Sampling and analysis of children's spontaneous language

From research to practice

Marleen Westerveld

In clinical practice, most paediatric speech pathologists (SPs) deal with young clients with communication difficulties on a daily basis. Routine assessments generally include standardised tests of children's speech and/or language skills to determine the severity of the speech/language disorder, the eligibility for service, and the possible direction for intervention. Detailed assessment of children's language skills in more natural situations is used less frequently, however, as it may seem a relatively difficult and time-consuming task. This paper provides a brief overview of current empirical knowledge about spontaneous oral language sampling in preschool and school-aged children across a range of discourse genres, with particular emphasis on clinical applications in an Australian context. It urges practitioners to adopt language sample analysis on a routine basis to determine a child's baseline level of performance and to monitor the child's response to intervention in an ecologically valid way.

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Marleen Westerveld

Spontaneous oral language sampling and analysis (LSA) should be central to the paediatric SP's assessment process (see Miller, 1996). Without addressing a client's spontaneous communication ability, it will be difficult, if not impossible to (a) determine the impact of a child's language impairment on his or her ability to execute communicative tasks in everyday situations, (b) set relevant detailed goals for intervention, or (c) evaluate whether newly learned skills have generalised to everyday communication following intervention. Results from overseas studies into LSA practices of SPs revealed that although most SPs gathered some information about the child's spontaneous language skills, few SPs fully transcribed these samples for detailed in-depth analysis (e.g., Hux, Morris-Friehe, & Sanger, 1993). Possible reasons for this limited analysis include the lack of training in (computerised) analysis, lack of (standardised) local norms for comparison, and time constraints (Gillon & Schwarz, 1998).

In recent years, there have been a significant number of research studies into the spontaneous language skills of children with differing communication profiles, including typically developing children (e.g., Nippold, Hesketh, Duthie, & Mansfield, 2005; Westerveld & Gillon, 2010b; Westerveld, Gillon, & Miller, 2004), children with traumatic brain injury (e.g., Thal, Reilly, Seibert, Jeffries, & Fenson, 2004), children with specific language impairment (e.g., Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004; Heilmann, Miller, & Nockerts, 2010), children with reading disabilities (e.g., Westerveld & Gillon, 2010a), children with known chromosomal disorders such as Down syndrome (e.g., Kay-Raining Bird, Cleave, White, Pike, & Helmkay, 2008), and bilingual populations (e.g., Miller, Heilmann, & Nockerts, 2006). The prevailing message is that LSA can successfully differentiate between children with (spoken and/or written) communication difficulties and their typically developing peers (see also Dunn, Flax, Sliwinski, & Aram, 1996). However, a wide range of methods have been reported in the research literature to elicit spontaneous language. This makes it more difficult for the busy clinician to decide which elicitation context or condition to use as it is well known that the choice of context influences the length, the syntactic complexity, as well as the overall structure of the child's oral language sample. Finally, without norms of typical performance, it will be difficult to determine clinically if an individual client's spoken language skills are significantly impaired. The current tutorial addresses these issues by summarising the most recent research into LSA in relation to the following four areas:

1. Elicitation: guidelines for eliciting spontaneous language in preschool and school-aged clinical populations.
2. Analysis: an overview of the clinically most relevant measures of language performance.
3. Reference databases: using normative data of typical language performance.
4. Progress monitoring: using LSA to determine response to intervention.

Eliciting spontaneous language samples: contexts and conditions

When eliciting a sample of a child's spontaneous language, the child's age and general speech-language ability need to be taken into consideration. When the child's mean length of utterance (MLU) is less than 3, typically below the age of 2;6 – 3;0 years, analysis of spontaneous language may focus on semantic relations, and real-time transcription of children's language productions may be sufficient. Once a child's MLU is greater than 3, analysis may concentrate on morphological and syntactic markers, and real-time transcription may become too difficult (see Klee, Mebrino, & May, 1991). Furthermore, the length of the sample is

important. Recent research suggests that eliciting relatively short samples may be appropriate when analysed as part of a comprehensive assessment battery of spoken language skills, or when used as a progress monitoring tool (Heilmann, Nockerts, & Miller, 2010). However, samples containing at least 50 complete and intelligible utterances are recommended for detailed analysis of a child's language production skills (Heilmann, Nockerts, et al., 2010; Miller, 1996). Next, the SP will need to decide in which context/s to elicit the child's spontaneous language to ensure the child's language production skills are sufficiently challenged to reveal strengths and weaknesses across the domains of semantics, morphology, and syntax.

