Constraints on language development

Insights from developmental disorders

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1. Introduction

When one assesses the language abilities of children and adults with developmental disorders, it is not uncommon to find an uneven profile across the sub-domains of language. Standardized tests for various aspects of language can exhibit a differential relationship compared both to each other and to overall (average) mental age (MA). For example, in a comparison of Down syndrome (DS), Williams syndrome (WS), autism and Fragile X (FraX), Fowler (1998) described dissociations between phonology, lexical semantics, morphosyntax and pragmatics. From these dissociations, it is evident that general cognition cannot be a reliable indicator of all aspects of language function in children with learning disabilities. While language acquisition typically lags behind MA-level expectations in children with learning disabilities, Fowler noted that disorders such as Williams syndrome and hydrocephalus with associated myelomeningocele appear superficially to be exceptions. From her comparison, Fowler concluded that pragmatics and lexical semantics are more closely tied to MA than phonology and morphosyntax.

Tager-Flusberg and Sullivan (1997) carried out a similar comparison of the same four disorders but this time seeking possible asynchronies in the early development of semantic, grammatical, and pragmatic aspects of language. These authors also noted disparities in areas such as vocal development, social communicative development, gesture, lexical development, phonological development, early grammar and pragmatics.

However, despite the differences highlighted in their respective reviews, both Fowler (1998) and Tager-Flusberg and Sullivan (1997) also noted similarities across the disorders. For example in early development, there were

consistent patterns of errors displayed in speech articulation; and in morphosyntax, although some disorders stopped short of mastery, the order of acquisition of syntactic structures appeared similar. In some senses, atypical language development generally retains some link with the profile of normal development.

What can this pattern of commonalities and dissociations tell us about the development of the language system? Two explanatory frameworks compete to interpret the results. One approach is based on the assumption of functional modularity in the normal adult system. The field of neuropsychology has identified case studies of healthy adults who exhibit selective deficits to different components of language following acquired brain damage. From these dissociations, a modular functional architecture has been inferred. Within modular theories, the linguistic performance of individuals with developmental language impairments is viewed as reflecting the architecture of the normal system but with selective components of this system under-developed or over-developed (Clahsen & Temple 2003). This framework provides a comfortable fit between the results of standardized language tests and atypical functional structure. Assuming we have tests that index the integrity of individual modules (e.g., tests of vocabulary, tests of grammar, tests of phonological awareness, and so on), scores in the normal range can be read off as reflecting a normally developed component and scores above or below the normal range can be read off as reflecting an (atypically) over- or under-developed component. This mapping of test results to modular structure in *developmental* disorders rests on one of two assumptions. Either the modular system identified in the adult is also present in the infant, so that language development can commence with an initial selective anomaly in one or more components; or the modular structure emerges through development in such a way that when things go wrong, some parts emerge with atypical functionality while the rest nevertheless manage to emerge displaying their normal functionality. Together, these alternatives constitute the assumption of *residual normality* (Thomas & Karmiloff-Smith 2002a). One further assumption is required for us to read off a normal score achieved on a standardized test as a guarantee of the normal functioning of an underlying component: that atypical cognitive processes could not generate the same normal score on this test.

The alternative framework, sometimes referred to as neuroconstructivism (Karmiloff-Smith 1998), places a much greater emphasis on the role of development in producing cognitive structure. It is based on the premise that the adult modular structure is not present in the infant but is itself a product of the developmental process. This is a view strongly motivated by data from de-

velopmental cognitive neuroscience (Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett 1996; Karmiloff-Smith 1998). This developmental perspective draws into question the sensitivity of standardized tests, raising the possibility that scores in the normal range may be achieved by atypical cognitive processes. Instead it is argued that sensitive on-line tasks are necessary to properly assess underlying processes (Karmiloff-Smith 1997; Karmiloff-Smith, Thomas, Annaz, Humphreys, Ewing, Grice, Brace, Van Duuren, Pike, & Campbell in press). In the view of these authors, the clean pattern of normal versus impaired modules identified in some developmental disorders may in part be an artifact of the straightjacket of standardized tests. If a child takes a receptive vocabulary test, they can only possibly score below, at or above the normal range.

The debate between these two explanations of uneven linguistic profiles has at times become polarized. On the one hand, there are strong claims that for given developmental disorders, certain cognitive structures *must have* developed normally given behavior in the normal range (sometimes these are referred to as 'intact' or 'spared' systems). On the other hand there are counter claims that since the developmental processes we know about could not have produced such an uneven modular outcome, the relevant behavior *must be* produced by structures that are qualitatively different and atypical. For example, such polarization has occurred in evaluating syntax processing in Williams syndrome, and in evaluating the lexicon in the so-called 'grammatical' subtype of Specific Language Impairment.

Although my own previous work has been carried out within the neuroconstructivist framework, in this chapter my intention is to step back from this debate somewhat, and focus on exploring the notion of *constrained development*. This is because both frameworks must eventually incorporate an account of this sort, even if the strength of the constraints will differ in the two types of account. In the next section, I consider how both modular and neuroconstructivist frameworks still face significant challenges in characterizing the developmental process.

2. Development produces the disorder

In an older child, adolescent, or adult with a developmental language disorder, development has played some role in producing the observed behavioral deficits. The exact contribution of development is disputed. However, in both modular and neuroconstructivist frameworks, the nature of the developmental process remains obscure.

The modular approach de-emphasizes the contribution of development, placing the antecedents of deficits in particular components of a proto-language system already present in the infant. For example, various explanations of Specific Language Impairment (SLI) exist which propose a deficit restricted to abstract language structures involved in the rule-governed movements or combinations of words into complex structures (see Ullman & Pierpont in press, for review). According to different versions, children may come to language impaired in their ability to establish structural relationships in sentences, such as agreement or specifier head-relations; or they may lack rules for linguistic features; or they may be stuck in a period of language development where marking of tense is taken to be optional; or they may be solely impaired on non-local dependency relations; or they may have problems with more general language functions such as learning implicit rules. The implication in a disorder argued to have a strong genetic component is that such impairments pre-date acquisition.

Two aspects remain vague in the modular account. The first is the exact granularity of the proto-language system, that is, the miniature, content-free modular functional architecture present in the pre-linguistic infant (see Thomas & Karmiloff-Smith in press, for discussion). The second is the developmental process by which this architecture acquires its content when exposed to a given social and language environment. While some researchers argue there is scant empirical evidence for the existence of adult-like modular functional structure in the infant (e.g., Bates & Roe 2001; Elman et al. 1996), here we need merely point out that if one is going to argue for such a structure, one needs to say exactly what it looks like. At what level of detail do functional distinctions exist in the infant system – between sounds, meanings, motor actions, and social interactions; or between phonology, morphology, syntax, and the lexicon? Stipulating the granularity of the infant proto-system permits specification of which components will have the initial developmental deficit. The account must then be complemented by specification of the processes of learning. Such processes must put particular content in each of the modular 'boxes' whilst allowing the components to interact fluidly in language comprehension and production. Even a strictly modular account of atypical language development needs to postulate firstly a startstate (however much constrained) and secondly a pathway via a set of interactions with an information-laden world to arrive at the final uneven structures observed in the adult developmental disorder.

While the neuroconstructivist approach accepts functional modularity as a possible characterization of the adult system, it rejects it as a startstate for

the infant cognitive system. This approach rests on a theory that modularity emerges as a product of development, from a relatively less differentiated information processing system. The less differentiated system has capacities that are *relevant* to cognitive domains rather than specific to them (for instance, ability to processes sequences may be relevant to syntax processing, without being specific to the linguistic structures that sentences contain). This initial flexibility is lost across development as the system commits its relevant capacities to particular domains. An explanation of developmental deficits consists in identifying how these initial domain relevancies have been altered in the disorder, and then how the subsequent process of emergent modularization has been perturbed (if indeed it has been). An emphasis on differences in the startstate leads neuroconstructivists to investigate the infant precursors of later uneven cognitive profiles (Karmiloff-Smith 1998). For example, Paterson, Brown, Gsödl, Johnson and Karmiloff-Smith (1999) noted that in adults with WS and DS, individuals with WS were relatively stronger than those with DS in language but the reverse was the case in the domain of number. When Paterson et al. explored the precursors of these cognitive skills in infants with the disorders, they found no advantage for toddlers with WS over DS in a language task, and *better* performance in WS than DS in the number task. The adult pattern was not replicated in the infant state, implying that different atypical developmental trajectories separate the populations (see Singer Harris, Bellugi, Bates, Jones, & Rossen 1997; Mervis & Robinson 2000, for discussion). These authors therefore argued against the atypical infant proto-cognitive system containing a miniature version of the adult functional structure with the same pattern of strengths and weaknesses.

Two difficulties remain for the neuroconstructivist approach. The first difficulty is not unrelated to the one faced by the modular approach. Even if there are much weaker constraints on the startstate of the proto-language system, these still need to be identified. What is the set of initial domain-relevancies that pre-date language, and what is the nature of the process that eventually delivers domain-specific functional structures? The account eventually needs to be concrete enough to establish the strength of the constraints governing the emergence of modularity; what "seeds" the proto-language systems starts with; what conditions would be sufficient to disrupt it; and how a genuinely "atypical" functional structure would behave. Presumably, even a system dealing in no more than domain relevancies must arrive with possible channels of information flow established – for example, between motor systems driving articulation, perceptual systems interpreting input, multi-modal systems linking to conceptual knowledge, and pragmatic systems linking with social

and emotional systems. The second difficulty is that while neuroconstructivism prompts its adherents to build developmental trajectories from infancy through childhood to adult language structures, the empirical basis for "proto" cognitive structures is problematic. For example, Paterson et al. (1999) compared scores on receptive vocabulary tests in adults (i.e., selecting a picture that goes with a word from a set of alternatives) with performance on a preferential looking task in infants, where infants were presented with two pictures (e.g., a dog and a cat) and their gaze behavior monitored when they heard a label (e.g., "Look at the dog! Look at the dog!"). Where differences are found in the adult and infant pattern in a cross-syndrome comparison, how do we know that the two 'vocabulary' tasks are indexing the same mechanism? The problem even hold when the same task is used – how can one be sure that the same task is treated the same way at very different ages? We need to be able to rule out the possibility that data showing differential relative profiles in infancy and adulthood not in fact the results of measuring different cognitive capacities at the two ages (such as, in the preceding example, lexical knowledge in the adult and attention/degree of novelty preference in the infant).

It is worth pointing out that evidence from brain imaging studies is often introduced in an attempt to distinguish modular and neuroconstructivist positions (predominantly by the latter group, as you may guess from the 'neuro' prefix). I won't discuss brain level evidence here, other than to suggest that it indicates that the effects of genetic mutations on brain development in developmental disorders tend to be widespread rather than focal (see Mareschal, Johnson, Sirios, Spratling, Thomas, & Westermann forthcoming; Karmiloff-Smith & Thomas 2003; Thomas 2003, for discussion); and that brain evidence has been interpreted both within modular and neuroconstructivist frameworks (e.g., for WS, see Reiss, Eckert, Rose, Karchemskiy, Kesler, Chang, Reynolds, Kwon, & Galaburda 2004; for a more modular perspective; and for a more neuroconstructivist perspective, Grice, Spratling, Karmiloff-Smith, Halit, Csibra, de Haan, & Johnson 2001; Karmiloff-Smith 1998; Neville, Mills, & Bellugi 1994; Mills, Alvarez, St. George, Appelbaum, Bellugi, & Neville 2000). Brain evidence remains problematic in that while it is suggestive, for instance in the lower degree of functional localization and specialization observed in the infant neocortex (Karmiloff-Smith 1998), it is not clear how brain function constrains the cognitive structures it is supporting at an given point in time (see Mareschal et al. forthcoming, for discussion).

Thus far, then, we have suggested that explanations of uneven language profiles are compromised by lack of an explicit developmental account of the origin of the architecture of the adult system. In the current chapter, I address

this issue as follows. First I characterize some of the properties a developmental account should have with reference to the multiple components of the language system. Second, taking the example of Williams syndrome, I indicate the type of empirical evidence that might be used to identify the (atypical) constraints operating on development in a disorder. Third, I discuss some recent findings from computational modeling, a forum that permits a more precise exploration of the way in which atypical constraints on development could produce behavioral deficits in a given language domain.

3. Characterizing the developmental process

A cognitive-level developmental theory that explains the uneven language profile found in some disorders must emphasize three characteristics: *interactivity, compensation*, and *timing* (Thomas & Karmiloff-Smith in press). In this section, I concentrate in the main on the first two of these (see Elman et al. 1996, for a more detailed consideration of timing).

3.1 Interactivity

Several authors have argued that early language development is characterized by *interactions* between multiple sources of information and the components that process them (e.g., Bishop 1997; Chiat 2001; Karmiloff-Smith 1997, 1998; McDonald 1997). For example, Chiat (2001) maintained that language acquisition should be construed as a mapping task between sound and meaning, through which the words and sentence structures of a language are established. To achieve this mapping, multiple sets of information are exploited. When semantics is ambiguous, phonology can be used to bootstrap the extraction of meaning. When phonology is ambiguous (for instance during lexical segmentation), semantics can be used to bootstrap the extraction of word-sound information. Together, phonological and semantic information help bootstrap the acquisition of morpho-syntax. In a developmental disorder where there are indications of differential deficits across the components of the language system, any explanation of behavioral impairments must incorporate the altered pattern of interactions (and their timing). Chiat (2001) carried out this exercise for SLI and favored an account that considers the language deficits in morphology and syntax as arising from impaired phonological processing. The phonological impairment then leads to consequent disruption of the interactions inherent in the mapping process.

A phonological account of SLI is consistent with the view that higher-level language deficits arise as a developmental consequence of lower level deficits, so that, for instance, the phonological impairments in SLI may themselves originate in low-level auditory processing problems. However, this theory is controversial in as much as some adults with SLI do not demonstrate low-level processing deficits in auditory discrimination (McArthur & Bishop 2004; Rosen 2003). One response is to postulate that auditory processing impairments may exist early in development and yet fail to be measurable in the mature system. This would be one instantiation of the claim that *timing* is an essential factor in producing developmental impairments. While the failure to find an auditory processing deficit in an adult with SLI cannot be assumed to mean that such a processing deficit did not exist in infancy and make an impact on early language development, the postulation of unmeasurable causal factors is problematic. One might argue that falsifiability of the low-level deficit theory is compromised if one assumes that the source of an adult language problem lies in a cause that can no longer be measured. Of course, this simply highlights the point that developmental deficits demand that empirical data are collected across the course of development rather than just at its endpoint. The early deficit theory is eminently testable using longitudinal studies in children with SLI or infants at risk for SLI.

The idea that low-level auditory processing deficits explain higher-level language problems in SLI is not supported as a *sufficient* condition by data comparing children with SLI and those with mild hearing impairments. Norbury, Bishop and Briscoe (2001) discovered phonological processing problems in both group but problems in productive inflectional morphology only in the SLI group. It appears that poor auditory processing is not necessarily associated with deficits in the more abstract, high-level aspects of language. In addition, even accepting the role of phonology, the causal pathway linking problems at this level to circumscribed syntactic difficulties (e.g., subject-verb number agreement) is at best obscure (though see Joanisse 2000, for some preliminary attempts to make these links in the domain of anaphor resolution).

Nevertheless, at a broad level, the importance of the quality of language input has been emphasized by a comparative analysis carried out by McDonald (1997), which contrasted several typical and atypical populations that exhibited either successful or unsuccessful acquisition of language. These populations included late L2 learners, deaf sign-language learners, individuals with Down syndrome, individuals with Williams syndrome and children with SLI. McDonald concluded that good representations of speech sounds were key in predicting the successful acquisition of a language including its syntax, again

supporting the view that the components of the language system interact across development.

3.2 Compensation

The second characteristic that any theory of atypical language development must incorporate is *compensation*. The importance of compensation can be illustrated by a triangular comparison of adult aphasics, healthy children who have experienced early focal brain damage, and children with developmental disorders (see Karmiloff-Smith & Thomas 2003; Thomas 2003). The comparison goes as follows. (1) Following focal brain damage to their left hemispheres, adults can show persistent selective deficits in their language abilities (e.g., as exhibited in non-fluent and fluent aphasia). However, (2) following similar focal damage, healthy children usually then go on to demonstrate recovery from initial aphasic symptoms and later perform within the normal range on language tasks (see Bates & Roe 2001, for a review). Presumably, the greater effective plasticity of the child brain has permitted compensation and reorganization of function. As a consequence, when we (3) compare adults who had focal lesions when they were children with adults who have developmental disorders of language, we find significant deficits only in the latter. Of course, pointing to the presence of deficits in a developmental disorder is somewhat tautological, but the comparison nevertheless raises the question that if genetic developmental disorders of language are to be characterized by initial selective deficits to language-relevant structures, why has compensation-to-recovery not occurred as it does in the children with early focal lesions? The answer is that compensation in the developmental disorder probably *has* occurred, but the constraints of the system are insufficient to allow performance to develop to a level within the normal range (Mareschal et al. forthcoming; Thomas 2003). This must be true for behaviorally defined disorders, because any child that had successfully compensated for their initial deficit would not be diagnosed as having a disorder. There are parallels to be drawn between healthy children with early acquired brain damage and those with developmental disorders, but the relevant comparison is for healthy children who have experienced widespread and/or diffuse brain damage rather than focal lesions (Thomas 2003).

Our account of the emergence of differentiated language structure in the adult will therefore need to incorporate interactivity, compensation, and timing, whether the early infant system is strongly or weakly constrained. This has significant implications for uneven profiles found in developmental disorders.

If we propose that the uneven profile can be explained by an initial deficit to a single component of the system (say, the proto-phonological system, proto-lexicon, proto-syntax system, or proto-pragmatic system), why wouldn't this impairment become smeared across other components through the interactions that occur between them during development? And why wouldn't other components in the system manage compensate for this selective deficit and so attenuate the impairment across development?

