" in favour of goal paths and end states rather than source paths and initial configurations (Lakusta and Landau 2005). Children may get stuck with a particular notion of a verb and going forward its meaning is never altered by the environment. Verb difficulties may then reflect some entrenched under-developed knowledge of events. Increased accuracy of use of verb argument structure in older CwSLI through the explicit teaching of verb meanings supports this idea (Ebbels *et al* 2007). In summary, part of the difficulty with language acquisition may be how children discern which among a large set of detectable perceptual differences, are relevant to linguistic meaning (Pulvermann *et al* 2008).

Verb Alternations

In early language development, alternations allow children to produce utterances they have not previously heard (Ambridge and Lieven 2011). Shortly after children begin to use causative alternations (e.g. the ball rolled / I rolled the ball), they begin to make overgeneralisation errors on verbs that do not alternate in a causative way; fixed transitives,

fixed intransitives, and anti-passives. Loeb *et al* (1998) give the example of a child trying to lexically alternate a verb with fixed transitivity, resulting in "I swam the doll" to indicate that she made the doll swim. Overgeneralisation errors are made over a protracted period (2; 06 - 12; 0). Errors result from difficulty applying broad and narrow constraints. Children have to know verb meaning before they can apply a broad range constraint (y changes state → x causes y to change state). Narrow range constraints are assumed to be learned from the environment and are based on semantic properties. Pinker (1989) proposes that from applying constraints, children form classes of verbs that alternate. Any verb that is not a member of an alternating class at a defined cut-off point is assumed not to alternate.

Alternating verbs are difficult for a number of reasons. Firstly, they allow multiple argument structures. Secondly, the same event structure can underlie more than one verb and use of one verb. Therefore, event sub-situations do not determine the grammatical behaviour of verbs alone. Differences among verbs in argument realisation options may be traced back to differences in how their root is fixed in the event structure (Levin and Rappaport Hovav 2005).

Following from this, CwSLI are significantly less likely to demonstrate flexible use of verb alternations in comparison to age-matched controls in spontaneous language samples (Thordardottir and Weismer 2002). However, Loeb *et al* (1998) found that school-aged CwSLI produced causative alternations as well as age controls. Ebbels *et al* (2012) also found that CwSLI did not differ from any group (age, MLU-m, vocabulary) in their use of locative verb alternations. But the CwSLI had more difficulties using change-of-state verbs accurately, which Ebbels *et al* (2012) suggest arises from inaccurate semantic representations and difficulties with reverse linking. Levin and Rappaport Hovav (2005) propose it may be the presentational focus of the event that results in difficulty with verb argument arrangement.

Interestingly, Andreu *et al* (2013) used eye-tracking experiments to investigate the formulation of verb argument structure in pre-school CwSLI and TD age-matched controls. They based their study on Griffin and Bock (2000) who found that when speakers described events based on a visual image, they focused their visual attention on each element before producing specific language about it (e.g. fixating on a zebra in a picture of the African

savannah, as they began to say “the zebra runs away”). Therefore, Andreu *et al* (2013) hypothesised that if children have a poor representation of verb semantics, they will be less accurate in selecting appropriate zones for eye fixation during this planning phase. Subsequently, they compared how language production could be guided by conceptual factors, such as the organization of the entities participating in an event. In a picture description task, eye-tracking patterns demonstrated that CwSLI looked less at the event zone than the age-matched controls during the first two seconds. CwSLI also spent significantly less time looking at the theme zones. This is important as it indicates that problems CwSLI have in forming sentences may stem from representational problems involving processing limitations and inaccurate semantic representations of the verbs in the sentences.

Cinderella

As mentioned, the disparity in findings regarding verb difficulties in CwSLI may in part be related to different sampling contexts; spontaneous speech samples and structured elicitation tasks. Narrative is a more ecologically valid measure of language difficulties as narrators are required to use more complex language in relating internal responses and causal concepts. Narratives elicit a greater number of obligatory contexts, more advanced syntactic structures, and more low-frequency verbs (Sealey and Gilmore 2007; Owen van Horne and Lin 2011). Additionally, narratives have been found to be more developmentally robust for school-age children (Heilmann *et al* 2010). In this study, the story of Cinderella is used as it has not been investigated in the literature regarding CwSLI and TDC. The consideration of normal data in comparison to data from CwSLI highlights the structures that should be present in a narrative sample (Webster *et al* 2007). Mok and Kipka (2009) advise that language analysis needs to move beyond superficial surface structures and utilize linguistic frameworks capable of addressing the interaction between language-internal components. The framework in this study will focus on two parts: a sub-eventual analysis, classifying verbs on the complexity of their event structure, and the production of verb alternations in Cinderella.

Conclusion

What children are producing from the point of view of their cognition; how they process events and create event structure has not been looked at in CwSLI. Difficulty with event conceptualisation at the message level may carry over to the lexical representation of a verb and consequently limit the range of syntactic structures available (Mok and Kipka 2009). To date, the research on verb alternations produced by CwSLI is sparse and there is a dearth of research on verb alternations in narrative samples. Verb competence allows a speaker to produce an infinite amount of sentences to express events and situations. Poor mastery of verbs could have far-reaching consequences on language development (Thordardottir and Weismer 2001).

SLI is a dynamic difficulty that tends to persist into adolescence (Conti-Ramsden and Durkin 2008). It has long term consequences for emotional and behavioural development, academic achievement and employment (Yew and O'Kearney 2013). Better understanding of event conceptualisation and the cognitive underpinnings of sentence building would allow for targeted therapies at an early age. This is a valuable area worth studying further.

In summary, this review looked at sentence production difficulties, verb knowledge, development of event structure and what might go wrong, and what may be the difficulty underpinning verb alternations. This study aims to establish whether verb alternations and event structure complexity are contributing to the difficulty CwSLI have with verb production and sentence structure, by comparing CwSLI with TDC. It also aims to investigate the role of verb knowledge in event structure complexity by comparing CwSLI with a verb comprehension matched group. Finally, this study will investigate the usefulness of a Cinderella narrative for assessment of children. Research converges on three hypotheses:

1) CwSLI will produce fewer verb alternations in Cinderella than TDC of the same age and older.

2) CwSLI will use a lower proportion of verbs with complex event schemas in Cinderella than TDC of the same age and older.

3) There will be no difference in event structure between CwSLI and a verb comprehension control group.