There are three main contexts for eliciting spontaneous language in children: conversation, narrative, and expository discourse. Conversation can be described as an 'unplanned' interactional exchange between two or more conversational partners. In contrast, narratives are accounts of experiences or events by just one speaker, and are temporally sequenced. Different narrative genres exist, including personal narratives and fictional narratives or stories. Expository discourse, like narrative language, requires planning at text level and can be described as a monologue providing factual descriptions or explanations of events. Within these broad elicitation contexts, spontaneous language samples can be elicited in different conditions (e.g., generation, retelling), utilising a variety of methods (e.g., with/without visual support such as pictures or video, a picture sequence or a single picture, with/without a model, naïve versus familiar listener). Although it goes beyond the scope of this paper to provide an extensive review, Box 1 presents an overview of the main elicitation contexts and conditions, including an approximate age range (see also Hughes, McGillivray, & Schmidek, 1997) and suggestions for further reading. The elicitation contexts in Box 1 are more or less in order of development/difficulty.

When choosing the context for LSA, several factors may influence the SP's decision. Although it is recommended to sample children's spontaneous language across different contexts (e.g., Price, Hendricks, & Cook, 2010), in clinical practice eliciting one formal language sample is better than none. Depending on the purpose of the LSA (screen versus full linguistic analysis), the child's age and the main measures the SP is interested in (see Box 1), a sample can be elicited either in conversation, narration, or exposition. As can be seen in Box 1, narrative samples (story retelling in particular) generally yield less than the 50 utterances needed for full linguistic analysis. In those situations, collecting a second language sample in a different context is suggested. Another consideration is whether the SP wishes to compare the language sample to age- or grade-matched peers. Finally the methods used in eliciting spontaneous language can have significant effects on the child's language production (e.g., Masterson & Kamhi, 1991; Schneider & Dubé, 2005). This highlights the importance of closely adhering to the language sampling protocol used for collecting normative data when comparing a language sample collected in the clinic to these norms of typical performance.

Transcription and analysis

Once a language sample has been elicited and transcribed, the most efficient way of analysing a language sample is to use a computer program. Examples of available programs are CLAN (available from http://childes.psy.cmu.edu/clan/), developed by Brian MacWhinney, Computerized Profiling (CP; http://www.computerizedprofiling.org/), developed by Steven Long, and Systematic Analysis of Language Transcripts (SALT; http://www.saltsoftware.com/) by Jon Miller and Ann Nockerts. Although the first two programs are available for free, one of the SALT program's main features is its ability to readily compare a child's transcript to a reference database (i.e., a database containing transcripts from typically developing children). The importance of this aspect will be discussed in more detail in the next section. First, let's consider which language production measures are known to be sensitive to age and/or language ability.

Morphology and syntax

Utterance length (MLU in morphemes or words) and clausal density are two known indicators of later language development (e.g., Nippold, 2007). Clausal density can be calculated by dividing the total number of clauses (independent

Box 1. An overview of elicitation contexts and conditions in approximate order of difficulty

Elicitation context	Conditions	Approximate minimal age in years	Main measures and expected length of sample	Examples of further reading
Conversation	Free play	3;0 (MLU > 3.0)	Semantics, syntax, morphology, pragmatics	
	Interview	4;6	> 50 utterances	(Evans & Craig, 1992)
Narration	Personal narratives	3;6 (embedded in conversation)	Semantics, syntax, morphology, narrative quality	(McCabe & Rollins, 1994)
		4;6 (using picture prompts)	> 50 utterances	(Westerveld et al., 2004)
	Fictional story retelling	4;4	Semantics, syntax, morphology, narrative quality	(Westerveld & Gillon, 2010b)
			5–93 utterances	http://www.saltsoftware.com/training/elicitation/protocol/#
	Fictional story generation	3;11	Semantics, syntax, morphology, narrative quality	(Schneider et al., 2009)
			20–96 utterances	http://www.rehabmed.ualberta.ca/spa/enni
Expository	Expository generation – favourite game or sport task	6;0	Semantics, syntax, morphology, expository structure	(Nippold, Hesketh, et al., 2005; Westerveld & Moran, 2011)
			4–140 utterances	http://www.saltsoftware.com/training/elicitation/protocol/#

and dependent) by the number of independent clauses. For example "I went to McDonalds **because it was my brother's birthday**" contains one independent clause (underlined) and one dependent clause (bold). MLU is sensitive to language ability (Scott & Windsor, 2000), with children with language disorder demonstrating lower MLU in narrative and expository discourse than their peers with typical language development. Grammatical accuracy can be assessed by considering the percentage of grammatically correct utterances (Fey et al., 2004) and may be particularly sensitive to language ability (Scott & Windsor, 2000).

Verbal productivity

The length of the overall sample may be an important indicator of verbal productivity that changes with age (e.g., Nippold, Hesketh, et al., 2005). Another verbal productivity measure is rate (words per minute, WPM). Research into WMP in conversation, narrative, and expository contexts has shown sensitivity of this measure to age (Heilmann, Miller, & Nockerts, 2010) and language ability (Scott & Windsor, 2000).