To take interactivity, if there were an initial selective impairment in pragmatics in infants with autism, one might expect the deficit to be passed to the lexicon, where words or phrases whose meaning can only be inferred from speaker intentions should not be acquired normally. One might expect non-canonical syntactic constructions (such as passives or cleft constructions) to be poorly processed, since these are predominantly employed in service of emphasizing the topic of the sentence for the listener, that is, for pragmatic reasons. To take compensation, if there were an initial selective impairment in syntax in SLI, why shouldn't the child compensate by using the lexicon to acquire common whole inflected forms and syntactic phrases, to be deployed in the appropriate communicative context and so avoiding diagnosis as having a language impairment? The exact answers to these questions are not important in the current context (perhaps both phenomena occur; see Section 5 for further discussion of SLI). The point is that uneven language profiles may encourage the idea that selective damage has occurred, but explanations must be couched in terms of the development of differentiated language structures. If theories propose highly selective deficits in the adult with the disorder, then they must incorporate *developmental* reasons why neither interactivity nor compensation has taken place.

If one is to build an explanation of language deficits in terms of the developmental process, what type of empirical evidence should guide one's hand? In this next section, I use Williams syndrome as an illustration.

4. The example of Williams syndrome

Williams syndrome involves the deletion of some 25 genes from one of the copies of chromosome 7 (see Donnai & Karmiloff-Smith 2000, for full details of the syndrome). Individuals with WS usually present with IQs in the 50–60s range, with poor spatial and numerical cognition. While there is an initial delay in language development, by adolescence and adulthood many individuals display large vocabularies that co-exist with relatively good scores on standard-

ized grammatical tests. Their language can include rich syntactic structure, with production and comprehension performance on complex syntactic structures (passives, relatives) in line with MA controls (Clahsen & Almazan 1998; Zukowski 2001).

In some respects, the developmental trajectory for language appears normal in WS. Thus, Mervis, Morris, Bertrand and Robinson (1999) noted that, while the syntactic abilities of children with WS (39 children from 2 years 6 months to 12 years of age) were considerably delayed, syntactic complexity was nonetheless appropriate for the mean length of utterance (MLU). This contrasts with DS, autism and FraX, where syntactic complexity turned out to be less than would be expected at MLUs over 3. This result prompted Mervis et al. to claim that WS is the first syndrome in which the normal relation between utterance length and complexity has been demonstrated. However, in other respects, the pattern is atypical. There are more errors in morphology (verb tense agreement, personal pronouns, grammatical gender; Karmiloff-Smith et al. 1997; Volterra, Capirci, Pezzini, Sabbadini, & Vicari 1996) than in syntax. Mervis et al. (1999) found that while the syntactic complexity scores of children with WS were significantly higher than would have been expected on the basis of spatial constructive ability, they were nevertheless significantly lower than would have been expected on the basis of receptive vocabulary ability, verbal ability, or auditory short-term memory. Across a large sample of 77 individuals between 5 and 52 years, Mervis et al. (1999) reported that performance on the Test of Receptive Grammar (Bishop 1983) was poor for complex constructions. Only 18% of the participants (22% of the adults) passed the test block that assessed relative clauses and only 5% (9% of the adults) passed the block assessing embedded sentences.

Such fractionation – patterns of strengths and weaknesses – appears in other areas of the WS language system (Thomas in press a). Pragmatics, less advanced in WS than grammar, also exhibits within-domain fractionation. There is relatively good performance in social sensitivity (e.g., making dyadic eye contact, sensitivity to non-verbal cues) but problems in areas such as greeting behaviors, topic maintenance, and question answering (Semel & Rosner 2003). In lexical-semantics, a relative strength in category concepts (e.g., the distinction between animals. Tools, clothing, furniture etc.) contrasts with problems understanding semantic relational concepts such as spatial-temporal terms (Phillips, Jarrold, Baddeley, Grant, & Karmiloff-Smith 2004). Even within category concepts, recent evidence has indicated differential naming problems across categories (Temple, Almazan, & Sherwood 2002; Thomas & Redington 2004), and it has been argued that the lexicon is an area of specific anomalies

in WS (Clahsen & Almazan 1998; Rossen, Klima, Bellugi, Bihrle, & Jones 1996; Temple et al. 2002).

In order to consider the developmental origins of this uneven pattern, researchers have turned to precursors of language in WS infants. In Karmiloff-Smith and Thomas (2003), we recently reviewed this work. The most salient aspect of the onset of language in WS is that it is delayed. Although this delay is variable, one study of 54 children with WS found an average delay of 2 years, similar to that found for children with Down syndrome (DS) (Singer Harris et al. 1997; see also Paterson et al. 1999). Though delayed, some aspects of early development reveal normal behavioural patterns. For example, the onset of hand banging predicts the onset of canonical babbling in infants with WS in the same way as it does in typically developing infants (Masataka 2001; Mervis & Bertrand 1997).

Despite the fact that phonological memory appears as a relative strength in WS in childhood and adulthood (Mervis et al. 1999), a study of the ability of infants and toddlers with WS to segment the fluent speech stream into words revealed serious delays (Nazzi, Paterson, & Karmiloff-Smith 2003). In part, then, language delays may be due to problems with the early development of speech perception and phonological representations.

However, some precursors appear not just delayed but atypical. For example, Laing and colleagues examined socio-interactive precursors to language development in toddlers with WS compared with MA controls (Laing, Butterworth, Ansari, Gsödl, Longhi, Panagiotaki, Paterson, & Karmiloff-Smith 2002). Although toddlers with WS were proficient at dyadic interactions with a caregiver (and indeed sometimes exceeded the scores of MA controls due to persistent fixation on the caregiver's face; see also Bertrand, Mervis, Rice, & Adamson 1993; Jones, Bellugi, Lai, Chiles, Reilly, Lincoln, & Adolphs 2000), there was a marked deficiency in triadic interactions incorporating an object. Specifically, toddlers with WS had difficulty switching attention from the caregiver to an object that was being referred to in communication (via pointing, looking, and naming). Such a deficiency could disadvantage the toddlers with WS in learning the names of objects, since shared attention to newly named objects is one of the main routes into vocabulary acquisition. And indeed, there is accumulating evidence that precursors to vocabulary development in WS are atypical.

Typically developing infants use the presence of linguistic or gestural information that accompanies the introduction of novel objects to influence their subsequent categorisation of those objects, sometimes over and above the perceptual similarities among the objects. However, Nazzi and Karmiloff-Smith

(2002) found that 2- to 6-year-old children with WS were significantly less able than typical controls to use verbal cues to constrain categorisation. Masataka (2000) found a similar poverty in the ability of 2–3 year olds with WS to use gestural information to constrain categorisation.

In typically developing children, the ability to use pointing to refer to objects tends to emerge before the use of verbal labels for the same purpose. Presumably, pointing indexes the emergence of the cognitive ability to make reference, prior to the lexical manifestation. Pointing to objects and eliciting pointing behaviour in adults also facilitate the ability to find the correct referent for a given label. However, in WS, Mervis and Bertrand (1997) found that the order was reversed, with the onset of productive vocabulary *preceding* pointing. Laing et al. (2002) confirmed a deficit in the pointing behaviour of infants with WS, despite relative proficiency at fine motor skills. Vocabulary acquisition, therefore, appears to rely on a different set of cues and constraints in WS. When Stevens and Karmiloff-Smith (1997) examined the constraints that older children and young adults with WS were using to learn novel words, these, too, appeared atypical.

Relations between markers of semantic knowledge and productive vocabulary were also unusual in young children with WS. Spontaneous exhaustive sorting of objects (such as arranging toy animals and blocks into their separate categories) indexes the development of semantic knowledge and tends to precede a rapid rise in the rate of vocabulary acquisition in typically developing children. By the time children find it clear which categories objects fall into, it becomes increasingly easier for them to attach consistent labels to different objects. However, for children with WS, Mervis and Bertrand (1997) found no evidence that exhaustive sorting preceded the vocabulary spurt. Indeed, several children with WS exhibited the reverse pattern – unlike children with DS who always displayed the normal pattern.

Finally, there is preliminary evidence that compared to normal children the vocabulary of young children with WS exhibits a reduced advantage for comprehension vocabulary over production vocabulary (Paterson 2000), implying a relatively higher productive vocabulary for their level for comprehension.

In sum, the study of precursors to language development in WS reveals two main themes. First there is an overall delay, perhaps of a more generalized nature incorporating delays in at least motor, phonological, and semantic development. Second, when language development gets underway, a differential balance emerges between the ability to encode and produce word forms on the one hand, and the acquisition of the semantic underpinnings for those words on the other. However, characterization of the endstate language sys-

tem in WS found in adolescents and adults remains controversial. Thomas and Karmiloff-Smith (2003) recently identified two main schools of theory. The first of these is more or less a null hypothesis. The *Conservative hypothesis* argues that the language we see in WS is not markedly atypical, just the product of delayed development combined with low IQ. The second school of theory develops the themes emerging from the study of early WS language development: the *Semantics-Phonology Imbalance hypothesis* comprises a cluster of claims that the WS language system involves a differential pattern of impairments across language.

The Conservative hypothesis runs as follows. Deficits in syntax and pragmatics in WS are what one might expect at a given level of mental retardation. Language development from the earliest age reflects the interests of a child with WS, specifically a strong desire for social interaction (e.g., Jones et al. 2000). Language is initially used more to mediate these interactions than as a referential tool. Subsequent vocabulary development reflects the special interests of the child with some degree of mental retardation, with unusual ('precocious') word usage employed as a strategic device to gain attention and mediate social interaction (Thomas & Redington 2004). Deficits that do exist in vocabulary reflect other non-linguistic aspects of WS. For instance their visuo-spatial processing deficit leads to problems acquiring spatial vocabulary (Phillips, Jarrold, Baddeley, Grant, & Karmiloff-Smith 2004). The challenge for the Conservative hypothesis, however, is to explain why individuals with WS should show errors in, for instance, morphosyntax, that are not found in typically developing children, and why they should show predominantly successful language acquisition when individuals with other genetic syndromes involving mental retardation do not. To the latter point, one could respond that it is the other disorders that have the problems (say, in phonology, while in WS, after a delay, this develops within the normal range). Tager-Flusberg, Plesa-Skwerer, Faja and Joseph (2003: 10) provide a recent statement of the Conservative position: "Despite claims to the contrary... there is no evidence that children with WS acquire language any differently than other [typically developing] children, although they may be delayed in the onset of first words and phrases, as would be expected given their mental retardation."

By contrast, the Semantics-Phonology Imbalance hypothesis (really a cluster of related hypotheses) argues that language development in WS takes place under altered constraints. Several atypical constraints have been proposed. First, there is the idea that individuals with WS have a *particular strength in, or a sensitivity of, phonological short-term memory* (Majerus 2004; Majerus, Palmisano, van der Linden, Barisnikov, & Poncelet 2001; Mervis et al. 1999).

For example, Vicari, Carlesimo, Brizzolara and Pezzini (1996) have labeled language in WS as "hyper-phonological", and Bishop (1999) has argued that WS demonstrates the importance of short-term memory for speech sounds in determining the success of language development. Second, there is the proposal the WS exhibits *a particular weakness in lexical semantics*. Volterra and colleagues have noted that grammatical problems in WS are especially evident with those aspects of morphology carrying out a semantic function; and that individuals with WS perform better than mental-age match controls only in those areas of language where semantic aspects are not involved (e.g., Pezzini, Vicari, Volterra, Milani, & Ossella 1999; Volterra, Capirci, & Caselli 2001). Rossen et al. (1996) proposed that anomalous activation dynamics within the lexicon, specifically impaired inhibitory dynamics mediating context effects, lead to imprecise knowledge of concepts in WS and atypical vocabulary usage (see Temple et al. 2002, for a similar proposal; Thomas, Docrell, Messer, Parmigani, Ansari, Karmiloff-Smith submitted, for discussion). Third, there might be *a lag between the development of phonology and semantics* in WS, or a *problem integrating the two sources of information*. For example, Karmiloff-Smith, Tyler, Voice, Sims, Udwin, Howlin and Davies (1998) found that when individuals with WS monitored a sentence for a target word, performance was like controls in showing disruptions following syntactic violations, but there was a divergence when those violations involved lexically based information. Here the control group showed disruption of word monitoring, but the WS group did not. This led the authors to propose that in WS, there is a deficit in integrating lexical-semantic information with phonological information in real-time processing. Indeed, Frawley (2002) subsequently argued that WS language should be seen primarily as a disorder involving integration deficits between processing modules.

In all of these cases, the outcome of the imbalance is a system that relies (or has relied at certain points in its developmental history) more on phonological information than semantic information, with certain consequent behavioral impairments. A complication of the Imbalance theory is that most of its components are logically independent and not mutually exclusive. It is at least possible that several of the hypotheses could conjointly turn out to be true. For example, WS might constitute a case where there are differences in phonology and in semantics, in a system exhibiting general delay and overlying effects of mental retardation.

From the example of Williams syndrome, then, we can see an initial characterization of an uneven language profile in adolescence and adulthood, including claims that grammar has (selectively) developed normally (Clahsen &

Almazan 1998). However, this initial modular proposal was not accompanied by any proposals for the developmental pathway (Thomas & Karmiloff-Smith in press). Moreover, the characterization was tempered by the fact that even syntax development is delayed in WS and then does not reach normal levels of mastery. Subsequent testing has revealed a good deal of fractionation or unevenness of different aspects of WS language, including within syntax, the lexicon, and pragmatics. This raises questions of whether a modular account of WS language could possibly deal with the granularity of fractionation by postulating one or more deficits to the initial proto-language system. To do so would seem to require implausible levels of detailed structure in the infant pre-linguistic system. The search for a developmental account then led to a focus on infant precursors, and here there accumulated evidence that some precursors to language were themselves atypical, for instance the deficit in triadic but not dyadic interaction, and the markers of referential communication. Although some researchers still prefer a "delayed but normal" explanation of WS language development, there is now a cluster of accounts that view this process in terms of an atypical balance between the lexical-semantic and phonological constraints, the former relatively weaker and the latter relatively stronger. In these accounts, the relatively high level of syntactic performance would be associated with the basis of good (albeit delayed) phonology. However, discussions still persist concerning whether syntax development itself follows a 'normal' course, and if it does, what this tells us of the constraints guiding typical and atypical language acquisition.

5. Computational investigations into constrained development

The methodology of computational modeling forms a convergent approach to understanding constraints on development, and how atypical constraints may produce sub-optimal development. Computational models provides a concrete basis to investigate more precisely how sources of information interact in the acquisition of a particular language domain, including opportunities for compensation, and the different ways in which delay and deviation may emerge from a system learning a facet of language. As with all methodologies, there are some limitations. Modeling necessarily involves simplification, and thus far it has focused in the main on individual domains (lexical segmentation, vocabulary acquisition, inflectional morphology, syntax processing; see Christiansen & Chater 2001) rather than the development and operation of multi-component systems (see Thomas & Karmiloff-Smith 2002a; Thomas &

Richardson in press, for discussion). Nevertheless, work to date has generated insights into the potential causes of developmental language deficits.

One of the main modeling formats applied to developmental disorders has been that of connectionist networks (see Thomas & Karmiloff-Smith 2002b, for a review). These are advantageous because the networks of simple processing units are learning systems that can acquire the structure of cognitive domains through training. Additionally, they contain computational parameters that alter the efficiency of learning, and so provide a tool to explore non-optimal conditions for acquisition. In the following paragraphs, I discuss four different theoretical issues I and various colleagues have investigated using connectionist modeling.

5.1 The contribution of the developmental process to producing behavioral impairments

In one model, we explored the implications of damaging a learning system in its initial state (analogous to a developmental disorder) compared to damaging a system in its trained state (analogous to an adult acquired deficit) as a way of gauging the potential contribution of a developmental process to generating behavioral impairments (Thomas & Karmiloff-Smith 2002a). The results demonstrated that some types of damage hurt an information processing system much more in its 'adult' state (e.g., severing network connections) while others hurt the system much more in the 'infant' state (e.g., adding noise to processing or blurring the input). The adult system can tolerate noise because it already has an accurate representation of the knowledge, but loss of network structure leads to a decrement in performance since connections contain established knowledge. By contrast, the infant system can tolerate loss of connections because it can organize remaining resources to acquire the knowledge, but the infant system is impaired by noisy processing because this blurs the knowledge that has to be acquired. This result echoes the conclusion of McDonald (1997) that a key factor in predicting the success of language acquisition across typical and atypical populations is whether the child has good representations of speech sounds.

5.2 Case study: English past tense formation in Williams syndrome

In other work, we have applied connectionist models to a much more detailed, data-driven consideration of one domain and one developmental disorder, the acquisition of English past tense formation in Williams syndrome (Thomas

& Karmiloff-Smith 2003). The model combines lexical-semantic information about a verb with phonological information about the verb's stem to generate its past tense form (Thomas & Karmiloff-Smith 2003; see Lavric, Pizzagalli, Forstmeier, & Rippon 2001 for discussion of this architecture). It thus allows detailed consideration of the relative influence of lexical-semantic and phonological constraints on the acquisition of this aspect of morphosyntax. As an outcome of the *normal* developmental process, the network comes to rely differentially on the two sources of information for driving two types of inflection, regular past tenses (talk ⇒ talked, wug ⇒ wugged) and irregular past tenses (go ⇒ went, hit ⇒ hit, think ⇒ thought). In particular, the system relies more heavily on lexical-semantic information for driving irregular inflections, so that in the trained model, a lesion to lexical-semantics differentially impaired irregulars (see also Joanisse & Seidenberg 1999). Our simulations focused on a cross-sectional developmental trajectory for the acquisition of regular, irregular, and novel verb past tense formation that we had generated from around 20 individuals with WS and 50 control children and adults (Thomas et al. 2001). These data indicated that individuals with WS exhibited a delay in the acquisition of the English past tense that was equal for regular and irregular verbs, but also a reduced tendency to generalize known inflectional patterns to novel verb forms.