Methodology

Participants

Cinderella narratives from 82 children; 65 TDC (3; 02 – 10; 09) and 17 CwSLI (6; 05 – 10; 01), collected as part of several previous investigations (O'Doherty *et al* 2009/2010; Hogan and Janicova 2010/2011; Murphy *et al* 2010, Murphy 2011) served as the basis for analysis of verb alternations, and event structure. TDC were split into two groups; Typically Developing Younger (TDY; < 6; 05), and Typically Developing Older (TDO; > 6; 05). Gender was not evenly distributed. A subgroup was formed by individually matching 17 of the TDC to the 17 CwSLI on the basis of performance on a verb comprehension task: raw score within 2 points. The task involved picture pointing to a named verb from a set of four including two semantically related and one unrelated distracter. The verb comprehension matched controls (VCMC; 3; 0 – 9; 0) were also required to score within the average range for their age (i.e. not more than 1 SD above or below the mean) on the task.

Convenience sampling was used. The TD data was collected in schools in Counties Carlow, Cork, Limerick, Meath, Tipperary and Wexford, as well as a crèche in Limerick. The SLI data was collected in three language classes in the Midlands, three language classes in the Midwest and one health centre in the Midwest. Ethical approval for each research project was obtained from the appropriate ethical committees (UL research ethics committee (REC); education and health sciences (EHS REC) for the TDC; UL REC, Midwest Regional Hospital REC and the Midlands HSE REC for CwSLI). Ethical approval for this study was obtained from UL EHS REC. Parental consent was obtained for each child.

The inclusionary criteria for CwSLI were that children be aged 6 years and above, have a diagnosis of SLI and be identified with sentence production difficulties. To meet the criteria for SLI, the children must have a diagnosis of language difficulty not primarily attributed to neurological, sensory, physical or cognitive reason, with a non-verbal IQ within the average range. Inclusionary criteria for the TDC were speech, language, cognition and hearing within normal limits, and English as a first language (Murphy 2011).

Design

The current study is a between-groups design comparing groups on a Cinderella narrative. The 2 independent variables were Groups of Children (TDY v TDO v SLI) and Verb Comprehension Matched Control Group (SLI v VCMC). The dependent variables are:

- verb comprehension score
- MLU-w
- number of utterances
- number of different lexical verbs
- number of verbs used more than once
- number of possible alternating verbs
- number of alternations
- number of verbs with simple event structure
- number of verbs with complex event structure
- number of each verb classified by sub-event (Act, Process, State, Act + Process, Process + State, Act + Process + State)

Materials

The Cinderella narrative was taken from *The Usborne Book of Fairy Tales* (Cartwright and Amery 2004). The text on each page was covered with strips of paper to ensure that the children could not read the story (Murphy 2011). Data analysis consisted of secondary analysis of the Cinderella transcripts. Quantitative analysis of the variables was undertaken using counts in Microsoft Excel and statistical testing in SPSS Version 20.

Procedure

The transcripts were already divided into utterances for analysis based on the following segmenting rules (Bishop 2004; Owens 2004, adapted in Paul 2007):

• A sentence or command is 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 a conjoining ‘and’ should be separated into utterances if the second part contains its own subject.

• For reported speech, boundaries are placed as above, that is, as if the speech had occurred without the preceding ‘said’ comment.

Every complete and unambiguous utterance was analysed. Number of utterances, number of different lexical verbs and number of verbs used more than once were manually counted and recorded for each child. All lexical verbs, phrasal verbs and copula verbs were included, with copula verbs coded once only, under the heading ‘copula’. Questions, imperatives, verbs with no accompanying arguments, relative clauses, auxiliaries and modal verbs were excluded. Semi-auxiliaries, such as *have to*, *going to* and *use to*, were also excluded. The verbs *have, do, go, be* and *use* were included in the analysis when used as main verbs. Some verbs demonstrated two or more usages different in meaning. These different usages were each categorised as separate verbs. The most notable were *get*; get, get dressed, get married and *run*; run, run away, run out of (time). MLU-w was also calculated for each child based on guidelines provided by Bishop (2004).

From the number of lexical verbs used more than once, the number of alternated verbs was calculated. Utterances including these alternations were recorded. A list of verbs that were used more than once, which could alternate, but were not alternated, was also recorded. Alternations were classified according to Levin (1993).

In the event structure analysis, each verb that a child used was classified as an Act, Process, State, Act + Process, Process + State, or Act + Process + State verb based on Black and Chiat (2003). This was dependent on how the verb was used, for example “She transformed into a princess” is P+S while, “the fairy godmother transformed her into a princess” is A+P+S. An example of verbs classified by event structure is in Table 1.

Table 1

Event Structure Classification

Verb	Example	Event Structure
Cry	"Cinderella was crying"	Act
Go	"Cinderella went to the ball"	Process
Have	"Cinderella had two ugly sisters"	State
Bring	"Cinderella brought the fairy godmother a pumpkin"	Act + Process
Appear	"The fairy godmother appeared"	Process + State
Transform	"The fairy godmother transformed the pumpkin into a carriage"	Act + Process + State

Inter-rater Reliability

To examine reliability of the analysis procedure, the student researchers agreed with the research supervisor on aspects of coding. Twenty randomly selected samples (24% of total); 10 CwSLI, 5 TDY and 5 TDO, were analysed by both research partners. Scoring revealed 97% inter-rater event structure agreement and 94% alternation agreement. The accuracy of coding included the presence and type of event structures and alternations.

Statistical Analyses

After calculating derived variables from the narrative samples, the counts were inputted into SPSS. The alternations data set comprised: verb comprehension score, MLU-w, number of utterances, number of different lexical verbs, number of verbs used more than once, number of possible alternating verbs, number of alternations. The second data set comprised the event structure dependent variables. All of the dependent variables were interval scale of measurement, therefore descriptive statistics and histograms were obtained to summarize the frequency distributions.

The data sets were tested for normality and parametric (ANOVA) and non-parametric (Kruscal-Wallis) comparison tests were run as appropriate. The researcher was aware that non-parametric tests are not as stringent as parametric tests and are therefore less sensitive, possibly not detecting differences between groups that actually exist (Pallant

2010). Initial statistical analysis on both data sets indicated if there was a significant difference between groups. Post Hoc Multiple Comparisons and a Mann-Whitney U were run between pairs to see where the statistical significance lay. Given the large number of tests performed, post-hoc tests set more stringent significance levels to reduce the risk of Type 1 errors (Pallant 2010). Given that verb comprehension emerged as a variable that more significantly differentiated the CwSLI from the TDC groups, CwSLI were compared to the VCMC group using an Independent Samples T-test. The critical probability p –value of <0.05, at which differences are considered to be statistically significant, was used during statistical analysis of the data sets.

