Grammatical-Specific Language Impairment (G-SLI): Identifying and Characterising the G-SLI Subgroup

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Abstract
Specific language-impairment (SLI) is a disorder of language acquisition in children whootherwise appear to be developing normally. The data suggest that the disorder is heterogeneous, with the deficits of different subgroups stemming from different underlying causes. Poor sensory and non-verbal abilities often co-occur with SLI, but there is no evidence that these impairments are the cause of grammatical deficits found in many forms of SLI. However, evidence suggests that impairment in at least one subgroup is specific to grammar.

Résumé
Le trouble spécifique du langage est un trouble d'acquisition du langage chez des enfants qui semblent autrement se développer normalement. Les données montrent que le trouble est hétérogène et que les déficits de différents sous-groupes découlent de différentes causes sous-jacentes. Les faibles capacités sensorielles et non verbales apparaissent souvent en même temps que le trouble spécifique du langage chez l'enfant, mais il n'y a aucune preuve que ces déficiences sont la cause des déficits grammaticaux décelés dans plusieurs formes de trouble spécifique du langage. Toutefois, les données montrent que ce trouble est spécifique à la grammaire dans au moins un sous-groupe.

Introduction

The developmental disorder of language, specific language impairment (SLI), occurs in children who are apparently developing other cognitive abilities normally (see (Bishop, 1997; Leonard, 1998) for reviews). Children with SLI are impaired in one or more component of language, such as syntax, morphology, phonology, vocabulary, and might also be impaired in pragmatic aspects of language (Conti-Ramsden, Crutchlet & Botting, 1997; Leonard, 1998; Norbury & Bishop, 2002; van der Lely, 2005). In contrast to most children who by 3 years old can talk using simple sentences, many children with SLI are prone to make errors (e.g., *Who did Marge see **someone**? Yesterday I **fall** over*) (Rice, Tomblin, Hoffman, Richman & Marquis, 2004; van der Lely & Battell, 2003).

Historically, SLI has been studied from a clinical perspective (Leonard, 1998). More recently, studies have been increasingly informed by linguistic and psycholinguistic theories, as well as by other disciplines, such as neuroscience, molecular genetics, and evolutionary biology. The integration of these theoretical approaches provides a new avenue for exploring SLI, one which is changing our understanding of the disorder through bringing finer-grained criteria and better psycholinguistically motivated tests for identifying subgroups within the SLI population. In turn, data from SLI are influencing theories of cognitive science (van der Lely, Rosen & McClelland, 1998).

It is increasingly recognised and accepted that SLI is a heterogeneous disorder and there are likely to be many different underlying deficits that cause language impairment—some specific to the language system, or more precisely to grammatical components of language (e.g., syntax, morphology, phonology) and some not (van der Lely, 2005). This view is supported not only by phenotypic data but by recent genetic discoveries. These discoveries indicate different genophenotype relations in SLI. Although it is well recognised that SLI has a genetic component (Lai, Fisher, Hurst, Vargha-Khadem & Monaco, 2001; SLI-Consortium, 2002; Stromswold, 1998), the picture is complex. To date, one gene (FOXP2) has been linked to a rare (and non-specific) form of language impairment exhibited by some members of the "KE" family (Lai, et al., 2001). This is a large family in the UK of more than 30 members of which, approximately, half have a language impairment (Lai, et al., 2001). However, impaired members also suffer from a speech impairment (dyspraxia) and the specificity of this form of language impairment has been questioned (Vargha-Khadem, Watkins, Alcock, Fletcher & Passingham, 1995).

Furthermore, Anthony Monaco and colleagues explored a large cohort of children with SLI, but none were found to have the FOXP2 variant causing SLI. In contrast, loci on chromosomes 16q and 19q were linked with phonological and expressive grammatical deficits respectively (SLI-Consortium, 2002). The different genophenotypic relations emphasise the need to consider more than one cause of SLI. It is only by identifying pertinent SLI phenotypes that we can illuminate functional specialised cognitive systems, and further our understanding of the possible ways different language components can be developmentally impaired. Can components of language (such as syntax or phonology) be differentially impaired? If so, how does this impact or interact on the acquisition of other language components (e.g., lexicon) or on non-verbal abilities (e.g. number concept development)? What is the effect of different component deficits on a particular linguistic form (e.g. the past tense marking in English)? Such aetiological insight is important for facilitating both clinical assessment and effective remediation.