We then set out to explore whether alterations to the model's initial constraints could account for these three features of the WS data. As we have seen, various claims have been made that there are subtle differences in the language system of individuals with Williams syndrome, including the proposals that their phonological representations may be atypical and perhaps rely on sensitive auditory processing, that their semantic representations may be atypical, or that semantic information about words may integrate poorly with phonology. Having established that the model could capture the normal developmental trajectory in this domain, we altered the initial constraints of the untrained network model to implement each type of proposed deficit. The results revealed that a manipulation of the phonological representations that reduced their similarity and redundancy was sufficient to reproduce the delay for regular and irregular past tense forms, as well as the reduction in generalization. Second, the pattern could also be produced when noise was added to the information coming from the semantic system during the acquisition of the past tense. Third, elimination or weakening of the semantic contribution produced a pattern inconsistent with this set of WS data comprising a selective delay for irregular verbs and no reduction in generalization (though see Clahsen & Almazan 1998, for a report of this pattern in a small sample of

4 children with WS). Lastly, slowed learning failed to produce a reduction in generalization, suggesting that delayed development alone was insufficient to explain WS performance and that atypical computational constraints are likely to be involved. This detailed modeling work was therefore able to test the viability of several competing hypotheses on the causes of particular language impairments in Williams syndrome. Manipulations to phonology or to the integration of phonology and semantics were able to simulate the past tense data; manipulations to semantics alone or delayed development were not.

5.3 Domain-specific versus domain-general deficits: A possible approach to explaining behavioral impairments in SLI

In a wider exploration of the model described above, we found that altering a 'domain-general' internal computational constraint prior to exposure to the problem domain could change the network's balance between the way it exploited lexical-semantic and phonological information during learning (Thomas in press b). With this atypical parameter setting, the network generated a profile of performance on English past tense acquisition that is not dissimilar to that reported for children with SLI. For example, van der Lely and Ullman (2001) reported that in a past tense elicitation task, children with SLI showed low levels of inflection for both regular and irregular verbs (10–20% correct) and similarly low levels of extension of the regular rule to novel stems. Since regulars are normally inflected more accurately than irregulars, this amounts to a greater deficit for regular verbs – one might view this as a kind of developmental fractionation. Van der Lely and Ullman's explanation of this pattern of behavior relies on a linguistic theory that distinguishes separate mechanisms for acquiring regular and irregular verbs (Pinker 1991). Regulars are learned by a rule-implementing mechanism whereas irregulars are learned by an associative memory (see Ullman & Pierpont in press, for a similar account where the two mechanisms are aligned with procedural and declarative memory systems in the brain). According to Ullman and colleagues, the children with SLI are unable to learn the regular rule due to an initial impairment in their rule-based/procedural system and the few regulars and irregulars that are correctly inflected reflect the compensatory action of the associative/declarative system. The idea that regulars are now inflected by a compensating associative memory system instead of a rule mechanism in the SLI group is supported by evidence of abnormally large frequency effects for regular verbs – frequency effects are taken to be the hallmark of domain-general associative memory.

It is important to be clear about the chain of inference in this case, because it clearly illustrates how researchers can move from behavioral evidence to deducing structural fractionations of the language system. The relatively greater impairment of regular inflections, along with the increased frequency effects in residual regular inflection are taken as evidence that in SLI, there has been a startstate deficit to a *domain-specific* computational structure responsible for learning regular past tense forms. It is important because the connectionist past tense model was able to simulate the same behavioral data without postulating any domain-specific fractionation, and moreover, exhibit the behavioral pattern as the product of an implemented developmental process.

To understand how the model simulated these data, we need to understand a little more about it. The model employs a 'three-layer' architecture, where a layer of internal processing units intercedes between the input layer (in this case representing lexical-semantics and verb-stem phonology) and the output layer (here representing inflected verb phonology). This internal or hidden layer is a common representational resource involved in processing regular, irregular, and novel inflections. The manipulation we applied to the network was to alter the initial properties of these hidden layer units. In particular, we reduced the sharpness of their thresholding functions. This manipulation roughly had the effect of attenuating the 'discriminability' of the units, making all computations fuzzier. The network was less able to learn sharp category boundaries in the problem domain to which it was exposed, requiring far more training than normal to generate these discriminations.

When the disordered network was 'aged-matched' to a normally developing past tense network, it exhibited low levels of regular and irregular inflection, along with poor regularization of novel stems. In other words, the disordered network gave an approximate fit to the SLI data presented by van der Lely and Ullman (2001). Importantly, in the model just as in the empirical data, regular verbs now exhibited an elevated frequency effect. Subsequent analysis of the network revealed that this was because regular inflection was being driven more strongly by lexical-semantic input than in the normal network. In effect, the system was treating regulars in the same way as irregulars, as if all verbs were exceptions to be generated via support from the lexicon.

On the face of it, this model would appear to parallel van der Lely and Ullman's explanation of their SLI data: residual regular inflection reflects the action of the declarative memory system storing word-specific information. Similarly, regulars and irregulars were treated in the same way in the disordered network, with equivalent reliance of lexical-semantics and equivalent sized frequency effects. Crucially, however, the startstate manipulation to the

connectionist network was not to a domain-specific processing structure affecting only regulars, as assumed by Ullman and Pierpont and van der Lely. Instead, the computational manipulation targeted a general processing resource used to inflect both regular and irregular verbs. However, the particular computational property altered was one upon which regular verbs differentially relied, since such verbs differ yet must all be treated in the same way. This requires sharp category boundaries that delineate regular space in which all items will be treated the same. The alteration of this domain-relevant property was a deflection of the developmental trajectory such that in terms of the relative size of deficits, there was an apparent fractionation between regular and irregular verbs. These initial alterations to the common computational resource had the effect of altering the balance of the information sources on which the network relied to generate past tense forms. Phonological regularities were downplayed, while word-specific information was emphasized. The atypical constraints of the learning system served to alter the interaction between phonological and semantic sources of knowledge during development of this morpho-syntactic ability.

In sum, this modeling results demonstrates that behavioral evidence taken by van der Lely and Ullman (2001) and Ullman and Pierpont (in press) to indicate a structural fractionation of the language system in SLI could also be explained in terms of a learning system without such a fractionation, and the initial manipulation of a computational parameter with no specific reference to regular or irregular verbs.

5.4 Inferences from the comparison of developmental profiles from different disorders

Modeling work also sheds light on the interpretation of similarities and differences in the way different disorder groups acquire language. The fact that we can take a model of normal development and create developmentally impaired systems of various types (noisy systems, systems with memory impairments, slow learners, and so on) allows us to explore the extent to which qualitatively different behavioral profiles are generated by altered internal constraints. We explored this in two recent models: the past tense model already discussed and a model of syntax acquisition.

One explanation of the similarities identified between the developmental profiles and patterns of errors across different disorders is that these similarities reflect immovable internal constraints of the language learning system (Newport 1990). The notion of a 'developmental delay' is predicated on iden-

tifying such similarities in children that are not reaching the landmarks at the correct ages. It is deployed even in the case where mastery is never reached. Similarities may therefore be taken to imply that nothing is qualitatively different in the system: it is just not 'working very well'. However, it is also possible that similarities between typical and atypical development have another explanation: the range of behaviors that individuals can exhibit in language development is constrained by the common physical, social, and informational environment in which each individual's cognitive system is embedded. More specifically, behaviors normal or otherwise are in part constrained by the structure of the problem domain to which the cognitive system is exposed, whatever its underlying architecture. The extent to which cognitive architecture is *visible* in the behavioral changes and error patterns exhibited across development is a serious and unresolved issue. The simplest illustration of this idea is a cognitive domain that has an easy part and a hard part. A wide range of learning systems would naturally acquire the easy part before the hard part. Consequently, a common developmental profile here would tell us little about the actual learning system involved. To investigate this proposal, we exposed a variety of associative architectures to the past tense domain, varying the computational resources that the learning system brought to the problem (Mareschal et al. forthcoming). The results indicated that there was indeed great variation across the developmental profiles. However, the systems also exhibited similarities in their profiles. In particular, regular verb acquisition was usually in advance of irregular acquisition, and generalization of the regular rule was usually weaker to novel stems that rhymed with irregulars than to those that did not. These patterns were a result of the structure of common past tense domain that each model learned, including the similarities between verbs and type and token frequencies of the various items involved.

Dick et al. (2001, 2004) recently argued that similarities in syntactic deficits found in adults with aphasia and in children with developmental language impairments can also be traced to features of the shared problem domain. In particular, in a comprehension task (agent-patient role assignment), low frequency constructions and non-canonical subject-object word order constructions such as passives and object clefts ('the cat was chased by the dog', 'it was the cat that the dog chased') revealed greater behavioral impairments than high frequency and canonical order constructions like actives and subject clefts ('the dog chased the cat', 'it was the dog that chased the cat'). We trained a recurrent, sequence processing connectionist network on sentences of this form in the frequency that young children hear them (Thomas & Redington 2004). The network had to perform the same comprehension task as human

subjects, identifying the agent in each sentence. The trained network showed the normal adult pattern of difficulty across the constructions. When it was trained with an initially reduced level of computational resources, it was also successful in simulating the exaggerated pattern of difficulty shown by children with developmental disorders. Importantly, the model also demonstrated relatively less vulnerability of constructions learned on the basis of unique lexical cues (such as passives, indicated by the word 'by') and relatively more vulnerability of constructions learned on the basis of sequence cues (such as object clefts, indicated by the two nouns that are not split by an intervening verb). The behavioral data (Dick et al. 2004) were also consistent with this differential effect. This pattern emerges in the model because reducing the initial computational resources produces a greater impairment in analyzing global information across sentences than in analyzing local information from individual lexical items. The consequence is that although the structure of the task domain paints a broad picture of task difficulty, the strengths and weaknesses of the computational learning system modulate this pattern.

In sum, models of two different aspects of grammar acquisition demonstrate that some similarities between atypical and normal development are the consequence of the problem domain. Disordered learning systems only serve to modify this pattern, sometimes in subtle ways. This line of computational work indicates firstly that the attributions of language disorders to 'developmental delay' on the basis of an absence of 'qualitative' differences need to be treated with caution; and secondly, the inference that behavioral similarities across different populations reflect internal constraints is not a secure one – they may as easily reflect external constraints.

6. Conclusions

In this chapter, we have considered how atypical profiles of language impairments may be informative about language acquisition. I have argued that the appropriate framework for explanations of deficits in developmental disorders is in terms of constraints on the developmental process – whether a given theory assumes the presence of domain-specific modular structure prior to language acquisition or assumes that such structure is the product of the developmental process itself. We considered characteristics that the atypical developmental process should incorporate such as interactivity and compensation. If these characteristics do not figure within the developmental process, theories must explicitly stipulate why they should not occur. The example of Williams

syndrome was used to illustrate how researchers can begin to identify the particular constraints that have deflected language development in an atypical population. Finally, computational modeling of atypical language acquisition was discussed, both as a method for testing whether a given set of atypical constraints (such as the balance of phonological and lexical-semantic information) are sufficient to generate particular behavioral impairments, and also as a way to assess the strength of inferences drawn from behavioral data. In the case of the latter, we saw how modeling indicated that behavioral dissociations in language development do not necessarily imply underlying structural fractionations, and how behavioral similarities between typical and atypical language acquisition do not necessarily stem from shared internal constraints but from the structure of the problem domain. Finally, we must note the context of this research. Understanding the constraints that shape and deflect the acquisition of language is an important step towards understanding how we may intervene to optimize the outcome of language learning in atypical populations.

References

Abbeduto, L. (Ed.). (2003). *Language and Communication in Mental Retardation*. New York: Elsevier, Academic Press.

Abbeduto, L. (2004). "Communication challenges facing youth with fragile X syndrome." Presentation at the biennial international conference of the National Fragile X Foundation, Washington, DC.

Abbeduto, L. & Hagerman, R. (1997). "Language and communication in fragile X syndrome." *Mental Retardation and Developmental Disabilities Research Reviews, 3*, 313–322.

Abbeduto, L. & Murphy, M. M. (2004). "Language, social cognition, maladaptive behavior and communication in Down syndrome and fragile X syndrome." In M. Rice & S. F. Warren (Eds.), *Developmental Language Disorders: From phenotypes to etiologies* (pp. 77–97). Mahwah, NJ: Lawrence Erlbaum Associates.

Abbeduto, L., Evans, J., & Dolan, T. (2001a). "Theoretical perspectives on language and communication problems in mental retardation and developmental disabilities." *Mental Retardation and Developmental Disabilities Research Reviews, 7*, 45–55.

Abbeduto, L., Murphy, M. M., Cawthon, S. W., Richmond, E. K., Weissman, M. D., Karadottir, S., & O'Brien, A. (2003). "Receptive language skills of adolescents and young adults with down or fragile X syndrome." *American Journal of Mental Retardation, 108*, 149–160.

Abbeduto, L., Pavetto, M., Karadottir, S., O'Brien, A., Weissman, M., Kesin, E., & Cawthon, S. (2000). "Expressive language development in adolescents and young adults with fragile X syndrome: Relationships with nonverbal cognition and syndrome specificity." Paper presented at the 7th International Fragile X Conference, Los Angeles, CA.

Abbeduto, L., Pavetto, M., Kesin, E., Weissman, M., Karadottir, S., O'Brien, A., & Cawthon, S. (2001b). "The linguistic and cognitive profile of Down syndrome: Evidence from a comparison with fragile X syndrome." *Down Syndrome Research and Practice, 7*, 9–16.

Alegria, J., Leybaert, J., Charlier, B., & Hage, C. (1992). "On the origin of phonological representations in the deaf: Hearing lips and hands." In J. Alegria, D. Holender, J. Morais, J. Radeau, & M. Radeau (Eds.), *Analytic Approaches to Human Cognition* (pp. 107–132). Amsterdam: Elsevier.

Allen, D., Steinberg, M., Dunn, M., Fein, D., Feinstein, C., Waterhouse, L., & Rapin, I. (2001). "Autistic disorder versus other pervasive developmental disorders in young children: Same or different?" *European Journal of Child Adolescent Psychiatry, 10*, 67–78.

Allen, M. C., Nikolopoulos, T. P., & O'Donoghue, G. M. (1998). "Speech intelligibility in children after cochlear implantation." *The American Journal of Otology, 19*, 742–746.

Allen, S. E. & Dyar, D. (1997). "Profiling linguistic outcomes in young children after cochlear implantation." *The American Journal of Otology, 18*, 127–128.

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV, 4th edition). Washington, DC: American Psychiatric Association.

Arehart, K. H., Yoshinaga-Itano, C., Thomson, V., Gabbard, S. A., & Stredler-Brown, A. (1998). "State of the states: The status of universal newborn hearing screening, assessment and intervention systems in 16 states." *American Journal of Audiology, 7*, 101–114.

Bailey, D. B., Bruer, J. T., Symons, F. J., & Lichtman, J. W. (Eds.). (2001). *Critical thinking about critical periods.* Baltimore, MD: Brookes.

Bailey, D. B., Jr., Hatton, D. D., & Skinner, M. (1998). "Early developmental trajectories of males with fragile X syndrome." *American Journal on Mental Retardation, 103*, 29–39.

Bailey, D. B., Jr., Hatton, D. D., Mesibov, G., & Ament, N. (2000b). "Early development, temperament and functional impairment in autism and fragile X syndrome." *Journal of Autism and Developmental Disorders, 30*, 49–59.

Bailey, D. B., Jr., Skinner, D., Hatton, D., & Roberts, J. (2000a). "Family experiences and factors associated with the diagnosis of fragile X syndrome." *Developmental and Behavioral Pediatrics, 21*, 315–321.

Baird, G., Cass, H., & Slonims, V. (2003). "Clinical review: Diagnosis of autism." *British Medical Journal, 327*, 488–493.

Baltaxe, C. & D'Angiola, N. (1996). "Referencing skills in children with autism and specific language impairment." *European Journal of Disorders of Communication, 31*, 245–258.

Baron-Cohen, S. & Staunton, R. (1994). "Do children with autism acquire the phonology of their peers? An examination of group identification through the window of bilingualism." *First Language, 14*, 241–248.

Bartak, L., Rutter, M., & Cox, A. (1975). "A comparative study of infantile autism and specific developmental receptive language disorder: I. The children." *British Journal of Psychiatry, 126*, 127–145.

Bartolucci, G., Pierce, S., & Streiner, D. (1980). "Cross-sectional studies of grammatical morphemes in autistic and mentally retarded children." *Journal of Autism and Developmental Disorders, 10*, 39–50.

Bates, E. (2004). "Explaining and interpreting deficits in language development across clinical groups: Where do we go from here?" *Brain and Language, 88*, 248–253.

Bates, E. & Goodman, J. (2001). "On the inseparability of grammar and the lexicon: Evidence from acquisition." In M. Tomasello & E. Bates (Eds.), *Language Development: The essential readings* (pp. 134–162). Malden, MA: Blackwell.

Bates, E. & Roe, K. (2001). "Language development in children with unilateral brain injury." In C. A. Nelson & M. Luciana (Eds.), *Handbook of Developmental Cognitive Neuroscience* (pp. 281–307). Cambridge, MA: The MIT Press.

Bauer, D., Goldfield, B., & Reznick, J. (2002). "Alternative approaches to analyzing individual differences in the rate of early vocabulary development." *Applied Psycholinguistics, 23*, 313–315.

Bauer, R. & Benedict, P. (1997). *Modern Cantonese Phonology.* Berlin: Mouton de Gruyter.

Baumgardner, T., Reiss, A. L., Freund, L., & Abrams M. T. (1995). "Specification of the neurobehavioral phenotype of males with fragile X syndrome." *Pediatrics, 95*, 744–752.

Behrend, D., Scofield, J., & Kleinknecht, E. (2001). "Beyond fast-mapping: Young children's extensions of novel words and novel facts." *Developmental Psychology, 37*, 698–705.

Belser, R. C. & Sudhalter, V. (1995). "Arousal difficulties in males with fragile X syndrome: A preliminary report." *Developmental Brain Dysfunction, 8*, 270–279.

Belser, R. C. & Sudhalter, V. (2001). "Conversational characteristics of children with fragile X syndrome: Repetitive speech." *American Journal on Mental Retardation, 106*, 28–38.