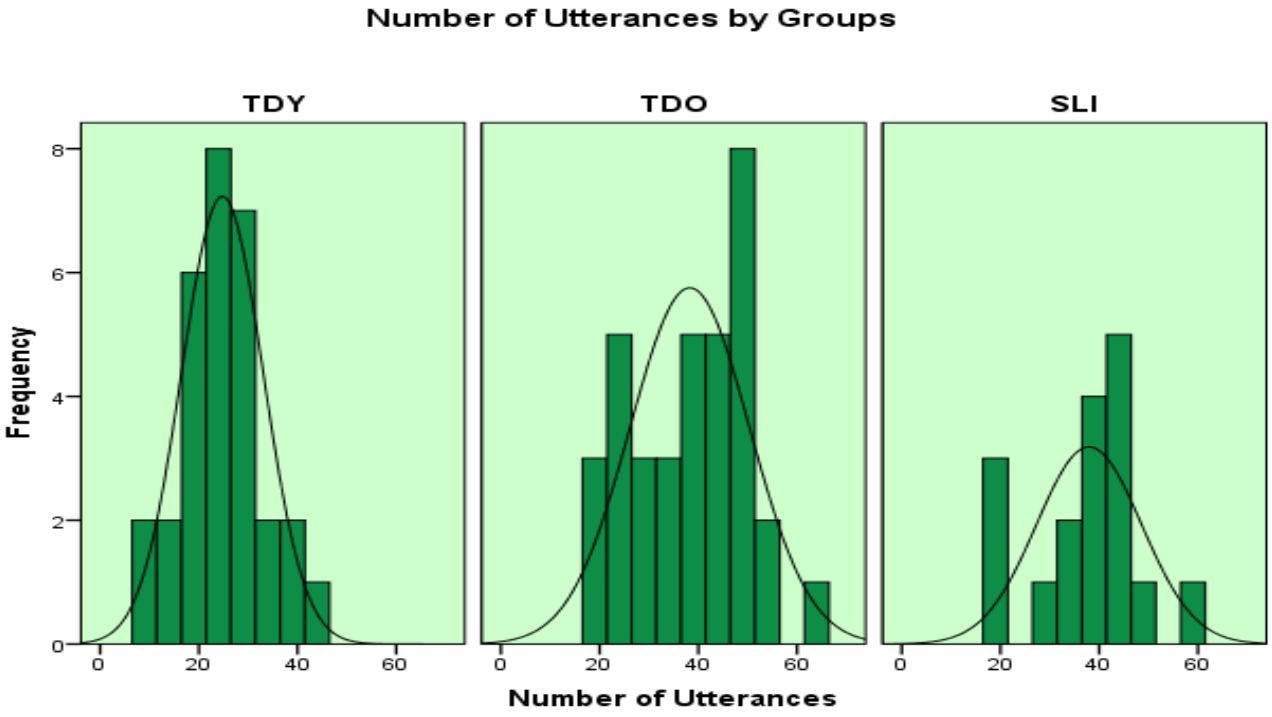
Results

Number of Utterances

TDY had the lowest number of utterances (N=30; mean = 24.77; SD = 8.274). SLI achieved a higher number of utterances than TDY (N=17; mean = 37.94; SD = 10.651), and almost the same amount of utterances as TDO (N=35; mean = 38.26; SD = 12.132). The Confidence Intervals (CI; 95%) indicated that 0 is not in the range of scores for any group (TDY = 21.68 – 27.86; SLI = 32.47 – 43.42; TDO = 34.09 – 42.42).

The 3 groups were normally distributed (Shapiro-Wilk, p = 0.902; 0.086; 0.314 respectively). Histograms (Figure 1) illustrated reasonably symmetrical distribution. ANOVA explored the difference between the 3 groups. There was a significant difference at the p < .05 level on number of utterances, F (2, 79) = 15.300, p = 0.00. The null stating that the means are equal was rejected. Post-hoc comparisons using the Tukey HSD test indicated that the mean number of utterances for SLI and TDO was significantly different from TDY (p = 0.000 for both). There was no significant difference between SLI and TDO (p = 0.994).