The behavioural heterogeneity reveals that although some children's core deficits are restricted to grammar (syntax, morphology, phonology) (e.g., Grammatical (G)-SLI (Van der Lely, Rosen & Adlard, 2004), or even components within grammar (syntax (Rice, Wexler, Marquis & Hershberger, 2000), phonology, (Gathercole, Service, Hitch, Adams & Martin, 1999; Ramus, 2001), others exhibit primary deficits in vocabulary (Lexical (L)-SLI, or word-finding SLI (Dockrell, Messer & George, 2001)), or pragmatics (P)-SLI (Bishop, 2000; Botting & Conti-Ramsden, 2003)). Yet, others evince deficits throughout the language system (Bishop, 1997). In addition, some children exhibit co-occurring auditory (Poldrack, et al., 2001), or non-verbal cognitive or even motor deficits (Bishop, 1997; Hill, 2001; Watkins, Dronkers & Vargha-Khadem, 2002), suggesting that the disorder, and by implication language systems, are not so specific as once thought.

Thus, children with SLI can be impaired in one or more component of language. I will focus on three components of the computational grammatical system: syntax – the structural rules combining words into sentences; morphology – the rules combining words or parts of words into new words (e.g., *jump* + *ed*); and grammatical-phonology the rules combining sounds into words (see (van der Lely, 2005).

Different SLI subgroups evince different degrees of impairment across language components. As a working hypothesis, I take the core impairment to be the most impaired component of language. Therefore, a core deficit will be significantly below age-matched peers' performance, and often below other language abilities: for example, grammatically impaired SLI children perform significantly worse on tasks tapping some aspects of morpho-syntax than younger children matched on vocabulary or general measures of grammar (e.g., Mean-length of utterance or sentence understanding) (Leonard, 1998; Rice, Wexler & Redmond, 1999; van der Lely & Battell, 2003; van der Lely & Christian, 2000; van der Lely & Ullman, 2001). Conversely, those with lexical deficits might show the reverse pattern (Dockrell, Messer, George & Wilson, 1998; Nation, Adams, Bowyer-Crane & Snowling, 1999). A core deficit does not militate against secondary or other less severe language impairments occurring.

The developmental relations between language components are complex. Typically, but not always, for any syntactic operation SLI children's abilities resemble those found in young children prior to mastery (Bishop, Bright, James, Bishop & van der Lely, 2000; van der Lely, 2004; Wexler, 1998). However, across different aspects of language SLI children do not evince the synchrony found in typically developing children; for example, whereas phonological development might be age appropriate (e.g., 10 years or older), vocabulary might be at a 7 year old level but tense marking might be similar to children of 5 years or younger (Ebbels, 2005; van der Lely & Battell, 2003). In the absence of explicit evidence, impairments in different components are often taken to mean that these impairments are causally linked through some common (though unspecified) mechanism/process, (Dale, Dionne, Eley & Plomin, 2000; Karmiloff-Smith, 1998; Norbury, Bishop & Briscoe, 2002). However, without data to the contrary, we do not assume that a common cognitive system underlies impairments in different language components, or non-verbal abilities. In this paper, I present selective phenotypic data from children with a relatively rare form of SLI-Grammatical (G)-SLI-who show evidence of a discrete grammatical deficit (van der Lely, 2005; van der Lely, et al., 1998). To characterise these phenotypic data, I adopt a developmental framework and focus on arguably the "core" deficits.