Bertrand, J., Mervis, C., Rice, C. E., & Adamson, L. (1993). "Development of joint attention by a toddler with Williams syndrome." Paper presented at the Gatlinberg Conference on Research and Theory in Mental Retardation and Developmental Disabilities, Gatlinberg.

Bishop, D. V. M. (1983). *The Test for Reception of Grammar.* Age and Cognitive Performance Research Centre, University of Manchester.

Bishop, D. V. M. (1989). *The Test for the Reception of Grammar*. Age and Cognitive Performance Centre, University of Manchester.

Bishop, D. V. M. (1989). "Autism, Asperger's syndrome and semantic-pragmatic disorder: Where are the boundaries?" *British Journal of Disorders of Communication, 24*, 107–121.

Bishop, D. V. M. (1997). "Cognitive neuropsychology and developmental disorders: Uncomfortable bedfellows." *Quarterly Journal of Experimental Psychology, 50A*, 899–923.

Bishop, D. V. M. (1999). "An innate basis for language?" *Science, 286*, 2283–2284.

Bishop, D. V. M. (2004). "Classification of developmental language disorders: Theoritical issues and clinical implications." In L. Verhoeven (Ed.), *Specific Language Impairment: Diagnostic dilemmas* (pp. 309–326). Mahwah, NJ: Lawrence Erlbaum Associates.

Bishop, D. V. M. & Norbury, C. (2002). "Exploring the borderlands of autistic disorder and specific language impairment: A study using standardized diagnostic instruments." *Journal of Child Psychology and Psychiatry, 37*, 391–403.

Blamey, P. J. (2003). "Development of spoken language by deaf children." In M. Marschark & P. E. Spencer (Eds.), *Oxford handbook of deaf studies, language and education* (pp. 232–246). NewYork: Oxford University Press.

Blamey, P. J., Barry, J. G., & Jacq, P. (2001). "Phonetic inventory development in young cochlear implant users 6 years postoperation." *Journal of Speech, Language and Hearing Research, 44*, 73–79.

Blanchard, J., Gangestad, S., Brown, S., & Horan, W. (2000). "Hedonic capacity and schizotypy revisited: A taxometric analysis of social anhedonia." *Journal of Abnormal Psychology, 109*, 87–95.

Bloom, L. (1970). *Language Development: Form and function in emerging grammars.* Cambridge, MA: The MIT Press.

Bloom, P. (2000). *How Children Learn the Meanings of Words.* Cambridge, MA: The MIT Press.

Bollard, P. M., Chute, P. M., Popp, A., & Parisier, S. C. (1999). "Specific language growth in young children using the Clarion cochlear implant." *Annals of Otology, Rhinology and Laryngology, 108*, 119–123.

Boothroyd, A. (1984). "Auditory perception of speech contrasts by subjects with sensorineural hearing loss." *Journal of Speech and Hearing Research, 27*, 134–144.

Boothroyd, A. & Boothroyd-Turner, D. (2002). "Postimplantation audition and educational attainment in children with prelingually acquired profound deafness." *Annals of Otology, Rhinology and Laryngology, 111*, 79–84.

Boothroyd, A., Geers, A. E., & Moog, J. S. (1991). "Practical implications of cochlear implants in children." *Ear and Hearing, 12*, 81–89.

Botting, N. & Conti-Ramsden, G. (2003). "Autism, primary pragmatic difficulties and specific language impairment: Can we distinguish them using psycholinguistic markers?" *Developmental Medicine and Child Neurology, 45*, 515–524.

Boudreau, D. & Chapman, R. S. (2000). "The relationship between event representation and linguistic skill in narratives of children and adolescents with Down syndrome." *Journal of Speech, Language and Hearing Research, 43*, 1146–1159.

Bregman, J. D., Leckman, J. F., & Ort, S. I. (1988). "Fragile X syndrome: Genetic predisposition to psychopathology." *Journal of Autism and Developmental Disorders, 18*, 343–354.

Brown, R. (1973). *A First Language: The early stages.* London: George Allen and Unwin.

Brown, W. T. (2002). "The molecular biology of the fragile X mutation." In R. J. Hagerman & P. J. Hagerman (Eds.), *Fragile X Syndrome: Diagnosis, treatment and research* (3rd edition, pp. 110–135). Baltimore, MD: Johns Hopkins University Press.

Bruer, J. T. (2001). "A critical and sensitive period primer." In D. B. Bailey, J. T. Bruer, F. J. Symons, & J. W. Lichtman (Eds.), *Critical Thinking about Crtical Periods* (pp. 3–26). Baltimore, MD: Brookes.

Bruner, J. S. (1983). *Child's Talk: Learning to use language*. Oxford: Oxford University Press.

Burack, J. A., Shulman, C., Katzir, E., Schaap, T., Brennan, J. M., Iarocci, G., Wilansky, P., & Amir, N. (1999). "Cognitive and behavioural development of Israeli males with fragile X and Down syndrome." *International Journal of Behavioral Development, 23*, 519–531.

Caplan, D. (1987). *Neurolinguistics and Linguistic Aphasiology*. Cambridge: Cambridge University Press.

Capone, N. C. & McGregor, K. K. (2004). "Gesture development: A review for clinical and review practices." *Journal of Speech, Language and Hearing Research, 47*, 173–186.

Carey, S. & Bartlett, E. (1978). "Acquiring a single new word." *Papers and Reports on Child Language Development, 15*, 17–29.

Chapman, R. S. (2000). "Children's language learning: An interactionist perspective." *Journal of Child Psychology and Psychiatry and Allied Disciplines, 41*, 33–54.

Chapman, R. S. (2003). "Language and communication in individuals with Down syndrome." In L. Abbeduto (Ed.), *International Review of Research in Mental Retardation: Language and communication, 27* (pp. 1–34). New York: Academic Press.

Chapman, R. S. & Hesketh, L. (2000). "The behavioral phenotype of Down syndrome." *Mental Retardation and Developmental Disabilities Research Review, 6*, 84–95.

Chapman, R. S., Kay-Raining Bird, E., & Schwartz, S. (1990). "Fast mapping of words in event contexts by children with Down syndrome." *Journal of Speech and Hearing Disorders, 55*, 761–770.

Chapman, R. S., Hesketh, L. J., & Kistler, D. (2002). "Predicting longitudinal change in language production and comprehension in individuals with Down syndrome: Hierarchical linear modeling." *Journal of Speech, Language and Hearing Research, 45*, 902–915.

Chapman, R. S., Schwartz, S. E., & Kay-Raining Bird, E. (1991). "Language skills of children and adolescents with Down syndrome I. Comprehension." *Journal of Speech and Hearing Research, 34*, 1106–1120.

Chapman, R. S., Seung, H.-K., Schwartz, S. E., & Kay-Raining Bird, E. (2000). "Predicting language production in children and adolescents with Down syndrome: The role of comprehension." *Journal of Speech and Hearing Research, 43*, 340–350.

Chapman, R. S., Seung, H.-K., Schwartz, S. E., & Kay-Raining Bird, E. (1998). "Language skills of children and adolescents with Down syndrome: II. Production deficits." *Journal of Speech, Language and Hearing Research, 41*, 861–873.

Charlier, B. & Leybaert, J. (2000). "The rhyming skills of deaf children educated with phonetically augmented speechreading." *Quarterly Journal of Experimental Psychology, 53A*(2), 349–375.

Charman, T., Baron-Cohen, S., Swettenham, J., Baird, G., Drew, A., & Cox, A. (2003b). "Predicting language outcome in infants with autism and pervasive developmental disorder." *International Journal of Language and Communication Disorders, 38*, 265–285.

Charman, T., Drew, A., Baird, C., & Baird, G. (2003a). "Measuring early language development in preschool children with autism spectrum disorder using the MacArthur Communicative Development Inventory (Infant Form)." *Journal of Child Language, 30*, 213–236.

Chiat, S. (2001). "Mapping theories of developmental language impairment: Premises, predictions and evidence." *Language and Cognitive Processes, 16*, 113–142.

Chiat, S. (2003). *Understanding Children with Language Problems.* Cambridge: Cambridge University Press.

Chin, S. B. (2002). "Aspects of stop consonant production by pediatric users of cochlear implants." *Language, Speech and Hearing Services in Schools, 33*, 38–51.

Chin, S. B. (2003). "Children's consonant inventories after extended cochlear implant use." *Journal of Speech, Language and Hearing Research, 46*, 849–862.

Chin, S. B. & Kaiser, C. L. (2000). "Measurement of articulation in pediatric users of cochlear implants." *The Volta Review, 102*(4), 145–156.

Chomsky, N. (1957). *Syntactic Structures.* The Hague: Mouton.

Chomsky, N. (1965). *Aspects of the Theory of Syntax.* Cambridge, MA: The MIT Press.

Christiansen, M. H. & Chater, N. (2001). *Connectionist Psycholinguistics.* Westport, CT: Ablex.

Clahsen, H. & Almazan, M. (1998). "Syntax and morphology in Williams Syndrome." *Cognition, 68*, 167–198.

Clahsen, H. & Temple, C. (2003). "Words and rules in Williams syndrome." To appear in Y. Levy & J. Schaeffer (Eds.), *Towards a Definition of Specific Language Impairment in Children* (pp. 323–353). Hillsdale, NJ: Lawrence Erlbaum Associates.

Clark, E. V. (2002). *First Language Acquisition.* Cambridge: Cambridge University Press.

Coerts, J. & Mills, A. (1994). "Spontaneous language development of young deaf children with a cochlear implant." *Annals of Otology, Rhinology and Laryngology, 166*, 385–387.

Coerts, J., Baker, A. E., van den Broek, P., & Brokx, J. (1996). "Language development by deaf children with cochlear implants." In C. E. Johnson & J. H. V. Gilbert (Eds.), *Children's language, 9* (pp. 219–234). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cohen, I. L. (1995). "A theoretical analysis of the role of hyperarousal in the learning and behavior of fragile X males." *Mental Retardation and Developmental Disabilities Research Reviews, 1*, 286–291.

Cohen, I. L., Vietze, P. M., Sudhalter, V., Jenkins, E. C., & Brown, W. T. (1989). "Parent-child dyadic gaze patterns in fragile X males and in non-fragile X males with autistic disorder." *Journal of Child Psychology and Psychiatry, 30*, 845–856.

Coltheart, M. (1983). "Aphasia therapy research: A single-case study approach." In C. Code & D. J. Muller (Eds.), *Aphasia Therapy* (pp. 194–202). London: Arnold.

Connor, C. M. & Zwolan, T. A. (in press). "Examining multiple sources of influence on the reading comprehension of children who use cochlear implants." *Journal of Speech, Language and Hearing Research.*

Connor, C. M., Heiber, S., Arts, H. A., & Zwolan, T. A. (2000). "Speech, vocabulary and the education of children using cochlear implants: Oral or total communication?" *Journal of Speech, Language and Hearing Research, 43*, 1185–1204.

Connor, C. M., Raudenbush, S., Zwolan, T. A., Heavner, K., & Craig, H. (submitted). "Age at cochlear implantation effects on vocabulary growth: Indications of an early sensitive phase for language acquisition."

Conti-Ramsden, G. & Botting, N. (1999). "Classification of children with specific language impairment: Longitudinal classifications." *Journal of Speech, Language and Hearing Research, 42*, 1195–1204.

Cornett, O. (1967). "Cued speech." *American Annals of the Deaf, 112*, 3–13.

Cornish, K., Sudhalter, V., & Turk, J. (2004). "Attention and language in fragile X." *Mental Retardation and Developmental Disabilities Research Reviews, 10*, 11–16.

Crawford, D. C., Acuna, J. M., & Sherman, S. L. (2001). "FMR1 and the fragile X syndrome: Human genome epidemiology review." *Genetics in Medicine, 3*, 359–371.

Croft, W. (2001). *Radical Construction Grammar.* Oxford: Oxford University Press.

Cromer, R. (1994). "A case study of dissociations between language and cognition." In H. Tager-Flusberg (Ed.), *Constraints on Language Acquisition: Studies of atypical children* (pp. 141–153). Hillsdale, NJ: Lawrence Erlbaum Associates.

Crosson, J. & Geers, A. E. (2000). "Structural analysis of narratives produced by a group of young cochlear implant users." *Annals of Otology, Rhinology and Laryngology, 185*, 118–119.

Crosson, J. & Geers, A. E. (2001). "Analysis of narrative ability in children with cochlear implants." *Ear and Hearing, 22*, 381–394.

Crystal, D., Fletcher, P., & Garman, M. (1976). *The Grammatical Analysis of Language Disability.* London: Arnold.

Cullington, H., Hodges, A. V., Butts, S. L., Dolan-Ash, S., & Balkany, T. J. (2000). "Comparison of language ability in children with cochlear implants placed in oral and total communication educational settings." *Annals of Otology Rhinology and Laryngology, 185*, 121–123.

Cunningham, M. (1966). "A five-year study of the language of an autistic child." *Journal of Child Psychology and Psychiatry and Allied Disciplines, 7*, 143–154.

Cunningham, C. C., Glenn, S. M., Wilkinson, P., & Sloper, P. (1985). "Mental ability, symbolic play and receptive and expressive language of young children with Down's syndrome." *Journal of Child Psychology and Psychiatry and Allied Disciplines, 26*, 255–265.

Curtiss, S. (1977). *Genie: A psycholinguistic study of a modern-day "wild child."* New York: Academic Press.

Dawson, G., Webb, S., Schellenberg, G. D., Dager, S., Friedman, S., Aylward, E., & Richards, T. (2002). "Defining the broader phenotype of autism: Genetic, brain and behavioral perspectives." *Development and Psychopathology, 14*, 581–611.

Dawson, P. W., Blamey, P. J., Dettman, S. J., Barker, E. J., & Clark, G. M. (1995b). "A clinical report on receptive vocabulary skills in cochlear implant users." *Ear and Hearing, 16*, 287–294.

Dawson, P. W., Blamey, P. J., Dettman, S. J., Rowland, L. C., Barker, E. J., Tobey, E. A., Busby, P. A., Cowan, R. C., & Clark, G. M. (1995a). "A clinical report on speech production of cochlear implant users." *Ear and Hearing, 16*, 551–561.

de Villiers, P. & Pomerantz, S. B. (1992). "Hearing-impaired students learning new words from written context." *Applied Psycholinguistics, 13*, 409–431.

Demark, J. L., Feldman, M. A., & Holden, J. J. A. (2003). "Behavioral relationship between autism and fragile X syndrome." *American Journal of Medical Genetics, 108*, 314–326.

Dick, F., Bates, E., Wulfeck, B., Aydelott, J., Dronkers, N., & Gernsbacher, M. (2001). "Language deficits, localization and grammar: Evidence for a distributive model of language breakdown in aphasic patients and neurologically intact individuals." *Psychological Review, 108*(3), 759–788.

Dick, F., Wulfeck, B., Krupa-Kwiatkowski, M., & Bates, E. (2004). "The development of complex sentence interpretation in typically developing children compared with children with specific language impairments or early unilateral focal lesions." *Developmental Science, 7*(3), 360–377.

Dionne, G., Dale, P., Boivin, M., & Plomin, R. (2003). "Genetic evidence for bidirectional effects of early lexical and grammatical development." *Child Development, 74*, 394–412.

Dodd, B. (1976). "The phonological systems of deaf children." *Journal of Speech and Hearing Disorders, 41*, 185–198.

Dollaghan, C. (1987). "Fast mapping in normal and language-impaired children." *Journal of Speech and Hearing Disorders, 52*, 218–222.

Dollaghan, C. (in press). "Taxonometric analysis of specific language impairment in 3- and 4-year-old children." *Journal of Speech, Language and Hearing Research.*

Dollaghan, C. & Campbell, T. (1998). "Nonword repetition and child language impairment." *Journal of Speech, Language, and Hearing Research, 41*, 1136–1146.

Donnai, D. & Karmiloff-Smith, A. (2000) "Williams Syndrome: From genotype through to the cognitive phenotype." *American Journal of Medical Genetics, 97*, 164–171.

Dromi, E. (1999). "Early lexical development." In M. Barrett (Ed.), *The Development of Language* (pp. 99–129). Hove: Psychology Press.

Dunn, L., Dunn, L., Whetton, C., & Burley, J. (1997). *British Picture Vocabulary Scale-Revised.* Slough, Bucks: NFER-Nelson Publishing Company.

Dunn, L., Dunn, L., Whetton, C., & Pintillie, D. (1982). *British Picture Vocabulary Scale*. Slough, Bucks: NFER-Nelson Publishing Company.

Dunn, M., Flax, J., Slivinski, M., & Aram, D. (1996). "The use of spontaneous language measures as criteria for identifying children with specific language impairment: An attempt to reconcile clinical and research incongruence." *Journal of Speech and Hearing Research, 39*, 643–654.

Dyer-Friedman, J., Glaser, B., Hessl, D., Johnston, C., Huffman, L. C., Taylor, A., Wisbeck, J., & Reiss, A. L. (2002). "Genetic and environmental influences on the cognitive outcomes of children with fragile X syndrome." *Journal of the American Academy of Child and Adolescent Psychiatry, 41*, 237–244.

Dykens, E. M. & Kasari, C. (1997). "Maladaptive behavior in children with Prader-Willi syndrome, Down syndrome and nonspecific mental retardation." *American Journal of Mental Retardation, 102*, 228–237.

Dykens, E. M., Hodapp R. M., Ort, S. I., & Leckman, J. F. (1993). "Trajectory of adaptive behaviour in males with fragile X syndrome." *Journal of Autism and Developmental Disorders, 23*, 135–145.

Dykens, E. M., Hodapp, R. M., & Evans, D. W. (1994). "Profiles and development of adaptive behavior in children with Down syndrome." *American Journal of Mental Retardation, 98*, 580–587.

Dykens, E. M., Hodapp, R. M., & Finucane, B. M. (2000). *Genetics and Mental Retardation Syndromes: A new look at behavior and interventions.* Baltimore, MD: Brookes.

Dykens, E. M., Hodapp, R. M., & Leckman, J. F. (1987). "Strengths and weaknesses in the intellectual functioning of males with fragile X syndrome." *American Journal on Mental Deficiency, 92*, 234–236.