Figure 1

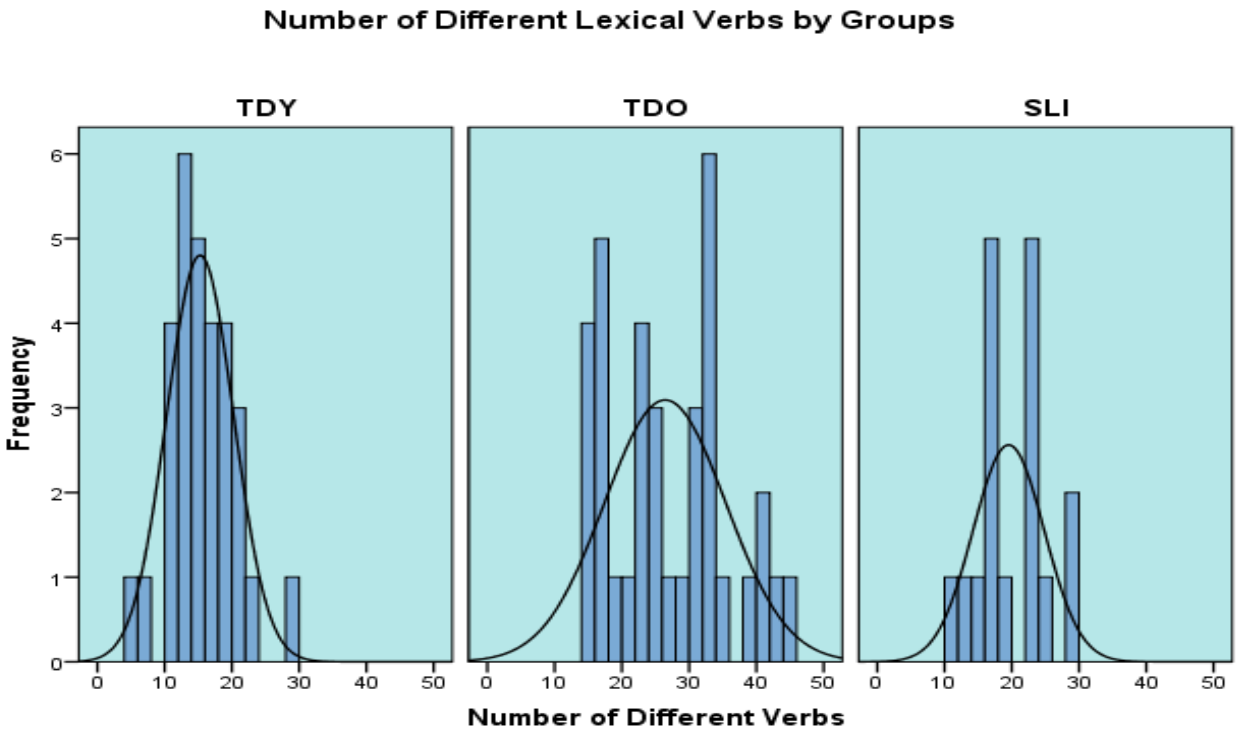


Number of Different Lexical Verbs

TDY used the least amount of different lexical verbs (N=30; mean = 15.27; SD = 4.982). The amount of different lexical verbs the SLI group used (N=17; mean = 19.53; SD = 5.293) fell between TDY and TDO (N=35; mean = 26.43; SD = 9.027) but was closer to TDY. The CI (95%) indicated that 0 is not in the range of scores for any group (TDY = 13.41 – 17.13; SLI = 16.81 – 22.25; TDO = 23.33 – 29.53).

The 3 groups were normally distributed (Shapiro-Wilk, p = 0.679; 0.062; 0.627 respectively). Histograms (Figure 2) illustrated reasonably normal distribution. ANOVA explored the difference between the 3 groups. There was a significant difference at the $p < .05$ level, $F(2, 79) = 20.596$, $p = 0.00$. The null stating that the means are equal was rejected. The Tukey HSD test indicated that the mean number of lexical verbs used by SLI and TDY was significantly different from TDO (p = 0.004 and 0.000 respectively). However, there was no significant difference between SLI and TDY (p = 0.122).

Figure 2



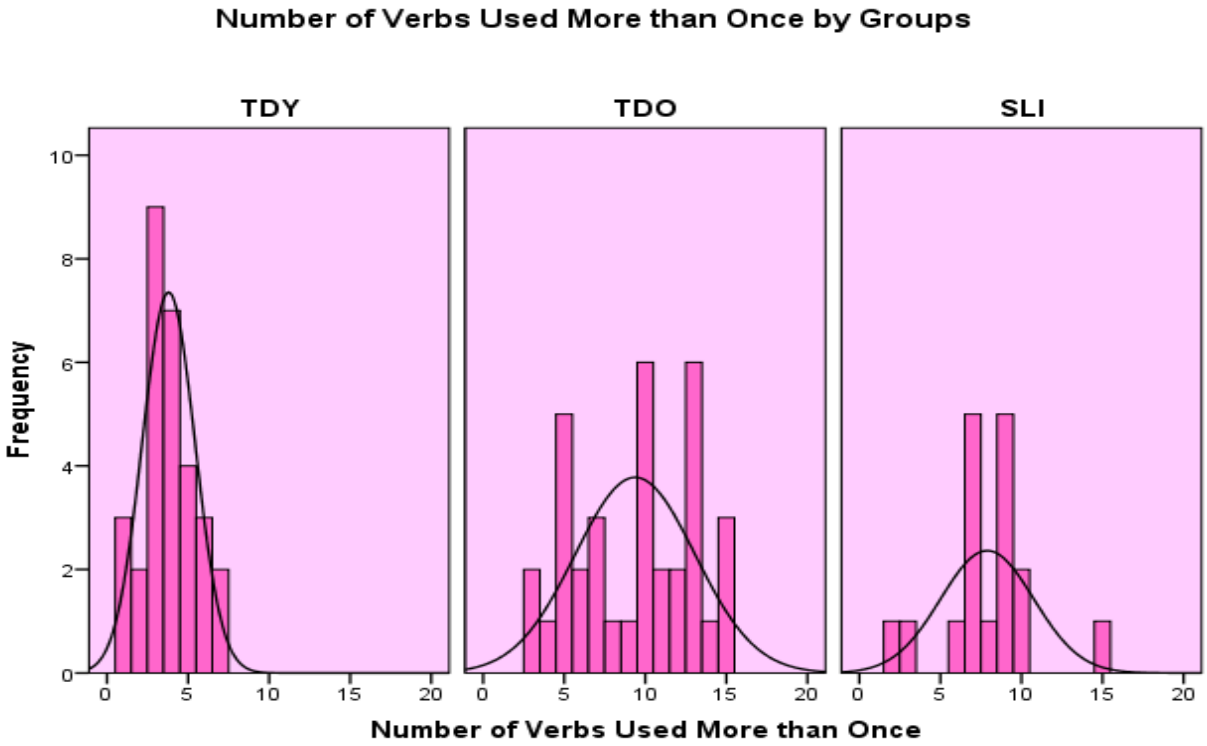
Number of Verbs Used More than Once

TDY used the least amount of verbs more than once (N=30; median = 4; IQR = 2). The number of verbs used more than once by the SLI group (N=17; median = 8; IQR = 2) was closer to the TDO group (N=35; median = 10; IQR = 7). The CI (95%) indicated that 0 is not in the range of scores for any group (TDY = 3.19 – 4.41; SLI = 6.41 – 9.36; TDO = 8.10 – 10.64).

Number of verbs used more than once by TDO was not normally distributed (Shapiro-Wilk, p = 0.039). Figure 3 illustrates the distribution in histograms. A boxplot of the distribution showed that the SLI group had high and low outliers (participant 80, 15 verbs used more than once; participant 76, 3 verbs used more than once; participant 78, 2 verbs used more than once). A Kruscal-Wallis test revealed a statistically significant difference between the 3 different groups (H(2) = 37.701, p = 0.000). The null stating that the medians are equal was rejected. TDO > SLI > TDY (where > indicates 'used more than') on the median number of verbs used more than once. A Mann-Whitney U test indicated that SLI and TDO were significantly different from TDY (p = 0.000 for both). There was no significant difference between SLI and TDO (p = 0.179).