Semantic diversity

The number of different words (NDW) that are used in spoken discourse is a well-known indicator of lexical diversity that is sensitive to age as well as language ability (e.g., Fey et al., 2004). Unfortunately, NDW is sensitive to sample length (the longer the sample, the higher the NDW), which makes it less useful in contexts in which the transcripts are not cut after a certain number of utterances, such as story retellings or generations. A mathematical solution to this problem was put forward (see Richards & Malvern, 2004) and referred to as the *vocd lexical diversity measure*. This measure can be calculated with software included with CLAN, but it is beyond the scope of this tutorial to discuss this measure in more detail.

Verbal fluency

Another measure of linguistic performance is mazing behaviour (i.e., filled pauses, repetitions, reformulations) (Loban, 1976). Mazing behaviour has been linked to sentence length and grammatical complexity in studies involving morpho-syntactic development in preschool children (Rispoli & Hadley, 2001). In other words, a child's mazing behaviour may increase as he or she tries to produce longer and/or more complex sentences. Moreover, excessive use of mazing behaviour may indicate linguistic vulnerability, especially when the cognitive demands of a task increase (MacLachlan & Chapman, 1988).

Narrative quality

Narrative language samples can also be analysed at a more global level to determine the overall quality of the narrative. This is referred to as macrostructure analysis (see Hughes et al., 1997) and typically focuses on the structure of the narrative. For example, personal narratives can be analysed using high point analysis (McCabe & Rollins, 1994), which evaluates the narrative for inclusion of past tense events, a "high point" ('the meaning the narrative had for the narrator' [p. 50]), and a resolution. Fictional narratives can be analysed at macrostructure level by scoring the inclusion of story grammar elements (e.g., setting, characters, problem; see Stein & Glenn, 1979), the overall cohesion of the narrative or story, and the theme of the story. Several scoring systems have been devised, including the Narrative Scoring Scheme (Heilmann, Miller, Nockerts, & Dunaway, 2010), and the Oral Narrative Quality rubric (Westerveld & Gillon, 2010b).

Difficulties producing good quality oral narratives have been observed in children with language impairment (e.g., Fey et al., 2004; Miranda, McCabe, & Bliss, 1998) and in children with reading disability (e.g., Westerveld, Gillon, & Moran, 2008).

Reference databases

To determine if a child functions significantly below his or her age level, language production measures derived through LSA should be compared to normative data. One potential obstacle to LSA in Australian children is the very limited availability of normative data based on Australian populations. Although it would be preferable to create databases containing spontaneous language samples of Australian children in a variety of contexts, this process is time consuming and expensive. Until such time, evidence from existing cross-cultural research examining spontaneous language produced by English-speaking children may provide some guidance as to whether Australian SPs can safely adopt overseas norms when analysing spontaneous language samples. At present, most readily available databases containing English language samples are from the US and New Zealand (Miller & Nockerts, 2010; http://www.saltsoftware.com/salt/downloads/referencedatabases.cfm) and Canada (Schneider, Dubé, & Hayward, 2009; http://www.rehabmed.ualberta.ca/spa/enni). All these databases are integrated into the SALT software, but norms for the Canadian samples can also be obtained from their website. In addition, the CHILDES database contains a wealth of transcripts from around the world (visit http://childes.psy.cmu.edu/).

Cross-cultural comparisons of language performance

Westerveld and Claessen (2009) compared spoken language samples produced by 5- and 6-year-old children from New Zealand (NZ) and Western Australia (WA). Conversational (n = 24) and story retelling transcripts (n = 39) from WA children were compared to the samples of all 5;0 to 6;0 year-old NZ children contained in the SALT-NZ reference database (n = 67 and n = 47 respectively) (Miller, Gillon, & Westerveld, 2008). In the conversational context, exactly the same protocol was used, in which the child was first asked to talk about an object, before being asked to talk about his or her family, school, and after-school activities (see Westerveld et al., 2004). In the story retelling condition, children were asked to listen twice to a novel story (NZ: *Ana Gets Lost*; Swan, 1992; WA: *A Day at the Zoo*; Strang & Leitão, 1992), before being asked to retell the story into a tape recorder so that "other children can listen to *your* story next time". The two model stories were comparable in length, semantic diversity, and grammatical complexity. Results indicated significant differences between the performance of the children in the two countries on a measure of grammatical accuracy (GA), with the NZ children performing better than the WA children both in conversation and in story retelling. In contrast there were no significant group differences on measures of story length, semantic diversity (NDW), or syntax (MLU). The authors hypothesised that several factors might have contributed to these differences in GA, including socioeconomic background and year of schooling of the participants. Further research is clearly needed to check these assumptions. In the meantime, clinicians should take caution when comparing the grammatical performance of Australian children against the NZ database.