Dykens, E. M., Hodapp, R. M., & Leckman, J. F. (1989b). "Adaptive and maladaptive functioning of institutionalized and noninstitutionalized fragile X males." *Journal of the American Academy of Child and Adolescent Psychiatry, 26*, 427–430.

Dykens, E. M., Hodapp, R. M., Ort, S., Finucane, B. M., Shapiro, L. R., & Leckman, J. F. (1989a). "The trajectory of cognitive development in males with fragile X syndrome." *Journal of the American Academy of Child and Adolescent Psychiatry, 28*, 422–426.

Eadie, P. A., Fey, M. E., Douglas, J. M., & Parsons, C. L. (2002). "Profiles of grammatical morphology and sentence imitation in children with specific language impairment and Down syndrome." *Journal of Speech, Language and Hearing Research, 45*, 720–732.

Edwards, J. & Lahey, M. (1996). Auditory lexical decisions of children with specific language impairment. *Journal of Speech and Hearing Research, 39*, 1263–1273.

Edwards, S., Fletcher, P., Garman, M., Hughes, A., Letts, C., & Sinka, I. (1997). *The Reynell Developmental Language Scales III: University of Reading Edition*. Windsor: NFER-Nelson Publishing Company.

Eisenmajer, R. & Prior, M. (1991). "Cognitive linguistic correlates of "theory of mind" ability in autistic children". *British Journal of Developmental Psychology, 9*, 351–364.

Eisenmajer, R., Prior, M., Leekam, S., Wing, L., Ong, B., Gould, J., & Welham, M. (1998). "Delayed language onset as a predictor of clinical symptoms in pervasive developmental disorders." *Journal of Autism and Developmental Disorders, 28*, 527–533.

El-Hakim, H., Levasseur, J., Papsin, B. C., Panesar, J., Mount, R. J., Stevens, D., & Harrison, R. V. (2001). "Assessment of vocabulary development in children after cochlear implantation." *Archives of Otolaryngology, Head and Neck Surgery, 127*, 1053–1059.

Ellis Weismer, S. & Hesketh, L. (1996). "Lexical learning by children with specific language impairment: Effects of linguistic input presented at varying speaking rates." *Journal of Speech and Hearing Research, 39*, 177–190.

Ellis Weismer, S. & Hesketh, L. (1998). "The impact of emphatic stress in novel word learning by children with specific language impairment." *Journal of Speech, Language and Hearing Research, 41*, 1444–1458.

Elman, J. L., Bates, E. A., Johnson, M. H., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1996). *Rethinking Innateness: A connectionist perspective on development.* Cambridge, MA: The MIT Press.

Emmorey, K. (2002). *Language, Cognition and the Brain.* Mahwah, NJ: Lawrence Erlbaum Associates.

Emmorey, K. & Corina, D. P. (1990). "Lexical recognition in sign language: Effects of phonetic structure and morphology." *Perceptual and Motor Skills, 71*, 1227–1252.

Emmorey, K., Bellugi, U., Friederici, A., & Horn, P. (1995). "Effects of age of acquisition on grammatical sensitivity: Evidence from on-line and off-line tasks." *Applied Psycholinguistics, 16*, 1–23.

Emmorey, K., Grant, R., & Ewan, B. (1994). "A new case of linguistic isolation: Preliminary report." Paper presented at the Boston University Conference on Language Development, Boston, MA.

Epstein, C. J., Korenberg, J. R., Anneren, G., Antonarakis, S. E., Ayme, S., Courchesne, E., Epstein, L. B., Fowler, A., Groner, Y., Huret, J. L., Kempter, T. L., Lott, I. T., Lubin, B. H., Magenis, E., Opitz, J. M., Patterson, D., Priest, J. H., Pueschel, S. M., Rapoport, S. I., Sinet, P. M., Tanzi, R. E., & de la Cruz, F. (1991). "Protocols to establish genotype-phenotype correlations in Down syndrome." *American Journal of Human Genetics, 49*, 207–235.

Ertmer, D. J. & Mellon, J. A. (2001). "Beginning to talk at 20 months: Early vocal development in a young cochlear implant recipient." *Journal of Speech, Language and Hearing Research, 44*, 192–206.

Ertmer, D. J., Kirk, K. I., Seghal, S. T., Riley, A. I., & Osberger, M. J. (1997). "A comparison of vowel production by children with multichannel cochlear implants or tactile aids: Perceptual evidence." *Ear and Hearing, 18*, 307–315.

Ertmer, D. J., Strong, L. M., & Sadagopan, N. (2003). "Beginning to communicate after cochlear implantation: Oral language development in a young child." *Journal of Speech, Language and Hearing Research, 46*, 328–340.

Ertmer, D. J., Young, N., Grohne, K., Mellon, J. A., Johnson, C., Corbett, K., & Saindon, K. (2002). "Vocal development in young children with cochlear implants: Profiles and implications for intervention." *Language, Speech and Hearing Services in Schools, 33*, 184–195.

Feinstein, C. & Reiss, A. L. (2001). "Autism: The point of view from fragile X studies." *Journal of Autism and Developmental Disorders, 28*, 393–405.

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., & Pethick, S. J. (1994). *Variability in Early Communicative Development. Monographs of the Society for Research in Child Development, 59*, 5, Serial No. 242.

Fenson, L., Dale, P. S., Resznick, S., Thal, D., Bates, E., Hartung, J., Pethick, S., & Reilly, J. S. (1993). *The MacArthur Communicative Development Inventories: User's guide and technical manual.* San Diego, CA: Singular.

Ferrier, L. J., Bashir, A. S., Meryash, D. L., Johnston, J., & Wolff, P. (1991). "Conversational skills of individuals with fragile X syndrome: A comparison with autism and Down syndrome." *Developmental Medicine and Child Neurology, 33*, 776–788.

Fey, M. & Proctor-Williams, K. (2000). "Recasting, elicited imitation and modelling in grammar intervention for children with specific language impairments." In D. V. M. Bishop & L. B. Leonard (Eds.), *Speech and Language Impairments in Children* (pp. 177–194). Hove: Psychology Press.

Filipek, P. A., Accardo, P. J., Baranek, G. T., Cook, Jr. E. H., Dawson, G., Gordon, B., Gravel, J. S., Johnson, C. P., Kellen, R. J., Levy, S. E., Minshew, N. J., Prizant, B. M., Rapin, I., Rogers, S. J., Stone, W. L., Teplin, S., Tuchman, R. F., & Volkmar, F. R. (1999). "The screening and diagnosis of autism spectrum disorders." *Journal of Autism and Developmental Disorders, 29*(2), 439–484.

Fisch, G. S., Holden, J. J. A., Carpenter, N. J., Howard-Peebles, P. N., Maddalena, A., Pandya, A., & Nance, W. (1999). "Age-related language characteristics of children and adolescents with fragile X syndrome." *American Journal of Medical Genetics, 83*, 253–256.

Fischer, S. D. (1998). "Critical periods for language acquisition: Consequences for deaf education." In A. Weisel (Ed.), *Issues Unresolved: New perspectives on language and deaf education* (pp. 9–26). Washington, DC: Gallaudet University Press.

Fletcher, P., Leonard, L., Wong, A. M.-Y., & Stokes, S. (in press). "The expression of aspect in Cantonese-speaking children with specific language impairment." *Journal of Speech and Hearing Research.*

Folstein, S. E., Santangelo, S. L., Gilman, S. E., Piven, J., Landa, R., Lainhart, J., Hein, J., & Wzorek, M. (1999). "Predictors of cognitive test patterns in autism families." *Journal of Child Psychology and Psychiatry, 40*, 1117–1128.

Fombonne, E., Bolton, P., Prior, J., Jordan, H., & Rutter, M. (1997). "A family study of autism: Cognitive patterns and levels in parents and siblings." *Journal of Child Psychology and Psychiatry, 38*, 667–683.

Fodor, J. (1983). *The Modularity of Mind*. Cambridge, MA: The MIT Press.

Forster, K. I. (1976). "Accessing the mental lexicon." In R. J. Wales & E. Walker (Eds.), *New Approaches to Language Mechanisms* (pp. 257–287). Amsterdam: North-Holland.

Fowler, A. (1998). "Language in mental retardation: Associations with and dissociations from general cognition." In J. A. Burack, R. M. Hodapp, & E. Zigler (Eds.), *Handbook of Mental Retardation and Development* (pp. 290–333). Cambridge: Cambridge University Press.

Fowler, A. E., Gelman, R., & Gleitman, L. R. (1994). "The course of language learning in children with Down syndrome." In H. Tager-Flusberg (Ed.), *Constraints on Language Acquisition* (pp. 91–140). Mahwah, NJ: Lawrence Erlbaum Associates.

Frawley, W. (2002). "Control and cross-domain mental computation: Evidence from language breakdown." *Computational Intelligence, 18*, 1–28.

Freund, L. S. & Reiss, A. L. (1991). "Cognitive profiles associated with the fra(X) syndrome in males and females." *American Journal of Medical Genetics, 38*, 542–547.

Freund, L. S., Reiss, A. L., & Abrams, M. T. (1993). "Psychiatric disorders associated with fragile X in the young female." *Pediatrics, 91*, 321–329.

Freund, L. S., Peebles, C. D., Aylward, E., & Reiss, A. L. (1995). "Preliminary report on cognitive and adaptive behaviours of preschool-aged males with fragile X." *Developmental Brain Dysfunction, 8*, 242–251.

Fryauf-Bertschy, H., Tyler, R. S., Kelsay, D. M., Gantz, B. J., & Woodworth, G. P. (1997). "Cochlear implant use by prelingually deafened children: The influences of age at implant and length of device use." *Journal of Speech Language and Hearing Research, 40*, 183–199.

Gardner, M. (1982). *Expressive One Word Picture Vocabulary Test* (*Upper Extension*). Los Angeles, LA: Western Psychological Services.

Gathercole, S. & Baddeley, A. (1990). "Phonological memory deficits in language disordered children: Is there a causal connection?" *Journal of Memory and Language, 29*, 336–360.

Geers, A. E. (2002). "Factors affecting the development of speech, language and literacy in children with early cochlear implantation." *Language, Speech and Hearing Services in Schools, 33*, 172–183.

Geers, A. E. (in press). "Spoken language in children using cochlear implants." In P. E. Spencer & M. Marschark (Eds.), *Advances in Spoken Language Development of Deaf Children.* New York: Oxford University Press.

Geers, A. E. & Moog, J. (1994). "Spoken language results: Vocabulary, syntax and communication." *The Volta Review, 96*(5), 131–148.

Geers, A. E. & Tobey, E. A. (1992). "Effects of sensory aids on the development of speech production skills in children with profound hearing impairment." *The Volta Review, 94*, 135–163.

Geers, A. E., Brenner, C., Nicholas, J., Uchanski, R., Tye-Murray, N., & Tobey, E. A. (2002). "Rehabilitation factors contributing to implant benefit in children." *Annals of Otology, Rhinology and Laryngology, 111*, 127–130.

Gernsbacher, M., Sauer, E., Geye, H., O'Reilly, M., & Goldsmith, H. (submitted). "Early motor markers predict later speech within the autism spectrum."

Gillam, R. & Pearson, N. (2004). *Test of Narrative Language*. Austin, TX: PRO-ED.

Gilbertson, M. & Kamhi, A. G. (1995). "Novel word learning in children with hearing impairment." *Journal of Speech and Hearing Research, 38*, 630–642.

Gillis, S., Schauwers, K., & Govaerts, P. J. (2002). "Babbling milestones and beyond: Early speech development in CI children." In K. Schauwers, P. Govaerts, & S. Gillis (Eds.), *Antwerp Papers in Linguistics 102: Language acquisition in young children with a cochlear implant* (pp. 23–40). Antwerp: University of Antwerp.

Glaser, B., Hessl, D., Dyer-Friedman, J., Johnstone, C., Wisbeck, J., Taylor, A., & Reiss, A. (2003). "Biological and environmental contributions to adaptive behaviour in fragile X syndrome." *American Journal of Medical Genetics, 117A*, 21–29.

Gleitman, L. & Wanner, E. (1982). "Language acquisition: The state of the state of the art." In E. Wanner & L. Gleitman (Eds.), *Language Acquisition: The state of the art* (pp. 3–48). Cambridge: Cambridge University Press.

Gold, T. (1980). "Speech production in hearing-impaired children." *Journal of Communication Disorders, 13*, 397–418.

Goldberg, A. (1995). *Constructions: A construction grammar approach to argument structure.* Chicago, IL: University of Chicago Press.

Goldin-Meadow, S. (2002). "Getting a handle on language creation." In T. Givón & B. Malle (Eds.), *The Evolution of Language out of Pre-language* [Typological Studies in Language 53] (pp. 341–372). Amsterdam: John Benjamins.

Goldin-Meadow, S. (2003). *The Resilience of Language.* New York: Psychology Press.

Goldin-Meadow, S., Mylander, C., & Butcher, C. (1995). "The resilience of combinatorial structure at the word level: Morphology in self-styled gesture systems." *Cognition, 56*(3), 195–262.

Goldman, R. & Fristoe, M. (1986). *Goldman-Fristoe Test of Articulation.* Circle Pines, MN: American Guidance Service.

Golinkoff, R. M., Hirsh-Pasek, K., Bloom, L., Smith, L. B., Woodward, A. L., Akhtar, N., Tomasello, M., & Hollich, G. J. (2000). *Becoming a Word Learner: A debate on lexical acquisition.* New York: Oxford University Press.

Govaerts, P. J., De Beukelaer, C., Daemers, K., De Ceulaer, G., Yperman, M., Somers, T., Schatteman, I., & Offeciers, F. E. (2002). "Outcome of cochlear implantation at different ages from 0 to 6 years." *Otology and Neurotology, 23*, 885–890.

Greenough, W. T., Klintsova, A. Y., Irwin, S. A., Galvez, R., Bates, K. E., & Weiler, I. J. (2001). "Synaptic regulation of protein synthesis and the fragile X protein." *Proceedings of the National Academy of Sciences of the United States of America, 98*, 7101–7106.

Grela, B. G. (2003). "Do children with Down syndrome have difficulty with argument structure?" *Journal of Communication Disorders, 36*, 263–279.

Grice, S., Spratling, M. W., Karmiloff-Smith, A., Halit, H., Csibra, G., de Haan, M., & Johnson, M. H. (2001). "Disordered visual processing and oscillatory brain activity in autism and Williams syndrome." *Neuroreport, 12*, 2697–2700.

Griffith, P. L., Ripich, D. N., & Dastoli, S. L. (1990). "Narrative abilities in hearing-impaired children: Propositions and cohesion." *American Annals of the Deaf, 135*, 14–19.

Grimshaw, G. M., Adelstein, A., Bryden, M. P., & MacKinnon, G. E. (1998). "First-language acquisition in adolescence: Evidence for a critical period for verbal language development." *Brain and Language, 63*, 237–255.

Grogan, M. L., Barker, E. J., Dettman, S. J., & Blamey, P. J. (1995). "Phonetic and phonological changes in the connected speech of children using a cochlear implant." *Annals of Otology, Rhinology and Laryngology, 166*, 390–393.

Hagerman, R. J. (Ed.). (1999). *Neurodevelopmental Disorders.* Oxford: Oxford University Press.

Hagerman, R. J., Schreiner, R. A., Kemper, M. B., Wittenberger, M. D., Zahn, B., & Habicht, K. (1989). "Longitudinal IQ changes in fragile X males." *American Journal of Medical Genetics, 33*, 513–518.

Hammes, D. M., Novak, M. A., Rotz, L. A., Willis, M., Edmondson, D. M., & Thomas, J. F. (2002). "Early identification and cochlear implantation: Critical factors for spoken language development." *Annals of Otology, Rhinology and Laryngology, 111*, 74–78.

Hanson, V., Liberman, I., & Shankweiler, D. (1984). "Linguistic coding by deaf children in relation to beginning reading success." *Journal of Experimental Child Psychology, 37*, 378–393.

Happé, F. (1995). "The role of age and verbal ability in the theory of mind task performance of subjects with autism." *Child Development, 66*, 843–855.

Hart, B. & Risley, T. (1992). "American parenting of language-learning children: Persisting differences in family-child interactions observed in natural home environments." *Developmental Psychology, 28*(6), 1096–1105.

Hart, B. & Risley, T. (1995). *Meaningful Differences in Everyday Experiences of Young American Children.* Baltimore, MD: Brookes.

Hattori, M., Fujiyama, A., Taylor, T. D., Watanabe, H., Yada, T., Park, H. S., Toyoda, A., Ishii, K., Totoki, Y., Choi, D. K., Groner, Y., Soeda, E., Ohki, M., Takagi, T., Sakaki, Y., Taudien, S., Blechschmidt, K., Polley, A., Menzel, U., Delabar, J., Kumpf, K., Lehmann, R., Patterson, D., Reichwald, K., Rump, A., Schillhabel, M., Schudy, A., Zimmermann, W., Rosenthal, A., Kudoh, J., Schibuya, K., Kawasaki, K., Asakawa, S., Shintani, A., Sasaki, T., Nagamine, K., Mitsuyama, S., Antonarakis, S. E., Minoshima, S., Shimizu, N., Nordsiek, G., Hornischer, K., Brant, P., Scharfe, M., Schon, O., Desario, A., Reichelt, J., Kauer, G., Blocker, H., Ramser, J., Beck, A., Klages, S., Hennig S., Riesselmann, L., Dagand, E., Haaf, T., Wehrmeyer, S., Borzym, K., Gardiner, K., Nizetic, D., Francis, F., Lehrach, H., Reinhardt, R., Yaspo, M. L.; Chromosome 21 mapping and sequencing consortium. (2000). "The DNA sequence of human chromosome 21." *Nature, 405*, 311–319.

Heibeck, T. & Markman, E. (1987). "Word learning in children: An examination of fast mapping." *Child Development, 58*, 1021–1034.

Heilmann, J. (2004). *Research on specific language impairment: A review*. Working document, Language Analysis Lab. University of Wisconsin, Madison, WI.