Qualitatively, of the verbs used more than once, CwSLI use a high proportion of high-frequency verbs, as classified by Thordardottir and Weismer (2001). 17 verbs match with high-frequency verbs produced in their study; *do, give, go, know, come, put, get (motion), get, let, look, have, try, stay, say, work, make, take*. The TDO also produce these high-frequency verbs however they also use a large proportion of lower frequency verbs more than once; *transform, wonder, attend, strike, stare, inspect, reply*.

Figure 3



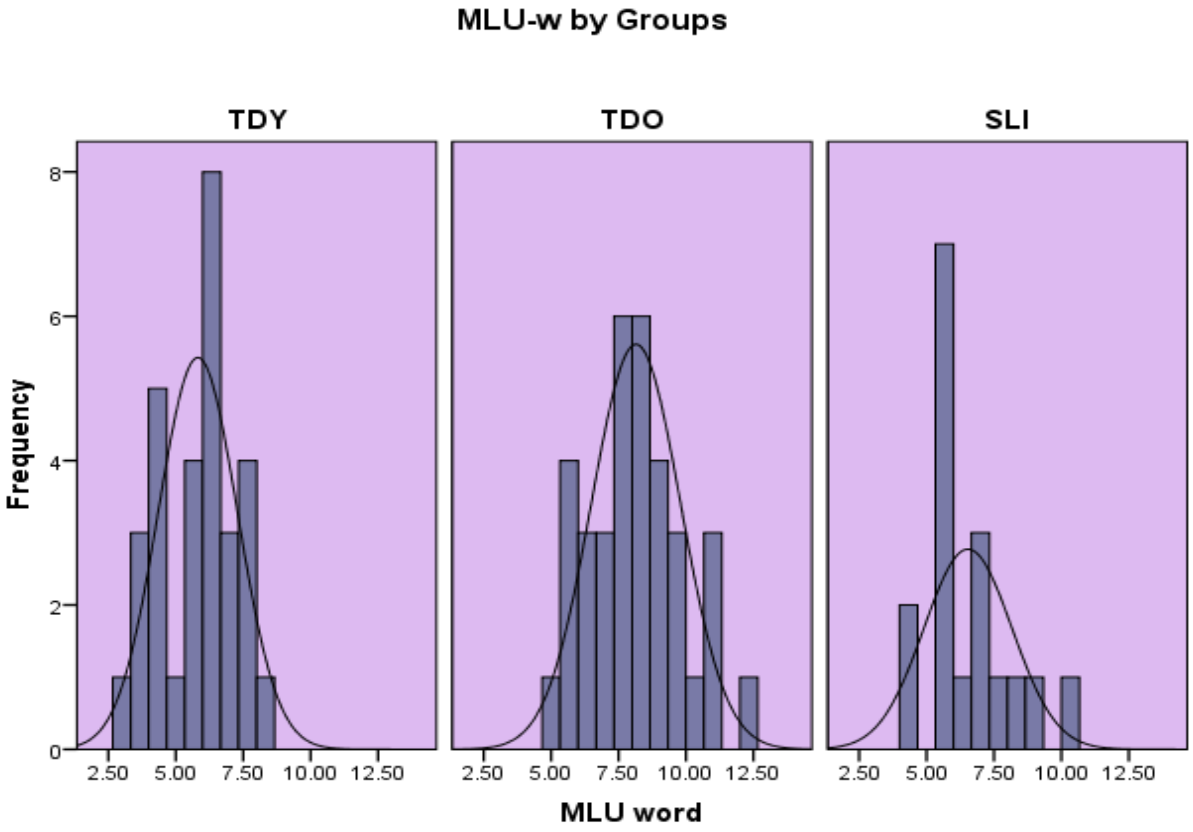
MLU-w

TDY scored the lowest on MLU-w (N=30; mean = 5.817; SD = 1.470). SLI achieved a higher mean score than TDY (N=17; mean = 6.53; SD = 1.630), but scored lower than TDO (N=35; mean = 8.14; SD = 1.658). The CI (95%) indicated that 0 is not in the range of scores for any group (TDY = 5.268 – 6.365; SLI = 5.695 – 7.371; TDO = 7.573 – 8.713).

The 3 groups were normally distributed (Shapiro-Wilk, p = 0.563; 0.496; 0.259 respectively). Boxplots of the distribution showed an outlier in the SLI group (participant 80, high MLU-w of 10.23). Histograms (Figure 4) illustrated reasonably symmetrical distribution overall. ANOVA explored the difference between the 3 groups. There was a significant difference at the $p < .05$ level in MLU-w scores, $F(2, 79) = 18.147$, $p = 0.00$. The null stating that the means are equal was rejected. The Tukey HSD test indicated that the mean score

for SLI was significantly different from TDO (p = 0.003), but not significantly different from TDY (p = 0.302). TDY and TDO were significantly different (p = .000).