A number of studies have compared spoken language samples from NZ children to samples produced by children from the US (Nippold, Moran, Mansfield, & Gillon, 2005; Westerveld et al., 2004; Westerveld & Heilmann, 2010). Westerveld et al. found differences in conversational samples between speakers from the two countries dependent on the age group. At age 5, the NZ children (n = 56) spoke at a faster rate compared to their US peers (n = 60). There were no differences on measures of MLU, GA, or

semantic diversity (NDW). At age 6, however, the NZ children (n = 93) outperformed the US children (n = 53) on measures of MLU and NDW. By age 7, these differences on MLU and NDW had disappeared and the only measure that differentiated the two groups was speaking rate. The authors postulated that the different schooling systems of the two countries might explain the group differences at age 6. In NZ, children typically start school around their fifth birthday, which might explain the generally stronger language production skills at the age of 6. In a more recent study, Westerveld and Heilmann (2010) compared story retelling samples of 6- and 7-year-old children from NZ and the US. Results showed that the only measure that differentiated the two groups was a verbal fluency measure (percent maze words), accounting for just over 5% of the variability, with the US children using more maze words than the NZ children. There were no differences on measures of MLU, total number of utterances, and narrative quality. Finally, Nippold, Moran, et al. (2005) found no statistically significant differences between older groups of speakers (n = 40; aged 11 and 17) from the two different countries on measures of syntactic complexity (MLU and dependent clause use) derived in conversation and expository generation.

In summary, until further research is conducted in Australia, the results from existing cross-cultural research indicate that we may have some confidence when comparing a language sample from an Australian child to a database of language samples produced by NZ or US children. However, utmost care should be taken to adhere to the specific language sampling protocols. To illustrate, Westerveld and Heilmann (2010) found significant differences in children's ability to retell a story when provided with pictures (as opposed to no pictures) during the retelling component of the task. Children told longer stories, containing a higher number of different words and a lower percentage of maze words when provided with pictures during the retell. These results are consistent with numerous other studies investigating the effects of elicitation conditions on children's productive language (e.g., Schneider & Dubé, 2005).

Evaluating language performance in children from linguistically diverse backgrounds

When evaluating the spontaneous language performance of children from linguistically diverse backgrounds, comparisons to a reference database containing samples from monolingual English speakers may not be appropriate. To help distinguish between a language difference and a language disorder, the SP may decide to use an alternative approach, such as Parent–Child Comparative Analysis (CPAA), in which the child's performance is compared to the parent's responses rather than the responses contained in the reference database (see Paul, 2007, for more information). For more information regarding personal narratives in children from culturally and linguistically diverse populations, the reader is advised to read Bliss and McCabe (2008).

Monitoring progress

Consistent with best practice guidelines, results from LSA should be used to confirm standardised test results, and to provide detailed information about a child's performance in the areas of syntax, morphology, verbal productivity, and fluency. Based on this information, very detailed goals may be set for intervention, which not only incorporate specific language production features (syntax, semantics, narrative quality, etc.), but also include the communicative context. A child's response to intervention can then be measured by collecting an additional language sample and comparing the child's performance to his or her previous one. Spontaneous language sampling thus provides an ecologically valid way of measuring progress following language intervention. In addition, language samples are more readily interpretable for teachers and can be used as part of school portfolios across listening and talking curriculum outcomes. For a detailed case study see Westerveld (2003), or contact the author for a copy.

In contrast, the use of standardised tests should be avoided to monitor progress. Although results from these tests may inform the clinician whether a child's performance still differs significantly from a normal population, they will not provide detail about the child's communicative performance in a more contextualised situation. Moreover, care should be taken when re-administering standardised tests, as learning effects may occur, which could inflate a child's performance.

Conclusion

Although there are few norms available of typical spoken language development for Australian children, this should not preclude the use of routine LSA for assessment and progress monitoring practices for children with (suspected) spoken language impairment. As SPs we strive to improve our clients' communication skills in everyday situations. LSA is the most sensitive, ecologically valid way of determining a child's spoken language performance in communicative situations and for monitoring progress following intervention.

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Marleen Westerveld is a senior lecturer and researcher at Massey University in Auckland. She also works as a research fellow at the University of Canterbury, Christchurch, New Zealand. Her research focuses on investigating the relationship between spoken and written language development and disorders. Particular interests include spontaneous language sampling and oral narrative development. Marleen has been the co-editor of *ACQuiring Knowledge in Speech, Language and Hearing* since 2009.

Correspondence to:
Marleen Westerveld, PhD
Senior Lecturer
Speech and Language Therapy Programme
Massey University, Auckland, New Zealand
email: m.westerveld@gmail.com