Hesketh, L. J. & Chapman, R. S. (1998). "Verb use by individuals with Down syndrome." *American Journal on Mental Retardation, 103*, 288–304.

Higgins, M. B., Carney, A. E., McCleary, E., & Rogers, S. (1996). "Negative intraoral air pressures of deaf children with cochlear implants: Physiology, phonology and treatment." *Journal of Speech and Hearing Research, 39*, 957–967.

Hoff, E. & Naigles, L. (2002). "How children use input to acquire a lexicon." *Child Development, 73*, 418–433.

Howlin, P. (2003). "Outcome in high-functioning adults with autism with and without early language delays: Implications for the differentiation between autism and Asperger syndrome." *Journal of Autism and Developmental Disorders, 33*, 3–13.

Howlin, P., Mawhood, L., & Rutter, M. (2000). "Autism and developmental receptive language disorder – a follow-up comparison in early adult life. II: Social, behavioural and psychiatric outcomes." *Journal of Child Psychology and Psychiatry, 41*, 561–578.

Huttenlocher, J., Haight, W., & Bryk, A. (1991). "Early vocabulary growth: Relation to language input and gender." *Developmental Psychology, 27*(2), 236–248.

Huttenlocher, J., Vasilyeva, M., Cymerman, E., & Levine, S. (2002). "Language input and child syntax." *Cognitive Psychology, 45*(3), 337–374.

Iglesias, A. (2004). "Narrative language skills and reading achievement in bilingual children." Paper presented at the Symposium on Research in Child Language Development. University of Wisconsin, Madison, WI.

Illg, A., von der Haar-Heise, S., Goldring, J. E., Lesinski-Schiedat, A., Battmer, R. D., & Lenarz, T. (1999). "Speech perception results for children implanted with the Clarion cochlear implant at the medical university of Hannover." *Annals of Otology, Rhinology and Laryngology, 108*, 93–98.

Ingham, R., Fletcher, P., Schelletter, C., & Sinka, I. (1998). "Resultative VPs and specific language impairment." *Language Acquisition, 7*, 87–111.

Iverson, J. M., Longobardi, E., & Caselli, M. C. (2003). "Relationship between gestures and words in children with Down's syndrome and typically developing children in the early stages of communicative development." *International Journal of Language & Communication Disorders, 38*, 179–197.

Jackendoff, R. (2000). "Fodorian modularity and representational modularity." In Y. Grodzinsky, L. Shapiro, & D. Sweeney (Eds.), *Language and the Brain: Representation and processing* (pp. 3–30). San Diego, CA: Academic Press.

James, D., Rajput, K., Brown, T., Sirimanna, T., Brinton, J., & Goswami, U. (submitted). "Phonologial awareness in deaf children who use cochlear implants." *Journal of Speech Language and Hearing Research*.

Jaswal, V. & Markman, E. (2001). "Learning proper and common names in inferential versus obstensive contexts." *Child Development, 72*, 768–786.

Joanisse, M. F. (2000). Connectionist Phonology. Unpublished Ph.D. Dissertation, University of Southern California.

Joanisse, M. F. & Seidenberg, M. S. (1999). "Impairments in verb morphology following brain injury: A connectionist model." *Proceedings of the National Academy of Science USA, 96*, 7592–7597.

Johnston, J. (2004). "Fearless and bold in following ideas wherever they lead." The Elizabeth Bates Memorial Lecture, 25th Symposium on Research in Child Language Disorders, Madison, WI.

Johnston, J. & Schery, T. (1976). "The use of grammatical morphemes in children with communication disorders." In D. Morehead & M. Morehead (Eds.), *Normal and Deficient Child Language* (pp. 239–258). Baltimore, MD: University Park Press.

Jones, W., Bellugi, U., Lai, Z., Chiles, M., Reilly, J., Lincoln, A., & Adolphs, R. (2000). "Hypersociability in Williams syndrome." *Journal of Cognitive Neuroscience, 12*, (supplement), 30–46.

Joseph, R., Tager-Flusberg, H., & Lord, C. (2002). "Cognitive profiles and social-communicative functioning in children with autism." *Journal of Child Psychology and Psychiatry, 43*, 807–821.

Kanner, L. (1985). "Autistic disturbances of affective contact." In A. M. Donnellan (Ed.), *Classic readings in autism* (pp. 11–52). New York: Teachers College Press.

Karmiloff-Smith, A. (1997). "Crucial differences between developmental cognitive neuroscience and adult neuropsychology." *Developmental Neuropsychology, 13*(4), 513–524.

Karmiloff-Smith, A. (1998). "Development itself is the key to understanding developmental disorders." *Trends in Cognitive Sciences, 2*(10), 389–398.

Karmiloff-Smith, A. & Thomas, M. S. C. (2003). "What can developmental disorders tell us about the neurocomputational constraints that shape development? The case of Williams syndrome." *Development and Psychopathology, 15*, 969–990.

Karmiloff-Smith, A., Grant, J., Berthoud, I., Davies, M., Howlin, P., & Udwin, O. (1997). "Language and Williams syndrome: How intact is 'intact'?" *Child Development, 68*, 246–262.

Karmiloff-Smith, A., Thomas, M. S. C., Annaz, D., Humphreys, K., Ewing, S., Grice, S., Brace, N., Van Duuren, M., Pike, G., & Campbell, R. (in press). "Exploring the Williams Syndrome face processing debate: The importance of building developmental trajectories." *Journal of Child Psychology and Psychiatry and Allied Disciplines.*

Karmiloff-Smith, A., Tyler, L. K., Voice, K., Sims, K., Udwin, O., Howlins, P., & Davies, M. (1998). "Linguistic dissociations in Williams syndrome: evaluating receptive syntax in on-line and off-line tasks." *Neuropsychologia, 36*, 343–351.

Kasari, C., Freeman, S., Mundy, P., & Sigman, M. (1995). "Attention regulation by children with Down syndrome: Coordinated joint attention and social referencing looks." *American Journal on Mental Retardation, 100*, 128–136.

Kasari, C., Freeman, S. F., & Bass, W. (2003). "Empathy and response to distress in children with Down syndrome." *Journal of Child Psychology and Psychiatry, 44*, 424–431.

Kasari, C., Freeman, S. F., & Hughes, M. A. (2001). "Emotion recognition by children with Down syndrome." *American Journal of Mental Retardation, 106*, 59–72.

Kasari, C., Sigman, M., Mundy, P., & Yirmiya, N. (1990). "Affective sharing in the context of joint attention interactions of normal, autistic and mentally retarded children." *Journal of Autism and Developmental Disorders, 20*, 87–100.

Kegl, J., Senghas, A., & Coppola, M. (1999). "Creation through contact: Sign language emergence and sign language change in Nicaragua." In M. DeGraff (Ed.), *Language Creation and Language Change* (pp. 179–237). Cambridge, MA: The MIT Press.

King, C. & Quigley, S. P. (1985). *Reading and deafness.* Austin: PRO-ED.

Kirk, K. I. & Hill-Brown, C. (1985). "Speech and language results in children with a cochlear implant." *Ear and Hearing, 6*(3), 36–47.

Kirk, K. I., Diefendorf, E., Riley, A., & Osberger, M. J. (1995). "Consonant production by children with multichannel cochlear implants or hearing aids." *Advances in Otorhinolaryngology, 50*, 154–159.

Kirk, K. I., Miyamoto, R. T., Lento, C. L., Ying, E., O'Neill, T., & Fears, B. (2002). "Effects of age at implementation in young children." *Annals of Otology, Rhinology and Laryngology, 111*, 69–78.

Kirk, K. I., Miyamoto, R. T., Ying, E. A., Perdew, A. E., & Zuganelis, H. (2000). "Cochlear implantation in young children: Effects of age at implantation and communication mode." *The Volta Review, 102*(4), 127–144.

Kirk, K. I., Pisoni, D. B., & Osberger, M. J. (1995). "Lexical effects on spoken word recognition by pediatric cochlear implant users." *Ear and Hearing, 16*(5), 470–481.

Kishon-Rabin, L., Taitelbaum, R., Muchnik, C., Gehtler, I., Kronenberg, J., & Hildesheimer, M. (2002). "Development of speech perception and production in children with cochlear implants." *Annals of Otology, Rhinology and Laryngology, 111*, 85–90.

Kjelgaard, M. & Tager-Flusberg, H. (2001). "An investigation of language impairment in autism: Implications for genetic subgroups." *Language and Cognitive Processes, 16*, 287–308.

Klecan-Aker, J. & Blondeau, R. (1990). "An examination of written stories of hearing-impaired school-age children." *The Volta Review, 92*, 275–282.

Klee, T. (1992). "Developmental and diagnostic characteristics of quantitative measures of children's language production." *Topics in Language Disorders, 12*, 28–41.

Klee, T., Stokes, S., Wong, A., Fletcher, P., & Gavin, W. (in press). "Utterance length and lexical diversity in Cantonese-speaking children with and without language impairment." *Journal of Speech, Language and Hearing Research.*

Korenberg, J. R., Chen, X.-N., Schipper, R., Sun, Z., Gonsky, R., Gerwehr, S., Carpenter, N., Daumer, C., Dignan, P., Disteche, C., Graham, J. M., Jr., Hugdins, L., McGillivray, B., Miyazaki, K., Ogasawara, N., Park, J. P., Pagon, R., Pueschel, S., Sack, G., Say, B., Schuffenhauer, S., Soukup, S., & Yamanaka, T. (1994). "Down syndrome phenotypes: The consequences of chromosomal imbalance." *Proceedings of the National Academy of Science USA, 91*, 4997–5001.

Kuhl, P. K. (2000). "A new view of language acquisition." *PNAS, 97*, 11850–11857.

Kumin, L. (1994). "Intelligibility of speech in children with Down syndrome in natural settings: Parents' perspectives." *Perception and Motor Skills, 78*, 307–313.

Kuo, S. C. L. & Gibson, W. P. R. (2000). "The influence of residual high-frequency hearing on the outcome in congenitally deaf cochlear implant recipients." *The American Journal of Otology, 21*, 657–662.

Laing, E., Butterworth, G., Ansari, D., Gsödl, M., Laing, E., Barnham, Z., Lakusta, L., Tyler, L. K., Grice, S., Paterson, S., & Karmiloff-Smith, A. (2002). "Atypical linguistic and socio-communicative development in toddlers with Williams syndrome." *Developmental Science, 5*(2), 233–246.

Lavric, A., Pizzagalli, D., Forstmeier, S., & Rippon, G. (2001). "Mapping dissociations in verb morphology." *Trends in Cognitive Sciences, 5*, 301–308.

Laws, G. & Gunn, D. (2004). "Phonological memory as a predictor of language comprehension in Down syndrome: A five-year follow-up study." *Journal of Child Psychology and Psychiatry, 45*, 326–337.

Lederberg, A. R. & Everhart, V. S. (1998). "Communication between deaf children and their hearing mothers: The role of language, gesture and vocalizations." *Journal of Speech, Language and Hearing Research, 41*, 887–899.

Lederberg, A. R. & Spencer, P. E. (2001). "Vocabulary development of deaf and hard of hearing children." In M. D. Clark, M. Marschark, & M. Karchmer (Eds.), *Context, Cognition and Deafness* (pp. 88–112). Washington, DC: Gallaudet University Press.

Lederberg, A. R., Prezbindowski, A. K., & Spencer, P. E. (2000). "Word learning skills of deaf preschoolers: The development of novel mapping and rapid word learning strategies." *Child Development, 53*, 1055–1065.

Lederberg, A. R., Spencer, P. E., & Huston, S. (2003). "Development of fast-mapping in deaf and hard of hearing children: A longitudinal study." Paper presented at the Society for Research in Child Development, Tampa, FL.

Lee, T. H.-T., Wong, C. H., & Wong, C. S.-P. (1996). "Functional categories in child Cantonese." In T. H.-T. Lee, C. H. Wong, C. S. Leung, P. Man, A. Cheung, K. Szeto, & C. S.-P. Wong (Eds.), *The Development of Grammatical Competence in Cantonese-speaking Children* (pp. 1991–1994). Report of Hong Kong RGC Ear-marked grant.

Lenarz, T., Lesinski-Schiedat, A., von der Haar-Heise, S., Illg, A., Bertram, B., & Battmer, R. D. (1999). "Cochlear implantation in children under the age of two: The MHH experience with the Clarion cochlear implant." *Annals of Otology, Rhinology and Laryngology, 108*, 44–49.

Lenneberg, E. H. (1967). *Biological Foundations of Language.* New York: Wiley.

Leonard, L. B. (1983). "Discussion: Part II: Defining the boundaries of language disorders in children." In J. Miller, D. Yoder, & R. Schiefelbusch (Eds.), *Contemporary Issues in Language Intervention* [ASHA Reports 12] (pp. 107–112). Rockville, MD: The American Speech-Language-Hearing Association.

Leonard, L. (1992). "The use of morphology by children with specific language impairment: Evidence from three languages." In R. S. Chapman (Ed.), *Processes in Language Acquisition and Disorders* (pp. 186–201). St. Louis, MS: Mosby Year Book.

Leonard, L. B. (1998). *Children with Specific Language Impairment.* Cambridge, MA: The MIT Press.

Leonard, L. B. (2000). "SLI across languages." In D. V. M. Bishop & L. B. Leonard (Eds.), *Speech and Language Impairments in Children: Causes, characteristics, intervention and outcome* (pp. 115–129). Hove: Psychology Press.

Leonard, L. B. & Deevy, P. (2004). "Lexical deficits in specific language impairment." In L. Verhoeven & H. van Balkom (Eds.), *Classification of Developmental Language Disorders: theoretical issues and clinical implications* (pp. 209–233). Mahwah, NJ: Lawrence Erlbaum Associates.

Leung, C. S. (1995). The Development of Aspect Markers in a Cantonese-speaking Child between the Ages of 21 and 45 Months. Unpublished Ph.D. dissertation, University of Hawaii.

Levin, B. (1993). *English Verb Classes and Alternations: A preliminary investigation.* Chicago, IL: Chicago University Press.

Leybaert, J. & D'Hondt, M. (2003). "Neurolinguistic development in deaf children: The effect of early language experience." *International Journal of Audiology, 42*, Suppl. 1, 34–40.

Leybaert, J., Alegria, J., Hage, C., & Charlier, B. (1998). "The effect of exposure to phonetically augmented lipspeech in the prelingual deaf." In R. Campbell, B. Dodd, & D. Burnham (Eds.), *Hearing by Eye II* (pp. 283–302). Hove: Psychology Press.

Lindblom, B., MacNeilage, P., & Studdert-Kennedy, M. (1984). "Self-organizing processes and the explanation of phonological universals." In B. Butterworth, B. Comrie, & O. Dahl (Eds.), *Explanations for Language Universals* (pp. 181–203). New York: Mouton.

Linguistic Society of Hong Kong. (1974). *The LSHK Cantonese Romanization Scheme.* Hong Kong: Linguistic Society of Hong Kong.

Lord, C., Rutter, M., Goode, S., Heemsbergen, J., Jordan, H., Mawhood, L., & Schopler, E. (1989). "Autism diagnostic observation schedule: A standardized observation of communicative and social behavior." *Journal of Autism and Developmental Disorders, 19*, 185–212.

Loveland, K. A. & Landry, S. H. (1986). "Joint attention and language in autism and developmental language delay." *Journal of Autism and Developmental Disorders, 16*, 335–349.

Lutman, M. E. & Tait, D. M. (1995). "Early communicative behavior in young children receiving cochlear implants: Factor analysis of turn-taking and gaze orientation." *Annals of Otology, Rhinology and Laryngology, 166*, 397–399.

MacWhinney, B. (Ed.). (1999). *The Emergence of Language.* Mahwah, NJ: Lawrence Erlbaum Associates.

Madison, L. S., George, C., & Moeschler, J. B. (1986). "Cognitive functioning in the fragile X syndrome: A study of intellectual, memory and communication skills." *Journal of Mental Deficiency Research, 30*, 129–148.

Maitel, S., Dromi, E., Sagi, A., & Bornstein, M. (2000). "The Hebrew communicative development inventory: Language specific properties and cross-linguistic generalizations." *Journal of Child Language, 27*, 43–67.

Majerus, S. (2004). "Phonological processing in Williams syndrome." In S. Bartke & J. Siegmuller (Eds.), *Williams Syndrome*: *A cross-linguistic approach* (pp. 125–142). Amsterdam: John Benjamins.

Majerus, S., Palmisano, I., van der Linden, M., Barisnikov, K., & Poncelet, M. (2001). "An investigation of phonological processing in Williams syndrome." *Journal of the International Society, 7*(2), 153.

Malvern, D., Richards, B., Chipere, N., & Duran, P. (2004). *Lexical Diversity and Language Development.* Basingstoke: Palgrave.

Marcell, M. M. & Weeks, S. L. (1988). "Short-term memory difficulties in Down's syndrome." *Journal of Mental Deficiency Research, 32*, 153–162.

Marchman, V. & Bates, E. (1994). "Continuity in lexical and morphological development: A test of the critical mass hypothesis." *Journal of Child Language, 21*, 339–366.

Mareschal, D., Johnson, M., Sirios, S., Spratling, M., Thomas, M. S. C., & Westermann, G. (forthcoming). *Neuroconstructivism: How the brain constructs cognition.* Oxford: Oxford University Press.

Markson, L. & Bloom, P. (2001). "Evidence against a dedicated system for word learning in children." *Nature, 385*, 813–815.

Marschark, M., Mouradian, R., & Halas, M. (1994). "Discourse rules in the language productions of deaf and hearing children." *Journal of Experimental Child Psychology, 57*, 89–107.

Marshall, (1984). "Multiple perspectives on modularity." *Cognition, 17*, 209–242.

Masataka, N. (2000). "Information from speech and gesture is integrated when meanings of new words are categorized in normal young children but not in children with Williams syndrome." *Bulletin of the Japanese Cognitive Science Society, 7*, 37–51.

Masataka, N. (2001). "Why early linguistic milestones are delayed in children with Williams syndrome: late onset of hand banging as a possible rate-limiting constraint on the emergence of canonical babbling." *Developmental Science, 4*, 158–164.