Identifying the G-SLI Subgroup

The G-SLI subgroup is one relatively rare form of SLI and we estimate the prevalence to be around 1-2:1000 (van der Lely & Stollwerck, 1996). G-SLI children are aged 9 years and older and are selected on the basis of a persistent deficit in syntax and morphology. Since the age criterion is used as at this age, we can rule-out "late talkers" who might look very similar at earlier stages. From children who are normal on non-verbal tests and meet the criteria for SLI based on standardized language (Leonard, 1998), i.e., they perform at or below-1.5sd in one or more tests of language abilities which tap a range of receptive and expressive language abilities (e.g.,CELF-3 (Semel, Wiig & Secord, 2000), TROG-2 (Bishop, 2003)), selection is based on tests designed to probe core aspects of morpho-syntax, e.g., passives, agreement and tense (van der Lely, 1996b; van der Lely, 2000). On each test, the child has to produce 20% or more errors at an age when normally developing children rarely make any. Many G-SLI children are also impaired in grammatical-phonology (Gallon, Harris & van der Lely, submitted; van der Lely, et al., 2004), but their speech for known words is clear and they do not evince any articulation impairments (van der Lely & Stollwerck, 1996). Vocabulary is impaired, but not as significantly as their grammar (van der Lely, 1996b), and initial investigations indicate that this is, at least partially, caused by their grammatical deficits (van der Lely, 1994). All children exhibit normal development in other respects including their pragmatic use of language (van der Lely, 2004; van der Lely, et al., 1998). Their performance on non-verbal IQ tests is average, and extensive testing on both non-verbal cognitive and auditory abilities has not revealed any consistent deficits (Rosen, Adlard & van der Lely, submitted; van der Lely, 1996b; van der Lely, et al., 2004; van der Lely, et al., 1998).

The G-SLI subgroup reveals that severe grammatical deficits do not necessarily occur with impairments in non-verbal or auditory abilities. In addition, the majority of children showed normal processing of non-speech and speech sounds using a same-different task (following Tallal) and a backward masking task (Rosen, et al., submitted; van der Lely, et al., 2004). Within the SLI population over 9 years old with persisting deficits and normal non-verbal abilities, the prevalence of G-SLI is around 10-20% (Bishop, et al., 2000; van der Lely & Stollwerck, 1996). Investigation of familiar aggregation of language impairments in first degree relatives is consistent with an autosomal dominant inheritance (van der Lely & Stollwerck, 1996).

Theoretical Framework: The Computational Grammatical Complexity Hypothesis

There are two major perspectives with respect to the underlying cause of SLI domain general perspectives and domain-specific perspectives. Domain-general hypotheses claim that all forms of SLI are caused by underlying "input-phonology" (speech) and/or processing deficit whereby input phonology is considered to be at the interface between language and either defective auditory processing (Joanisse & Seidenberg, 2003; Leonard, 1998; Tallal, 2002), phonological-Short-Term Memory (Gathercole, et al., 1999), processing capacity or speed (Chiat, 2001; Miller, Kail, Leonard & Tomblin, 2001; Montgomery & Leonard, 1998).

In contrast, domain-specific hypotheses claim that some forms of SLI are caused by a deficit to certain aspects of grammar. Hypotheses within this grammatical perspective differ in the breadth of the characterisation of grammatical deficits, which might reflect real differences in SLI populations or that the deficit is not fully revealed until late childhood (Rice, 2004; van der Lely, 1998; van der Lely, 2004). The hypothesis developed to account for G-SLI fits within this perspective. According to the Deficit in Computational Grammatical Complexity (CGC) hypothesis (a development of the Representational Deficit for Dependent Relations (RDDR) account), children with G-SLI are impaired in the computations underlying hierarchical, structurally-complex forms in one or more component of grammar (van der Lely, 2004; van der Lely, 2005). The CGC hypothesis emphasises the distinction between syntactic, morphological and phonological hierarchical structural complexity, and their independent and differential effects on sentence processing and production (van der Lely, 2004). This predicts a pervasive deficit in grammatical components determined by structural complexity.

Thus, Chloe Marshall and I characterise their grammar as demonstrating grammatical structural economy. Specifically, syntactic complexity can be understood with respect to structural "syntactic dependencies" (which may be equated with Chomsky's 1995 notion of "Movement" (Chomsky, 1995)), such as those found between words in questions: e.g., ***Who** did Joe see___ ?* where ***who*** and the "***gap***" following the verb (which in declarative sentences is filled by the object) form such a syntactic dependency (van der Lely & Battell, 2003). Thus, in syntax, not only marking tense, but all structures requiring syntactic dependencies (Movement) are predicted to be problematic, such as passive sentences (*Joe was hit by Jill*), and pronominal reference (*Joe hit **him/himself***).

Morphological complexity can be understood with respect to Pinker's Words and Rules model (Pinker, 1999), whereby normal developers store irregular forms whole in monomorphemic (simple) forms, but compute morphologically regular (complex) forms using a symbolic rule (*roll + ed*). Thus, suffixation creates a hierarchical branching structure. Frequency and phonological properties affect stored irregular words, but have little effect on regular forms. However, the CGC predicts that for children with a morphological deficit, regularly inflected verbs might be preferentially stored, and thus subject to word effects, (e.g. frequency) that are typically found for only irregulars.