Figure 4

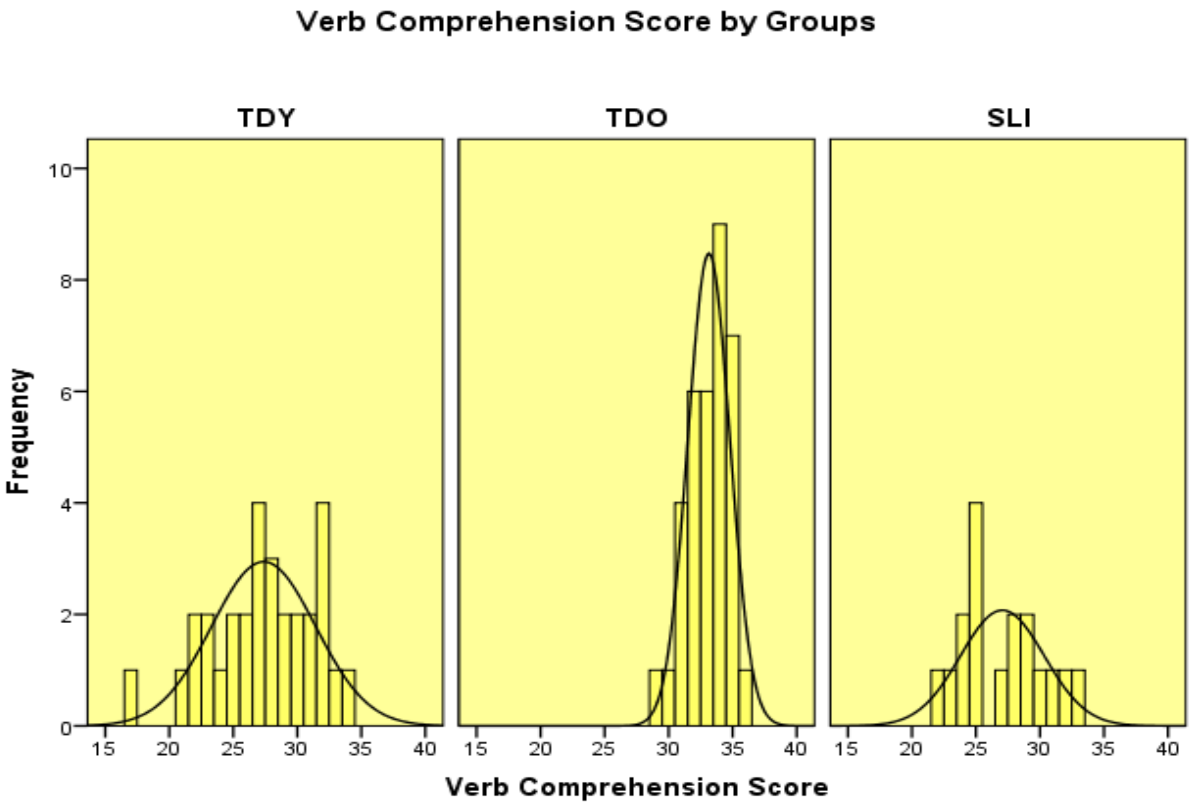


Verb Comprehension Score

The SLI group achieved the lowest mean score on verb comprehension (N=17, mean = 27.06, SD = 3.269). The TDY group scored slightly higher (N=30; mean = 27.37; SD = 4.064). The TDO group scored the highest (N=35; mean = 33.14; SD = 1.648). The CI (95%) indicated that 0 is not in the range of scores for any group (SLI = 32.47 – 43.42; TDY = 25.85 – 28.88; TDO =32.58 – 33.71).

The 3 groups were normally distributed (Shapiro-Wilk, p = 0.483, 0.058, 0.496 respectively). Histograms (Figure 5) illustrated slight negative skews for TDY and TDO. ANOVA explored the difference between the 3 groups. There was a significant difference at the $p < .05$ level on verb comprehension score, $F(2, 79) = 37.063$, $p = 0.000$. The null stating that the means are equal was rejected. The Tukey HSD test indicated that SLI and TDY were not significantly different ($p = 0.941$). However, SLI and TDY differed significantly from TDO ($p = 0.000$ for both).

Figure 5



SLI versus VCMC on Alternation Data Set

The CwSLI achieved higher means than VCMC on MLU-w (6.5335; 6.4029 respectively), number of different lexical verbs (19.53; 18.35 respectively), number of verbs used more than once (7.88; 5.71 respectively), and number of utterances (37.94; 28.53 respectively).

SLI and VCMC were normally distributed for all continuous variables in the alternations data set on a Shapiro-Wilk test of normality. An Independent Samples T-test compared the means of the continuous variables. The comparisons did not violate Levene's Test for Equality of Variances, therefore equal variances were assumed. Controlling for verb comprehension score, there was no significant difference on mean scores for MLU-w, t (32) = - 0.215, p = 0.831 2-tailed. There was no significant difference on mean number of different lexical verbs used, t (32) = - 0.438, p = 0.665 2-tailed, nor on number of verbs used more than once, t (32) = - 1.815, p = 0.79 2-tailed. There was a significant difference in the number of utterances, t (32) = -2.216, p = 0.034 2-tailed.

Alternations

Examination of the raw data indicated that the numbers of alternations were too small to warrant further statistical analysis. Eleven children from the total sample of 82 used 1 causative alternation each. Two CwSLI alternated the verb *'turn into'*. Four TDO children alternated the verb *'turn into'*. Four TDY children alternated the verb *'turn into'* and one alternated *'transform'*. The alternations are listed in Table 2.

The number of verbs which could possibly alternate but did not, was also small and therefore not meaningful. There is a large variety of possible alternations in Cinderella although they are likely to be context bound. These are listed in Appendix A.

On analysis of the use of verbs which have the potential to alternate, across the dataset the following were noted:

- Differences within children in the use of transitive or intransitive argument structures for verbs (e.g. “It fit” / “It fit Cinderella’s foot”; “Cinderella cleaned” / “Cinderella cleaned the floor”).
- Use of resultative particles (e.g. “The step-sisters are trying on the shoe”/“Cinderella tried it on”; “Cinderella is putting on the shoe”/“Cinderella put it on”).

Table 2

Verb alternations used in Cinderella

Group	Age	Alternations
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
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 the rags

Event Structure

TDY, TDO, and SLI groups were tested for normality. A mixture of normally distributed and skewed data emerged from a Shapiro-Wilk test. A Kruscal-Wallis test explored the difference between groups on the continuous variables. Significant differences were found between groups on all variables except Process + State (P+S) verbs. Table 3 illustrates these findings.

Table 3

Group comparison (TDY, TDO, SLI) on continuous variables

	Act	Act + Process	Act + Process + State	Process	Process + State	State	Total Simple Events	Total Complex Events
Chi-Square	13.738	20.149	10.417	14.807	1.284	25.767	27.783	15.590
Df	2	2	2	2	2	2	2	2
Asymp. Sig.	.001	.000	.005	.001	.526	.000	.000	.000

A follow-up Mann-Whitney U indicated that there was a significant difference between TDY and TDO on all variables except P+S verbs. TDO achieved a higher median on all other variables. Table 4 illustrates the findings.

Table 4

Comparison between TDY and TDO

	Act	Act + Process	Act + Process + State	Process	Process + State	State	Total Simple Events	Total Complex Events
Mann-Whitney U	262.500	202.500	297.000	258.500	469.000	167.500	144.500	234.000
Z	-3.509	-4.312	-3.103	-3.576	-.761	-4.747	-5.023	-3.845
Asymp. Sig. (2-tailed)	.000	.000	.002	.000	.447	.000	.000	.000

There was a significant difference between TDY and SLI on Process (P), State (S), Total Simple Events, and Act + Process (A+P) events. No significant difference was found on Act (A), P+S, Act + Process + State (A+P+S) and Total Complex Events. Table 5 summarises these findings. A comparison of the medians indicates that the SLI group achieved a higher median on all continuous variables except P+S.