Matthews, S. & Yip, V. (1994). *Cantonese*: *A comprehensive grammar.* London: Routledge.

Mayberry, R. I. (1993). First language acquisition after childhood differs from second language acquisition: The case of American Sign Language." *Journal of Speech and Hearing Research, 36*, 1258–1270.

Mayberry, R. I. (1994). "The importance of childhood to language acquisition: Evidence from American Sign Language." In J. C. Goodman & H. C. Nusbaum (Eds.), *The Development of Speech Perception: The transition from speech sounds to spoken words* (pp. 58–90). London: The MIT Press.

Mayberry, R. I. & Eichen, E. B. (1991). "The long-lasting advantage of learning sign language in childhood: Another look at the critical period for language acquisition." *Journal of Memory and Language, 30*, 486–512.

Mayberry, R. I. & Fischer, S. D. (1989). "Looking through phonological shape to lexical meaning: The bottleneck of non-native sign language processing." *Memory and Cognition, 17*(6), 740–753.

Mayberry, R. I. & Lock, E. (2003). "Age constraints in first versus second language acquisition: Evidence for linguistic plasticity and epigensis." *Brain and Language, 87*, 369–384.

Mayberry, R. I. & Witcher, P. E. (2002). "Native and non-native phonology effects on lexical access in ASL." Paper presented at the 43rd Annual Meeting of the Psychonomic Society, Kansas City, KS.

Mayes, S. D. & Calhoun, S. L. (2001). "Non-significance of early speech delay in children with autism and normal intelligence and implications for DSM-IV Asperger's disorder." *Autism, 5*, 81–94.

Mayne, A. M., Yoshinaga-Itano, C., Sedey, A. L., & Carey, A. (2000a). "Expressive vocabulary development of infants and toddlers who are deaf or hard of hearing." *The Volta Review, 100*(5), 1–28.

Mayne, A. M., Yoshinaga-Itano, C., Sedey, A. L., & Carey, A. (2000b). "Expressive vocabulary development of infants and toddlers who are deaf or hard of hearing." *The Volta Review, 100*(5), 29–52.

Mazzocco, M. M. M. (2000). "Advances in research on the fragile X syndrome." *Mental Retardation and Developmental Disabilities Research Reviews, 6*, 96–106.

Mazzocco, M. M. M., Pennington, B., & Hagerman, R. J. (1993). "The neurocognitive phenotype of female carriers of fragile X: Further evidence for specificity." *Journal of Development and Behavioral Pediatrics, 14*, 328–335.

McArthur, G. M. & Bishop, D. V. M. (2004). "Which people with specific language impairment have auditory processing deficits?" *Cognitive Neuropsychology, 21*, 79–94.

McCaffrey, H. A., Davis, B., MacNeilage, P. F., & von Hapsburg, D. (1999). "Multichannel cochlear implantation and the organization of early speech." *The Volta Review, 101*(1), 5–29.

McCann, J. & Peppe, S. (2003). "Prosody in autism spectrum disorders: A critical review." *International Journal of Language and Communication Disorders, 38*, 325–350.

McLean, L. & Cripe, J. (1997). "The effectiveness of early intervention for children with communication disorders." In M. J. Guralnick (Ed.), *The Effectiveness of Early Intervention*. Baltimore, MD: Brookes.

McLean, J., Yoder, D., & Schiefelbusch, R. (Eds.). (1972). *Language Intervention with the Retarded: Developing strategies*. Baltimore, MD: University Park Press.

McDonald, J. L. (1997). "Language acquisition: The acquisition of linguistic structure in normal and special populations." *Annual Review of Psychology, 48*, 215–241.

McGarr, N. S. (1983). "The intelligibility of deaf speech to experienced and inexperienced listeners." *Journal of Speech and Hearing Research, 26*, 451–458.

Meadow-Orlans, K. P., Spencer, P. E., & Koester, L. S. (in press). *The World of the Deaf Infant: A longitudinal study.* New York: Oxford University Press.

Mervis, C. B. & Bertrand, J. (1997). "Developmental relations between cognition and language: Evidence from Williams syndrome." In L. B. Adamson & M. A. Romski (Eds.), *Research on Communication and Language Disorders: Contributions to theories of language development* (pp. 75–106). Baltimore, MD: Brookes.

Mervis, C. B. & Robinson, B. F. (2000). "Expressive vocabulary of toddlers with Williams syndrome or Down syndrome: A Comparison." *Developmental Neuropsychology, 17*, 111–126.

Mervis, C. B., Morris, C. A., Bertrand, J., & Robinson, B. F. (1999). "William syndrome: Findings from an integrated program of research." In H. Tager-Flusberg (Ed.), *Neurodevelopmental Disorders: Contributions to a new framework from the cognitive neurosciences* (pp. 65–110). Cambridge, MA: The MIT Press.

Metsala, J. L. & Walley, A. C. (1998). "Spoken vocabulary growth and the segmental restructuring of lexical representations: Precursors to phonemic awareness and early reading ability." In J. L. Metsala & L. C. Ehri (Eds.), *Word Recognition in Beginning Literacy* (pp. 89–120). Hillsdale, NJ: Lawrence Erlbaum Associates.

Miles, S. & Chapman, R. S. (2002). "Narrative content as described by individuals with Down syndrome and typically developing children." *Journal of Speech, Language and Hearing Research, 45*, 175–189.

Miller, J. F. (1981). *Assessing Language Production in Children: Experimental procedures.* Baltimore, MD: University Park Press.

Miller, J. F. (1983). "Identifying children with language disorders and describing their language performance." In J. Miller, D. Yoder, & R. Schiefelbusch (Eds.), *Contemporary Issues in Language Intervention* [ASHA Reports 12] (pp. 61–74). Rockville, MD: The American Speech-Language-Hearing Association.

Miller, J. F. (1991). "Quantifying productive language disorders." In J. F. Miller (Ed.), *Research on Child Language Disorders: A decade of progress* (pp. 211–220). Austin, TX: Pro-Ed.

Miller, J. F. (1995). "Individual differences in vocabulary acquisition in children with Down syndrome." *Progress in Clinical Biology Research, 393*, 93–103.

Miller, J. F. (1999). "Profiles of language development in children with Down syndrome." In J. F. Miller, M. Leddy, & L. A. Leavitt (Eds.), *Improving the Communication of People with Down Dyndrome* (pp. 11–40). Baltimore, MD: Brookes.

Miller, J., Lall, V., Hollar, C., Jones, M., Lodholtz, C., Pech, S., Rolland, M., Tarnow, M., Vernon, M., Wood, M., & Dagget, B. (2001). "*Documenting age-related changes in language production.*" Presented at the Annual convention of the American Speech-Language-Hearing Association, New Orleans, LA.

Miller, J. F. & Ozonoff, S. (1997). "Did Asperger's cases have Asperger disorder? A research note." *Journal of Child Psychology and Psychiatry, 38*, 247–251.

Miller, J. & Yoder, D. (1972). "A Syntax Teaching Program." In J. McLean, D. Yoder, & R. Schiefelbush (Eds.), *Language Intervention with the Retarded: Developing strategies.* Baltimore, MD: University Park Press.

Miller, J. & Yoder, D. (1974). "An ontogenetic language teaching strategy for retarded children." In R. Schiefelbusch & L. Lloyd (Eds.), *Language Perspectives-Acquisition, Retardation and Intervention.* Baltimore, MD: University Park Press.

Mills, D. L., Alvarez, T. D., St. George, M., Appelbaum, L. G., Bellugi, U., & Neville, H. (2000). "Electrophysiological studies of face processing in Williams syndrome." *Journal of Cognitive Neuroscience, 12*, 47–64.

Mirrett, P. L., Bailey, D. B., Jr., Roberts, J. E., & Hatton, D. D. (2004). "Developmental screening and detection of developmental delays in infants and toddlers with fragile X syndrome." *Journal of Developmental and Behavioral Pediatrics, 25*, 21–27.

Mirrett, P. L., Roberts, J. E., & Price, J. (2003). "Early intervention practices and communication intervention strategies for young males with fragile X syndrome." *Language, Speech and Hearing Services in Schools, 34*, 320–331.

Miyamoto, R. T., Kirk, K. I., Svirsky, M. A., & Sehgal, S. T. (1999). "Communication skills in pediatric cochlear implant recipients." *Acta Otolaryngolica, 119*, 219–224. Stockholm.

Miyamoto, R. T., Svirsky, M. A., & Robbins, A. M. (1997). "Enhancement of expressive language in prelingually deaf children with cochlear implants." *Acta Otolaryngolica* (Stockholm), *117*, 154–157.

Moeller, M. P. (2000). "Early intervention and language development in children who are deaf and hard of hearing." *Pediatrics, 106*(3), e43, 41–49.

Moeller, M. P., Osberger, M. J., & Eccarius, M. (1986). "Receptive language skills." *Language and learning skills in hearing-impaired children, 23*, 41–53.

Mondain, M., Sillon, M., Vieu, A., Lanvin, M., Reuillard-Artieres, F., Tobey, E. A., & Uziel, A. (1997). "Speech perception skills and speech production intelligibility in French children with prelingual deafness and cochlear implants." *Archives of Otolaryngology, Head and Neck Surgery, 123*, 181–184.

Monsen, R. B. (1978). "Toward measuring how well hearing-impaired children speak." *Journal of Speech and Hearing Research, 21*, 197–219.

Monsen, R. B. (1983). "The oral speech intelligibility of hearing-impaired talkers." *Journal of Speech and Hearing Disorders, 48*, 286–296.

Moog, J. S. (2002). "Changing expectations for children with cochlear implants." *Annals of Otology, Rhinology and Laryngology, 111*, 138–142.

Moog, J. S. & Geers, A. E. (1999). "Speech and language acquisition in young children after cochlear implantation." *Otolaryngologic Clinics of North America, 32*(6), 1127–1141.

Moore, J. A. & Bass-Ringdahl, S. (2002). "Role of infant vocal development in candidacy for and efficacy of cochlear implantation." *Annals of Otology, Rhinology and Laryngology, 111*, 52–55.

Morehead, D. M. & Ingram, D. (1976). "The development of base syntax in normal and linguistically deviant children." In D. Morehead & M. Morehead (Eds.), *Normal and Deficient Child Language* (pp. 209–238). Baltimore, MD: The University Park Press.

Morehead, D. M. & Morehead, A. E. (Eds.). (1976). *Normal and Deficient Child Language.* Baltimore, MD: University Park Press.

Morford, J. P. (1996). "Insights to language from the study of gesture: A review of research on the gestural communication of non-signing deaf people." *Language and Communication, 16*(2), 165–178.

Morford, J. P. (1998). "Gesture when there is no speech model." *New Directions for Child Development, 79*, 101–106.

Morford, J. P. (2003). "Grammatical development in adolescent first-language learners." *Linguistics, 41*, 681–721.

Morford, J. P. & Goldin-Meadow, S. (1997). "From here and now to there and then: The development of displaced reference in homesign and English." *Child Development, 68*(3), 420–435.

Morford, J. P., Singleton, J. L., & Goldin-Meadow, S. (1995a). "From homesign to ASL: Identifying the influences of a self-generated childhood gesture system upon language proficiency in adulthood." In D. MacLaughlin & S. McEwen (Eds.), *Proceedings of the Nineteenth Boston University Conference on Language Development* (pp. 403–414). Somerville, MA: Cascadilla Press.

Morford, J. P., Singleton, J. L., & Goldin-Meadow, S. (1995b). "The genesis of language: How much time is needed to generate arbitrary symbols in a sign system?" In K. Emmorey & J. S. Reilly (Eds.), *Language, Gesture and Space* (pp. 313–332). Hillsdale, NJ: Lawrence Erlbaum Associates.

Morgan, B., Maybery, M., & Durkin, K. (2003). "Weak central coherence, poor joint attention and low verbal ability: Independent deficits in early autism." *Developmental Psychology, 39*, 646–656.

Mundy, P., Kasari, C., Sigman, M., & Ruskin, E. (1995). "Nonverbal communication and early language acquisition in children with Down syndrome and in normally developing children." *Journal of Speech and Hearing Research, 38*, 157–167.

Mundy, P., Sigman, M., & Kasari, K. (1990). "A longitudinal study of joint attention and language development in autistic children." *Journal of Autism and Developmental Disorders, 20*, 115–128.

Murphy, M. M. & Abbeduto, L. (2003). "Language and communication in fragile X syndrome." In L. Abbeduto (Ed.), *International Review of Research in Mental Retardation, Vol. 27* (pp. 83–119). New York: Academic Press.

Murphy, M. M. & Abbeduto, L. (in press). "Indirect genetic effects and the early language development of children with genetic mental retardation syndromes: The role of joint attention." *Infants and Young Children.*

Murphy, M. M., Abbeduto, L., Giles, N., Bruno, L., Richmond, E. K., & Schroeder, S. (2004). "Cognitive, language and social-cognitive skills of individuals with fragile X syndrome with and without autism." Poster presented at the annual Gatlinburg Conference on Mental Retardation, San Diego, CA.

Musselman, C. R., Wilson, A. K., & Lindsay, P. H. (1988). "Effects of early intervention on hearing impaired children." *Exceptional Children, 55*(3), 222–228.

Nass, R., Gross, A., & Devinsky, O. (1998). "Autism and autistic epileptiform regression with occipital spikes." *Developmental Medicine and Child Neurology, 40*, 453–458.

Nazzi, T. & Karmiloff-Smith, A. (2002). "Early categorization abilities in young children with Williams syndrome." *NeuroReport, 13*, 1259–1262.

Nazzi, T., Paterson, S., & Karmiloff-Smith, A. (2003). "Early word segmentation by infants and toddlers with Williams syndrome." *Infancy, 4*(2), 251–271.

Nespoulous, J. (1999). "Universal vs. language-specific constraints in agrammatic aphasia: Is comparatism back?" In C. Fuchs & S. Robert (Eds.), *Language Diversity and Cognitive Representations* (pp. 195–207). Amsterdam: John Benjamins.

Neville, H. J., Mills, D. L., & Bellugi, U. (1994). "Effects of altered auditory sensitivity and age of language acquisition on the development of language–relevant neural systems: Preliminary studies of Williams syndrome." In S. Broman & J. Grafman (Eds.), *Atypical Cognitive Deficits in Developmental Disorders: Implications for brain function* (pp. 67–83). Hillsdale, NJ: Lawrence Erlbaum Associates.

Newbury, D. & Monaco, A. (2002). "Molecular genetics of speech and language disorders." *Current Opinion in Pediatrics, 14*, 696–701.

Newport, E. L. (1990). "Maturational constraints on language learning." *Cognitive Science, 14*, 11–28.

Newport, E. L. (1991). "Contrasting conceptions of the critical period for language." In S. Carey & R. Gelman (Eds.), *The epigenesis of mind: Essays on biology and cognition* (pp. 111–130). Hillsdale, NJ: Lawrence Erlbaum Associates.

Newport, E. L., Bavelier, D., & Neville, H. J. (2001). "Critical thinking about critical periods: Perspectives on a critical period for language acquisition." In E. Dupoux (Ed.), *Language, Brain and Cognitive Development* (pp. 482–502). Cambridge, MA: The MIT Press.

Nicholas, J. G., & Geers, A. E. (2003). "Hearing status, language modality and young children's communicative and linguistic behavior." *Journal of Deaf Studies and Deaf Education, 8*, 422–437.

Nicholas, J. G. & Geers, A. E. (in press). "The process and early outcomes of cochlear implantation by three years of age." In P. E. Spencer & M. Marschark (Eds.), *Advances in the Spoken Language Development of Deaf Children.* New York: Oxford University Press.

Norbury, C. F., Bishop, D. V. M., & Briscoe, J. (2001). "Production of English finite verb morphology: A comparison of SLI and mild-moderate hearing impairment." *Journal of Speech, Language and Hearing Research, 44*, 165–178.

Nordin, V. & Gillberg, C. (1998). "The long-term course of autistic disorders: Update on follow-up studies." *Acta Psychiatrica Scandinavica, 97*, 99–108.

O'Hara, M. & Johnston, J. (1997). "Syntactic bootstrapping in children with specific language impairment." *European Journal of Disorders of Communication, 32*, 189–205.

O'Brien, E., Zhang, X., Nishimura, C., Tomblin, J., & Murray, J. (2003). "Association of specific language impairment (SLI) to the region of 7q31." *The American Journal of Human Genetics, 72*, 1536–1543.

O'Donoghue, G. M., Nikolopoulos, T. P., & Archbold, S. M. (2000). "Determinants of speech perception in children after cochlear implantation." *The Lancet, 356*, 762–767.

O'Donoghue, G. M., Nikolopoulos, T. P., Archbold, S. M., & Tait, M. (1999). "Cochlear implants in young children: The relationship between speech perception and speech intelligibility." *Ear and Hearing, 20*(5), 419–425.

Oller, D. K. (1980). "The emergence of the sounds of speech in infancy." In G. H. Yeni-Komshian, J. F. Kavanagh, & C. A. Ferguson (Eds.), *Child phonology, 1* (pp. 93–112). New York: Academic Press.

Oller, D. K. & Eilers, R. E. (1988). "The role of audition in infant babbling." *Child Development, 59*, 441–449.

Oostra, B. A. (1996). "FMR1 protein studies and animal models for fragile X syndrome." In R. J. Hagerman & A. C. Cronister (Eds.), *Fragile X Syndrome: Diagnosis, treatment and research* (2nd edition, pp. 193–209). Baltimore, MD: Johns Hopkins University Press.

Oostra, B. A. & Willemsen, R. (2003). "A fragile balance: FMR1 expression levels." *Human Molecular Genetics, 12*, Review Issue 2, R249–R257.

Osberger, M. J. & McGarr, N. S. (1982). "Speech production characteristics of the hearing impaired." In N. Lass (Ed.), *Speech and Language: Advances in basic research and practice* (pp. 257–316). New York: Academic Press.

Osberger, M. J., Maso, M., & Sam, L. K. (1993). "Speech intelligibility of children with cochlear implants, tactile aids, or hearing aids." *Journal of Speech and Hearing Research, 36*, 186–203.