Phonological complexity can also be defined with respect to hierarchical structure (van der Lely, 2005). Here "marked" parameters affecting the stress pattern of words (prosodic structure) and syllables, which typically create clusters (syllable structure) increase the hierarchical structure. For phonologically impaired children, inflected words such as *ro**lled*** are predicted to be harder than row**ed**, as phonologically the word-end in *rolled* is more structurally complex. This framework allows us to characterise the grammatical deficits in G-SLI.

Characteristics of Grammatical-SLI

Syntax

G-SLI children show that grammatical impairment, like language acquisition, is not random. Our previous results reveal that particular aspects of grammar are impaired in G SLI teenagers (van der Lely, 1998; van der Lely & Battell, 2003; van der Lely & Christian, 2000; van der Lely & Ullman, 2001). Within syntax, G-SLI is a broad but discrete deficit, which includes impairment in marking tense and agreement, (*Yesterday I **walk** to school*) assigning thematic roles (Agent, Theme) and pronominal reference to noun phrases in sentences (van der Lely, et al., 2004; van der Lely, et al., 1998; van der Lely & Stollwerk, 1997; van der Lely & Ullman, 2001) – just those structures that are at the core of the syntactic system (van der Lely, 2005). These findings are supported by data from both typologically close and distant languages (Hebrew, Greek, German and French) (Friedmann & Novogrodsky, 2004; Hamann, et al., in press; Hamann, Penner & Lindner, 1998; Jakubowicz, Nash, Rigaut & Gérard, 1998; Stavrakaki, 2002). Our studies of the same children with G-SLI over many years provide a longitudinal perspective: We find that the same deficit, e.g., understanding passive sentences, is evident at 4-6 years, at 9-12 years and at 15-18 years (van der Lely, 1996a; van der Lely & Dewart, 1986; van der Lely, 1994, 1998; van der Lely & Harris, 1990; van der Lely, et al., 1998).

Therefore, despite normal non-verbal abilities, their defects persist and are not compensated for by other mechanisms or structures. In normal conversation, these deficits are often not apparent, particularly as many G-SLI individuals are socially very competent, but they are revealed in the test situation when contextual cues cannot facilitate performance and avoidance strategies cannot be used so easily (van der Lely & Battell, 2003; van der Lely & Ullman, 2001). The existence of G-SLI and the nature of their deficit were initially doubted, but empirical tests of domain-specific predictions are supported. The Computational Grammatical Complexity (CGC) hypothesis predicted that Wh-questions, particularly object questions, would be impaired. Results of an elicitation experiment in 15 teenaged G-SLI children revealed a significant impairment, even when their performance was compared to 5-7 year old children (van der Lely & Battell, 2003). Moreover, they produced errors, such as "*Who did Joe see someone?* and *What Jessie like jewellery*? (target, "*What jewellery did Jessie like?*"); exactly the errors predicted if syntactic dependencies are not made (van der Lely & Battell, 2003), but which, as far as we are aware, hard, if not impossible, to account for by any domain-general hypothesis. These findings are supported by cross-linguistic investigations (Friedmann & Novogrodsky, in press; Stavrakaki, 2001).

In contrast, syntactic forms, such as the negative particle (**not**, do**n't**) which do not involve syntactic dependencies are not impaired in G-SLI (Davies, 2001; Davies, 2002). Thus, G-SLI children correctly produced sentences with the full negative form "*They're not running; He's not on the skateboard*" as well as the contracted form "*They aren't on the skateboards*; *He isn't skipping*" (Davies, 2001). However, predicted problems with omission of agreement and tense marking forms were found (e.g., *They not wearing hats; He not on the skateboard*).

The fact that similar syntactic deficits are found in children with SLI who do not exhibit such discrete deficits as the G-SLI subgroup (Norbury, Bishop & Briscoe, 2001; Norbury, et al., 2002; O'Hara & Johnston, 1997) opens up the whole question of how (if at all) are deficits outside the grammatical system, or even outside language, impacting on the grammatical deficits in these children. We need further careful studies to elucidate this issue.