Table 5

Comparison between TDY and SLI

	Act	Act + Process	Act + Process + State	Process	Process + State	State	Total Simple Events	Total Complex Events
Mann-Whitney U	239.500	136.500	178.000	131.500	208.000	123.500	137.500	172.000
Z	-.353	-2.675	-1.777	-2.789	-1.074	-2.972	-2.623	-1.853
Asymp. Sig. (2-tailed)	.724	.007	.076	.005	.283	.003	.009	.064

There was a significant difference between SLI and TDO on Total Simple Events, A, and S events. There was no significant difference between SLI and TDO on Total Complex Events, A+P+S, A+P, P+S, and P. Table 6 illustrates the findings. On the variables that had a significant difference the TDO group achieved higher medians.

Table 6

Comparison between SLI and TDO

	Act	Act + Process	Act + Process + State	Process	Process + State	State	Total Simple Events	Total Complex Events
Mann-Whitney U	173.500	220.000	234.500	264.000	273.000	185.500	170.000	210.000
Z	-2.457	-1.525	-1.267	-.662	-.497	-2.214	-2.495	-1.717
Asymp. Sig. (2-tailed)	.014	.127	.205	.508	.619	.027	.013	0.086

SLI versus VCMC on Event Structure

The SLI and VCMC had a mixture of normal and skewed data distribution on a Shapiro-Wilk test. A Mann-Whitney U test compared SLI and VCMC on all event structure continuous variables. No significant difference was found between groups on any of the continuous variables. The results are illustrated in Table 7.

Table 7

Comparison between SLI and VCMC

	Act	Act + Process	Act + Process + State	Process	Process + State	State	Total Simple Events	Total Complex Events
Mann-Whitney U	140.500	117.000	138.500	96.500	141.000	101.000	103.500	135.000
Z	-.141	-.959	-.216	-1.686	-.124	-1.520	-1.420	-.331
Asymp. Sig. (2-tailed)	.888	.337	.829	.092	.901	.128	.156	.741

Discussion

This study aimed to investigate whether verb alternations and event structure complexity are contributing to the difficulty CwSLI have with verb production and verb argument structure, and whether verb knowledge plays a role in the complexity of event structure. It also aimed to investigate the usefulness of a Cinderella narrative as a means of assessment. Within this section, the results of analyses of verb alternations, verb knowledge, and event structure will be discussed, prior to discussing the usefulness of Cinderella, the limitations of the data set and the possible contribution of this analysis.

Verb Alternations

Cinderella only yielded a small number of alternations; insufficient to warrant further statistical analysis. The TDC samples show the types and complexity of verb alternations that are likely to be evident during the telling of Cinderella. Nine causative alternations are used across the TDC. The samples highlight that just because verb alternations are only used twice by CwSLI, this may not be indicative of a problem. Therefore, the current findings may be consistent with Loeb *et al* (1998) who found that CwSLI do not demonstrate a significant difference in use of causative alternations compared with TDC. Of the CwSLI who used alternations, one has the lowest MLU-w, number of utterances and number of lexical verbs, while the other has the highest. But a single use of a form does not imply full mastery of that form (Thordardottir and Weismer 2002). Therefore evidence is inconclusive on verb alternations based on the results obtained in this study. Cinderella is not considered a useful tool for eliciting data on verb alternations.

Despite this, this study usefully considers normal performance on a narrative task, namely Cinderella. Consideration of normal performance on a task is crucial when evaluating the value of the task in eliciting particular types of linguistic structures and for characterising normal variability. Interestingly, considerable examples of verbs which allow for alternations, as classified by Levin (1993), are found in the Cinderella narratives. It is possible that these verbs are not alternated due to the context bound nature of Cinderella.

Verb Knowledge

CwSLI and TDY produce significantly fewer different lexical verbs than TDO. In contrast, SLI and TDO are not significantly different on number of verbs used more than once. This implies that the CwSLI have a smaller verb diversity than TDO and are more reliant on a particular set of verbs. The findings are not in agreement with Thordardottir and Weismer (2001) who found no differences between school-age CwSLI and TDC in verb diversity. This may arise from differences in sampling method and analysis metrics used. In contrast, the results may be consistent with Conti-Ramsden and Jones (1997) who concluded from a longitudinal study of pre-school CwSLI that the development of their cumulative verb lexicons proceeded at a similar rate to that of their younger siblings with normal language, even though the CwSLI used fewer verbs per session. As the CwSLI in this study are older, direct comparisons cannot be made.

In this study, the CwSLI make use of the same high frequency verbs as TDO. But the results suggest that TDO have a protracted development, adding more high-frequency and low frequency verbs to their repertoire. This is consistent with the finding that older CwSLI learn fewer novel words than age match controls, which particularly affects verbs (Weismer and Hesketh 1996). Differences may exist in the extent of the children's knowledge of the verbs that are not apparent in the mere diversity of the verbs used (Thordardottir and Weismer 2001). Ebbels *et al* (2007) believe that inaccurate semantic representations could arise from observational biases as CwSLI are more reliant on observational cues than TDC and have more difficulty with reverse linking (O'Hara and Johnston 1997; van der Lely 1994). If the child has to assign to each verb the correct event structure before target lexical representations can be projected, this kind of ambiguity may be a potential hindrance to learning the meaning of verbs.

Considering verb comprehension, the CwSLI and TDY are not significantly different from each other, but have significantly lower verb comprehension scores than TDO. The results show a clear progression with age in verb comprehension for TDC. Considering the theoretical model of sentence production outlined in the introduction, it is suggested that there may be a potential cascading effect of entrenched inaccurate event biases on verb

knowledge. Consequently, verb knowledge was controlled for. There is no significant difference between SLI and VCMC on MLU-w, number of lexical verbs produced and number of verbs used more than once. A significant difference is to be expected on number of utterances as twelve of the children in the VCMC group came from the TDY group.

Event Structure

On examination of event structure, there are significant differences between TDY, TDO, and SLI on all variables except Process + State (P+S) verbs. In contrast to predictions, CwSLI do not differ significantly from TDO in the complexity of event structure. The small and uneven group sizes may have prevented a significant difference emerging. TDO produce significantly more Act Verbs, State Verbs, and Total Simple Verbs than the CwSLI. This is consistent with eye-tracking evidence (Andreu *et al* 2013) showing that CwSLI look less at the event zone and spend less time looking at the theme zones than age-matched controls. All of the children in this study produce a significantly higher number of simple event verbs than complex event verbs. This implies that regardless of language ability, children will choose the most parsimonious way of describing events. This is consistent with findings that the eye gazes at the element in a scene that is the easiest to use to start a sentence (Griffin and Bock 2000), and that all children use GAP verbs allowing for semantic and syntactic simplifications (Thordardottir and Weismer 2001).