Morphology

Following Pinker's dual system model (Pinker, 1999), the CGC predicts that because normally developing children are using different systems to form regular and irregular past tense, but SLI children might be preferentially using one system (the lexical storage-associative system that is thought by all to underlie irregular forms), they will show a qualitatively different pattern of performance to normally developing children. Data reveal qualitative differences in performance between children with G-SLI and normally developing children: G-SLI children do not show the normal regularity advantage and therefore perform at a similar level on regular-irregular past tense marking, but, in contrast to normally developing children, show similar frequency effects for regular as irregular verbs (van der Lely & Ullman, 2001). Interestingly, the G-SLI children, but not the controls, behave in the way that single mechanism accounts might predict if only one system underlies tense marking in English. Individuals with a non-specific and rare form of LI (from the KE family) show the same pattern of regular and irregular past tense marking as the G-SLI children, which is different from unimpaired family members (Ullman & Gopnik, 1999; Watkins, et al., 2002). Thus, children with G-SLI and other forms of SLI perform not just worse than typically developing children, but qualitatively different too. In other words, it is not simply a case of the same mechanism(s) not functioning as well as normal. We predicted that if G-SLI children preferentially store regular forms whole (like irregular forms) they should use such forms inside compounds (*rats-eater*), whereas ordinarily regulars (but not stored irregulars) are dispreferred in compounds (Gorden, 1985; Pinker, 1999). We discovered that G-SLI children produce regular plurals inside compounds, whereas normally developing children and adults rarely do so (van der Lely & Christian, 2000). Not all SLI children, however, show such morphological deficits (cf.(Oetting & Rice, 1993)).

Further evidence that G-SLI children have a morphological deficit comes from analysing performance on regular verbs that differ with respect to whether their phonology provides clues to their morphological structure (Marshall, 2004; Marshall & van der Lely, submitted-a). Holding phonological complexity constant, some regular verbs contain clusters at the inflected verb-end that also occur in uninflected, monomorphemic words (what we term 'monomorphemically legal clusters', MLC) (*cro**ss**ed*/*fro**st**, scow**led**/co**ld***), whereas others have clusters that can only occur in inflected words ("monomorphemically illegal clusters", MIC) (*slammed, robbed, rushed*). MLCs are more frequent than MICs. We predicted that if children can compute morphologically complex forms (as we anticipated normally developing children could) they will show no difference in performance as a function of cluster frequency. Conversely, if children cannot compute morphologically complex forms, cluster frequency will have an impact, and they will perform better on the verbs with MLCs. Chloe Marshall and I re-analysed previously published data from a past tense elicitation task from G-SLI (van der Lely & Ullman, 2001) as well as collecting data from a new group of G-SLI children and language matched controls.

The data showed a consistent pattern: whereas typically developing children show no effect of phonotactics, G-SLI children consistently perform better on MLC verbs, suggesting they store them whole (Marshall, 2004; Marshall & van der Lely, submitted-a). Thus, the data from G-SLI children show a consistent and predicted pattern indicating that they have a morphological deficit alongside a syntactic one.

Phonology

In phonology, some stress pattern of words (cf. *tidy vs. today*) (metrical structure) and sound combinations within syllables (clusters) are prosodically more complex (Harris, 1994). We used a new non-word repetition test, the Test of Phonological Structure (TOPhS) (van der Lely & Harris, 1999), that allows a thorough examination of phonological abilities by systematically varying the prosodic complexity of a word. The test consists of 96 non-words that were constructed using five binary phonological parameters, chosen because they establish the major typological outlines of syllable and metrical structure in English. Each parameter can be either unmarked or marked. The marked setting is deemed more complex as it does not occur in all languages and is acquired later in young children. Three of these parameters affected syllable structure: onset (e.g. ***dr****epa*), rhyme (*dem****pa***) and word end (*de****p***), and two metrical structure: Left adjunction (***ba****depa*) making a week-strong (WS) stress pattern, rather than the unmarked SW pattern, and right adjunction (*depa****ri***) making a SWW stress pattern. The combination of settings on the different prosodic parameters was systematically varied to produce 24 sets of non-words containing between zero and four marked structures. Two separate experiments of different groups of G-SLI and control children reveal a consistent pattern: the G-SLI children's accuracy repeating non-words systematically decreased as prosodic complexity increased (Gallon, et al., submitted; Marshall, 2004; Marshall, Harris & van der Lely, 2003). In contrast, the control children, although much younger than the G-SLI group, achieved relatively low error rates, even at high levels of phonological complexity.

Previous psycholinguistic research into G-SLI has found that complexity in morphology and syntax affects performance. The results of these studies indicate that linguistic complexity also affects phonological performance. In the last section, I will describe the cumulative effects that such deficits in different components of language have on a particular linguistic formpast – tense marking.

Lessons from the Past-Tense: The Cumulative Effects of Syntactic, Morphological and Phonological Deficits on Performance

One possible reason that tense marking is such a good clinical marker of SLI in English speaking children (Rice & Wexler, 1996) is because it involves complex hierarchical structures in syntax, morphology, and grammatical-phonology. This makes it a good starting point for exploring the potential autonomy and cumulative effects of impairments in these different components.

First, if we take the syntactic properties of tense marking, the CGC hypothesis predicts deficits in irregular as well as regular tense marking. The data show that G-SLI children omit to tense mark both regular and irregular verbs (*Yesterday I fall/jump over...*) (Marshall, 2004; van der Lely & Ullman, 2001). Thus, the deficit for irregular as well as regular forms illustrates the syntactic nature of this deficit, and militates against a purely perceptual deficit (cf.(Joanisse & Seidenberg, 1998)).

Second, with respect to the morphological properties of tense, the CGC hypothesis predicts problems with forming morphologically complex forms—that is regular forms (van der Lely & Ullman, 2001). Data from various sources support a further deficit in regular morphological past tense marking that is over and above their syntactic deficit in marking tense. This is revealed in qualitative differences in performance between children with G-SLI and normally developing children:

1) G-SLI children perform at a similar level on regular-irregular past tense marking, whereas normally developing children show a regularity advantage;
2) in comparison to younger children matched on sentence comprehension, the G-SLI children perform at a similar level on irregular past tense forms, but significantly worse on regular forms and;
3) in contrast to normally developing children, G-SLI children show frequency effects for both regular and irregular verbs (van der Lely & Ullman, 2001);
4) the phonotactic data for monomorphemically legal and illegal clusters, (reported above) whereby G-SLI children, but not controls, are particularly poor at producing regular past tense forms with MIC lends further support for the impact of a morphological deficit on regular past tense. Thus, the data from G-SLI children show a consistent and predicted pattern indicating that they have a morphological deficit alongside a syntactic one which is impacting on past tense marking.

Turning, thirdly, to phonological structural complexity, we predicted that for regular forms, increasing the phonological complexity of the verb-end (vvd-***sowed***, vcd-*ye**lled***) would significantly decrease correct past tense performance in children with G-SLI who have a phonological deficit, but not in those with normal phonological development. When only regular forms with legal clusters are considered, increasing phonological complexity of the verb-end (vvd ***sowed,*** vcd-*ye**lled***, vccd-*dan**ced***) significantly decreases correct past tense performance in 9-16 year old children with G-SLI, but not typically developing 5-9 year-old children (Marshall & van der Lely, submitted-b).

These data illustrate the need for careful and detailed assessments and investigations to identify core deficits in the different language components, and then to consider the effect of these deficits on each linguistic form. We cannot assume that a deficit in, for example tense marking, is only caused by a deficit in syntax, or morphology, or phonology. Each component deficit is likely to cause some degradation in performance. Above, we have illustrated the cumulative effect of deficits in different components. Such detailed assessment and understanding of the underlying impairment can provide a foundation for effective remediation.

Conclusion

The heterogeneity of SLI phenotypes indicate that the impairment can have multiple causes (Rice, et al., 2004; van der Lely, et al., 1998) and to talk of a unified disorder is increasingly untenable. G-SLI is characterised by core, primary deficits in grammatical components, that is syntax, morphology, and for most G-SLI children phonology too, alongside normal non-verbal cognitive abilities. Replications of some of our studies with SLI children who do not fall into this subgroup indicate that other SLI children exhibit similar grammatical deficits, along side co-occurring non-grammatical and non-verbal primary deficits (Bishop, et al., 2000; Norbury, et al., 2001, 2002; O'Hara & Johnston, 1997; Precious & Conti-Ramsden, 1988). This raises important questions with respect to the apparent lack of relations between such deficits on the grammar system. Deficits in each of three components of grammar might co-exist or dissociate (van der Lely, 2005). I claim that these developmental deficits in grammar are best accounted for within the theoretical framework in which the mind contains domain-specific systems, that can be differentially impaired in some (but not all) children. The challenge is now to provide a full picture of the individual SLI phenotypes and subsequently unravel the underlying deficits that ultimately contribute to these phenotypes.