The relationship between verb knowledge and event structure was also explored. This study is the first as far as one is aware to directly investigate this area in CwSLI. The hypothesis that verb knowledge and event structure complexity are related is consistent with evidence that verb difficulties may reflect an entrenched under-developed knowledge of events. This is seen through increased verb argument structure accuracy in older CwSLI after explicit teaching of verb meaning and which argument is the main focus of events (Ebbels *et al* 2007). There is no significant difference between CwSLI and VCMC on any of the event structure continuous variables. This implies that verb knowledge (at least that which can be determined from a verb comprehension picture pointing task) is related to the processing and production of event structure. There is a relationship although we do not

know the direction of causation. Inaccurate event knowledge, arising due to inaccurate semantic representations, processing difficulties and difficulty with reverse linking, may become entrenched if the child does not access disconfirming evidence; explicit instruction or increased frequency of input. Additionally, hearing verbs in context, which are higher in frequency with predictable transitivity patterns may bias children toward noticing certain event types.

Cinderella

The number of utterances produced by the CwSLI and TDO are not significantly different. This suggests that the argument structure omissions and less complex predicate argument structure used by the CwSLI in Murphy (2011) is not merely attributable to production limitations in telling Cinderella, but that they may only have partial representations of verbs. But uneven group sizes must be taken into consideration. The TDC in this study produce mostly complete utterances and children across the data set produce high and low frequency verbs. This highlights the value of Cinderella in identifying different lexical verbs, verb diversity, and event structures. This is consistent with the finding that narratives provide the speaker with the opportunity to use the most complex language they are capable of under optimal conditions (Thordardottir and Weismer 2002).

This research suggests that Cinderella can be added to assessment procedures for children. It is a low cost, widely available and easy to administer tool. It has ecological validity and elicits a large number of obligatory contexts and advanced syntactic structures (Sealey and Gilmore 2007). Pictures also elicit more event verbs than static verbs (Black and Chiat 2003). Cinderella is easy to segment and provides a good means of monitoring changes. Furthermore, it provides greater contextual support for interpreting the speaker's production and there is greater predictability in the propositional and lexical content (Webster *et al* 2007).

Limitations

This study was exploratory in nature and had some design limitations. Murphy (2011) states that the lack of standardisation around the elicitation procedure, by way of different researchers collecting data and varying levels of support given to a number of children, may have implications for the reliability and validity of the results. There is a queried gender bias in using Cinderella, and the story as an elicitation tool may provide some children with an advantage over others as the level of familiarity cannot be controlled. Furthermore, the CwSLI were a small sample. This created uneven group sizes which may have limited the power of the statistical analysis. The findings must also be viewed with caution as the mean number of utterances produced did not meet the recommendation of 100 utterances in order to obtain adequate examples of syntactic complexity (Miller 1981).

Clinical Implications and Recommendations

This study has important implications, as given the ecological validity of Cinderella, it demonstrates that CwSLI continue to demonstrate verb difficulties up to 10 years of age, thus increasing the risk of communication breakdowns in academic and social contexts (Lyndsay and Dockrell 2000). It is recommended that methods of elicitation such as those used by Ebbels *et al* (2012) and Loeb *et al* (1998) be used to investigate verb alternations, as exemplars were limited in Cinderella. However, across the data set, differences were found in the use of transitivities and resultative particles within children on verbs that allow for alternations. Cinderella might be a useful tool for studying this further.

The event structure analysis framework is supported by Black and Chiat (2003). It delineates event structure and organises the relationships between individuals in an event in a way that semantic role based accounts cannot (Levin and Rappaport Hovav 2005). This framework is recommended for continued use, but it would be important to compare event structure complexity on spontaneous language samples or controlled tasks. In light of time limitations, it was decided to compare CwSLI only with VCMC, since this emerged as a variable that more significantly differentiates the CwSLI from TDC. Arguably, the CwSLI could

also have been compared with MLU-w matched children. It is recommended that this is studied further.

The current findings show that event structure complexity is related to age, group and verb knowledge. There are implications for clinical practice. Since CwSLI demonstrate difficulty learning verbs in naturalistic contexts (Ambalu *et al* 1997) because the relationship between verbs and the scene they depict is not always predictable, a form of parent training based on impending and completed condition cues may be useful for delimiting the properties of verbs for children. It is suggested that language intervention should focus on providing experiences with verbs that will enrich the knowledge the child has in the semantic lexicon (Andreu *et al* 2013). Ebbels *et al* (2007) use shape coding for this purpose which has resulted in significant progress in verb argument structure for CwSLI. However, since verb knowledge and event structure are related in this study, it is suggested that lexical-conceptual information also be provided (Andreu *et al* 2013). When planning intervention it is important that the clinician evaluate multiple properties of verbs (semantic and syntactic) to determine which verbs may be particularly problematic. Furthermore, intervention implications include incorporating verbs from a variety of semantic categories and transitivity contexts to diversify the verb repertoires of CwSLI (Loeb *et al* 1998).

Conclusion

CwSLI produce fewer simple event structures than TDO. All children use more simple event structures overall. It is important to note that all children may be using the most efficient way of describing events and that verb knowledge is related to the complexity of event structure. This study found inconclusive evidence on verb alternation production for CwSLI. Cinderella provides a rich data set that can be explored over and above MLU and grammatical morpheme errors. The significance of these findings for theories of the nature of SLI is that it argues for a wider characterisation of verb deficits and has clinical implications for assessment and intervention. Targeted intervention could have far-reaching benefits for academic and social achievement in CwSLI. This is an exciting linguistic area with regards CwSLI and is worth studying further.

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Appendix A:

Verbs that allow for alternations in the Cinderella samples

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
Get Ready	Understood Reflexive Object Alternation
Give	Dative
Hold	Body Part Possessor Ascension Alternation
Kiss	Body-Part Possessor Ascension 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
	Understood Reflexive Object 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
	Understood Reciprocal Object Alternation
Take	Dative
Transform	Causative
Turn into	Causative
Walk	Induced Action Alternation
	Locative Preposition Drop Alternation
Want	Possessor-Object Possessor-Attribute Factoring Alternation