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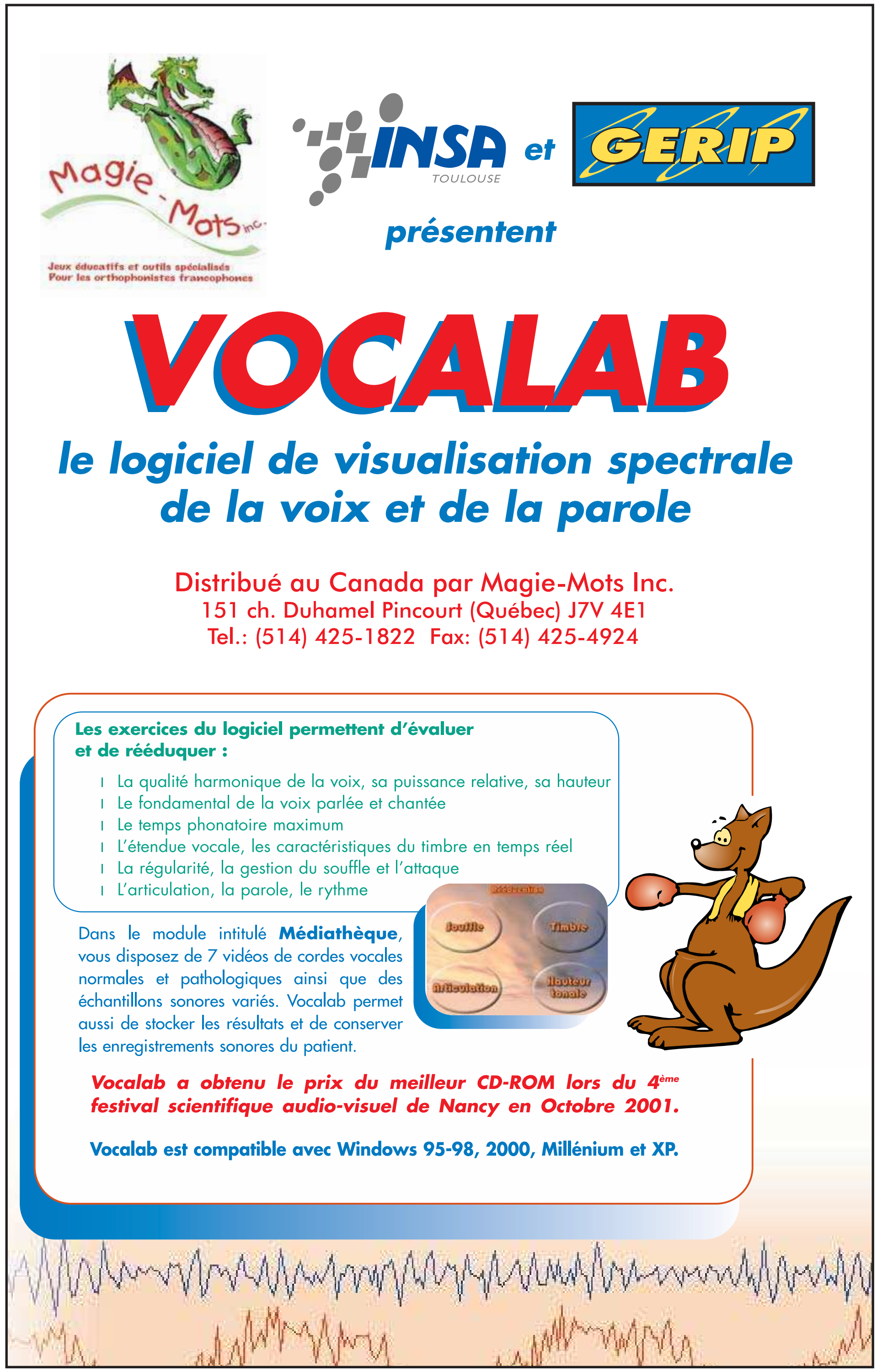

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