Osberger, M. J., Miyamoto, R. T., Zimmerman-Phillips, S., Kemink, J. L., Stroer, B. S., Firszt, J. B., & Novak, M. A. (1991a). "Independent evaluation of the speech perception abilities of children with the Nucleus 22-channel cochlear implant system." *Ear and Hearing, 12*, 66–80.

Osberger, M. J., Robbins, A. M., Berry, S. W., Todd, S. L., Hesketh, L. J., & Sedey, A. (1991b). "Analysis of the spontaneous speech samples of children with cochlear implants or tactile aids." *The American Journal of Otology, 12*, 151–164.

Osberger, M. J., Robbins, A. M., Todd, S. L., & Riley, A. I. (1994). "Speech intelligibility of children with cochlear implants." *The Volta Review, 96*(5), 169–180.

Paterson, S. J. (2000). The Development of Language and Number Understanding in Williams Syndrome and Down's Syndrome: Evidence from the infant and mature phenotypes. Unpublished Ph.D. dissertation, University College London.

Paterson, S. J., Brown, J. H., Gsödl, M. K., Johnson, M. H., & Karmiloff-Smith, A. (1999). "Cognitive modularity and genetic disorders." *Science, 286*, 2355–2358.

Paul, R. & Cohen, D. (1984). "Responses to contingent queries in adults with mental retardation and pervasive developmental disorders." *Applied Psycholinguistics, 5*, 349–357.

Paul, R. & Cohen, D. (1985). "Comprehension of indirect requests in adults with mental retardation and pervasive developmental disorders." *Journal of Speech and Hearing Research, 28*, 475–479.

Paul, R., Cohen, D. J., Breg, R., Watson, M., & Herman, S. (1984). "Fragile X syndrome: Its relations to speech and language disorders." *Journal of Speech and Hearing Disorders, 49*, 326–336.

Paul, R., Dykens, E., Leckman, F., Watson, M., Breg, W. R., & Cohen, D. J. (1987). "A comparison of language characteristics of mentally retarded adults with fragile X syndrome and those with nonspecific mental retardation and autism." *Journal of Autism and Developmental Disorders, 17*, 457–468.

Paul, R., Fischer, M., & Cohen, D. (1988). "Brief report: Sentence comprehension strategies in children with autism and specific language disorders." *Journal of Autism and Developmental Disorders, 18*, 669–679.

Peters, A. (1997). "Typology, prosody and the acquisition of morphemes." In D. I. Slobin (Ed.), *The Cross-linguistic Study of Language Acquisition, Vol. 5* (pp. 135–197). Mahwah, NJ: Lawrence Erlbaum Associates.

Peña, E., Gutierrez-Clellen, V., Iglesias, A., Goldstein, B., & Bedore, L. M. (in preparation). "Bilingual English Spanish assessment (BESA)."

Pezzini, G, Vicari, S., Volterra, V., Milani, L., & Ossella, M. T. (1999). "Children with Williams syndrome: Is there a single neuropsychological profile?" *Developmental Neuropsychology, 15*, 141–155.

Phillips, C. E., Jarrold, C., Baddeley, A., Grant, J., & Karmiloff-Smith, A. (2004). "Comprehension of spatial language terms in Williams syndrome: Evidence for an interaction between domains of strength and weakness." *Cortex, 40*, 85–101.

Philofsky, A., Hepburn, S. L., Hayes, A., Hagerman, R., & Rogers, S. J. (2004). "Linguistic and cognitive functioning and autism symptoms in young children with fragile X syndrome." *American Journal on Mental Retardation, 109*, 208–218.

Piattelli-Palmarini, M. (2001). "Grammar – the basest essentials." *Nature, 411*, 887–888.

Pinker, S. (1989). *Learnability and Cognition: The acquisition of argument structure.* Cambridge, MA: The MIT Press.

Pinker, S. (1991). "Rules of language." *Science, 253*, 530–535.

Pinker, S. (1994). *The Language Instinct*. New York: W. Morrow and Co.

Pisoni, D. B., Cleary, M., Geers, A. E., & Tobey, E. A. (1999). "Individual differences in effectiveness of cochlear implants in children who are prelingually deaf: New process measures of performance." *The Volta Review, 101*(3), 111–164.

Plante, E. & Vance, R. (1994). "Selection of preschool language tests: A data-based approach." *Language, Speech, and Hearing Services in Schools, 25*, 15–24.

Prizant, B. (1983). "Language acquisition and communicative behavior in autism: toward an understanding of the "whole" of it." *Journal of Speech and Hearing Disorders, 48*, 296–307.

Prizant, B. & Rydell, P. (1993). "Assessment and intervention considerations for unconventional verbal behavior." In J. Reichle & D. Wacker (Eds.), *Communicative Alternatives to Challenging Behavior: Integrating functional assessment and intervention strategies* (pp. 263–297). Baltimore, MD: Brookes.

Prouty, L. A., Rogers, R. C., Stevenson, R. E., Dean, J. H., Palmer, K. K., Simensen, R. J., Coston, G. N., & Schwartz, C. E. (1988). "Fragile X syndrome: Growth, development and intellectual function." *American Journal of Medical Genetics, 30*, 123–142.

Pueschel, S. M. (1996). "Young people with Down syndrome: Transition from childhood to adulthood." *Mental Retardation and Developmental Disabilities Research Reviews, 2*, 90–95.

Quirk, R., Greenbaum, S., Leech, G., & Svartvik, J. (1972). *A Grammar of Contemporary English.* London: Longman.

Rapin, I. & Wilson, B. (1978). "Children with developmental language disability: Neurological aspects and assessment." In M. A. Wyke (Ed.), *Developmental Dysphasia* (pp. 13–41). London: Academic Press.

Reeves, R., Baxter, L., & Richtsmeier, J. (2001). "Too much of a good thing: Mechanisms of gene action in Down syndrome." *Trends in Genetics, 17*, 83–88.

Reilly, J., Losh, M., Bellugi, U., & Wulfeck, B. (2004). "'Frog, where are you?' Narratives in children with specific language impairment, early focal brain injury, and Williams syndrome." *Brain and Language, 88*, 229–242.

Reiss, A. L., Eckert, M. A., Rose, F. E., Karchemskiy, A., Kesler, S., Chang, M., Reynolds, M. F., Kwon, H., & Galaburda, A. (2004). "An experiment of nature: Brain anatomy parallels cognition and behaviour in Williams syndrome." *Journal of Neuroscience, 24*(21), 5009–5015.

Reynell, J. K. (1969). *Reynell Developmental Language Scales.* Slough, Bucks: NFER-Nelson Publishing.

Rice, M. (2004). "Growth models of developmental language disorders." In M. L. Rice & S. F. Warren (Eds.), *Developmental Language Disorders: From phenotypes to etiologies* (pp. 207–240). Mahwah, NJ: Lawrence Erlbaum Associates.

Rice, M., Buhr, J., & Nemeth, M. (1990). "Fast-mapping word-learning abilities of language-delayed preschoolers." *Journal of Speech and Hearing Disorders, 55*, 33–42.

Rice, M. & Wexler, K. (2001). *Rice/Wexler Test of Early Grammatical Impairment.* San Antonio, TX: Harcourt Assessment Inc.

Robbins, A. M., Bollard, P. M., & Green, J. (1999). "Language development in children implanted with the Clarion cochlear implant." *Annals of Otology, Rhinology and Laryngology, 108*, 113–118.

Robbins, A. M., Kirk, K. I., Osberger, M. J., & Ertmer, D. (1995). "Speech intelligibility of implanted children." *Annals of Otology, Rhinology and Laryngology, 166*, 399–401.

Robbins, A. M., Svirsky, M., & Kirk, K. I. (1997). "Children with implants can speak, but can they communicate?" *Archives of Otolaryngology, Head and Neck Surgery, 117*, 155–160.

Roberts, J. (1989). "Echolalia and comprehension in autistic children." *Journal of Autism and Developmental Disorders, 19*, 271–281.

Roberts, J. E., Mirrett, P., & Burchinal, M. (2001). "Receptive and expressive communication development of young males with fragile X syndrome." *American Journal on Mental Retardation, 106*, 216–230.

Robinshaw, H. M. (1996). "Acquisition of speech, pre- and post-cochlear implantation: Longitudinal studies of a congenitally deaf infant." *European Journal of Disorders of Communication, 31*, 121–139.

Robinson, K. (1998). "Implications of developmental plasticity for the language acquisition of deaf children with cochlear implants." *International Journal of Pediatric Otorhinolaryngology, 46*, 71–80.

Roizen, N. J. (2001). "Down syndrome: Progress in research." *Mental Retardation and Developmental Disabilities Research Reviews, 7*, 38–44.

Rosen, S. (2003). "Auditory processing in dyslexia and specific language impairment: Is there a deficit? What is its nature? Does it explain anything?" *Journal of Phonetics, 31*(3–4), 509–527.

Rosenberg, S. & Abbeduto, L. (1993). *Language and communication in mental retardation: Development, processes and intervention.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Rosin, M. M., Swift, E., Bless, D., & Vetter, D. K. (1988). "Communication profiles of adolescents with Down syndrome." *Journal of Childhood Communication Disorders, 12*, 49–64.

Rossen, M., Klima, E. S., Bellugi, U., Bihrle, A., & Jones, W. (1996). "Interaction between language and cognition: Evidence from Williams syndrome." In J. H. Beitchman, N. Cohen, M. Konstantareas, & R. Tannock (Eds.), *Language Learning and Behaviour* (pp. 367–392). New York: Cambridge University Press.

Rossi, P. G., Parmeggiani, A., Posar, A., Scaduto, M. C., Chiodo, S., & Vatti, G. (1999). "Landau-Kleffner syndrome (LKS): Long-term follow-up and links with electrical status epilepticus during sleep (ESES)." *Brain and Development, 21*, 90–98.

Rowland, C. Pine, J., Lieven, E., & Theakston, A. (2003). "Determinants of acquisition order in wh-questions: Re-evaluating the role of caregiver speech." *Journal of Child Language, 30*, 609–635.

Ruben, R. (1997). "A time frame of critical/sensitive periods of language development." *Acta Otolaryngologica, 117*, 202–205.

Ruscio, J. & Ruscio, A. (2000). "Informing the continuity controversy: A taxometric analysis of depression." *Journal of Abnormal Psychology, 109*, 473–487.

Rutter, M., Greenfield, D., & Lockyer, L. (1967). "A five to fifteen year follow-up study of infantile psychosis: II. Social and behavioral outcome." *British Journal of Psychology and Psychiatry, 133*, 1183–1199.

Rydell, P. & Mirenda, P. (1994). "Effects of high and low constraint utterances on the production of immediate and delayed echolalia in young children with autism." *Journal of Autism and Developmental Disorders, 24*, 719–735.

Scarborough, H. S. (1990). "Index of productive syntax." *Applied Psycholinguistics, 11*, 1–22.

Schauwers, K., Gillis, S., Daemers, K., De Beukelaer, C., & Govaerts, P. J. (submitted). "Cochlear implantation between 5 and 20 months of age: The onset of babbling and the audiological outcome."

Schiefelbusch, R. L. (1972). *Language of the Mentally Retarded.* Baltimore, MD: University Park Press.

Schiefelbusch, R. L. & Lloyd, L. L. (Eds.). (1974). *Language Perspectives – Acquisition, Retardation, and Intervention.* Baltimore, MD: University Park Press.

Sehgal, S. T., Kirk, K. I., Svirsky, M., Ertmer, D. J., & Osberger, M. J. (1998). "Imitative consonant feature production by children with multichannel sensory aids." *Ear and Hearing, 19*, 72–84.

Seibert, J. M., Hogan, A. E., & Mundy, P. C. (1982). "Assessing interactional competencies: The early social-communication scales." *Infant Mental Health Journal, 3*, 244–258.

Seidenberg, M. S. (2003). "Critical periods in language and other domains: The paradox of success." Paper presented at the Society for Research in Child Development, Tampa, FL.

Semel, E. & Rosner, S. R. (2003). *Understanding Williams syndrome: Behavioral patterns and interventions.* Mahwah, NJ: Lawrence Erlbaum Associates.

Semel, E., Wiig, E., & Secord, W. (1987). *Clinical Evaluation of Language Fundamentals* (3rd edition). San Antonio, TX: The Psychological Corporation, Harcourt Brace and Co.

Serry, T. A. & Blamey, P. J. (1999). "A 4-year investigation into phonetic inventory development in young cochlear implant users." *Journal of Speech, Language and Hearing Research, 42*, 141–154.

Serry, T. A., Blamey, P., & Grogan, M. (1997). "Phoneme acquisition in the first 4 years of implant use." *The American Journal of Otology, 18*, 122–124.

Seung, H.-K. & Chapman, R. S. (2000). "Digit span in individuals with Down syndrome and typically developing children: Temporal aspects." *Journal of Speech, Language and Hearing Research, 43*, 609–620.

Seymour, H., Roeper, T., & de Villiers, J. (2003). *Diagnostic Evaluation of Language Variation: Screening Test.* San Antonio, TX: The Psychological Corporation.

Sharma, A., Dorman, M., & Spohr, A. (2002a). "Early cochlear implantation in children allows normal development of central auditory pathways." *Annals of Otology, Rhinology and Laryngology, 111*, 38–41.

Sharma, A., Dorman, M., & Spohr, A. (2002b). "Rapid development of cortical auditory evoked potentials after early cochlear implantation." *NeuroReport, 13*, 1346–1368.

Shinnar, S., Rapin, I., Arnold, S., Tuchman, R., Shulman, L., Ballaban-Gil, K., Maw, M., Deuel, R. K., & Volkmar, F. R. (2001). "Language regression in childhood." *Pediatric Neurology, 24*, 183–189.

Silverman, W. & Wisniewski, H. M. (1999). "Down syndrome and Alzheimer disease: Variability in individual vulnerability." In J. A. Rondal & L. Nadel (Eds.), *Down Syndrome: A review of current knowledge* (pp. 178–194). London: Whurr Publishers.

Singer Harris, N. G., Bellugi, U., Bates, E., Jones, W., & Rossen, M. (1997). "Contrasting profiles of language development in children with Williams and Down syndromes." *Developmental Neuropsychology, 13*, 345–370.

Siple, P., Caccamise, F., & Brewer, L. (1982). "Signs as pictures and signs as words: Effect of language knowledge on memory for new vocabulary." *Journal of Experimental Psychology: Language, memory and cognition, 8*, 619–625.

Skinner, B. F. (1957). *Verbal Behavior*. New York: Appleton-Century-Crofts.

Smith, C. R. (1975). "Residual hearing and speech production in deaf children." *Journal of Speech and Hearing Research, 18*, 795–811.

Smith, N. & Tsimpli, I. (1995). *The Mind of a Savant: Language learning and modularity.* Oxford: Blackwell.

Snik, A. F. M., Vermeulen, A. M., Geelen, C. P. L., Brokx, J. P. L., & van der Broek, P. (1997). "Speech perception performance of congenitally deaf patients with a cochlear implant: The effect of age at implantation." *The American Journal of Otology, 18*, 138–139.

Spencer, L. J., Tye-Murray, N., & Tomblin, J. B. (1998). "The production of English inflectional morphology, speech production and listening performance in children with cochlear implants." *Ear and Hearing, 19*, 310–318.

Spencer, P. E. (1993). "The expressive communication of hearing mothers and deaf infants." *American Annals of the Deaf, 138*(3), 275–283.

Spencer, P. E. (in press). "Individual differences in language performance after cochlear implantation at one to three years of age: Child, family and linguistic factors." *Journal of Deaf Studies and Deaf Education.*

Spencer, P. E. & Lederberg, A. R. (1997). "Different modes, different models: Communication and language of young deaf children and their mothers." In L. B. Adamson & M. A. Romski (Eds.), *Research on Communication and Language Disorders: Contributions to theories of language development* (pp. 203–230). Baltimore, MD: Brookes Publishing Co.

Spencer, P. E. & Marschark, M. (2003). "Cochlear implants: Issues and implications." In M. Marschark & P. E. Spencer (Eds.), *Oxford Handbook of Deaf Studies, Language and Education* (pp. 434–449). New York: Oxford University Press.

Stark, R. & Montgomery, J. (1995). "Sentence processing in language-impaired children under conditions of filtering and time compression." *Applied Psycholinguistics, 16*, 137–154.

Stark, R. E. (1980). "Stages of speech development in the first year of life." In G. H. Yeni-Komshian, J. F. Kavanagh, & C. A. Ferguson (Eds.), *Child Phonology, 1* (pp. 73–92). New York: Academic Press.

Stark, R. E. (1983). "Phonatory development in young normally hearing and hearing-impaired children." In H. Hochberg, H. Levitt, & M. J. Osberger (Eds.), *Speech of the Hearing-impaired: Research, training and personnel preparation* (pp. 297–312). Baltimore, MD: University Park.

Steele, S., Joseph, R., & Tager-Flusberg, H. (2003). "Brief report: Developmental change in theory of mind abilities in children with autism." *Journal of Autism and Developmental Disorders, 33*, 461–467.

Stevens, T. & Karmiloff-Smith, A. (1997). "Word learning in a special population: Do individuals with Williams syndrome obey lexical constraints?" *Journal of Child Language, 24*, 737–765.

Stoel-Gammon, C. (1988). "Prelinguistic vocalizations of hearing-impaired and normally hearing subjects: A comparison of consonantal inventories." *Journal of Speech and Hearing Disorders, 53*, 302–315.

Stoel-Gammon, C. (1997). "Phonological development in Down syndrome." *Mental Retardation and Developmental Disabilities Research Review, 3*, 300–306.

Stoel-Gammon, C. & Otomo, K. (1986). "Babbling development of hearing-impaired and normally hearing subjects." *Journal of Speech and Hearing Disorders, 51*, 33–41.

Stojanovik, V., Perkins, M., & Howard, S. (in press). "Williams syndrome and specific language impairment do not support developmental double dissociations and innate modularity." *Journal of Neurolinguistics*.

Stokes, S. F. (2002). "Lexical and morphological diversity in children with SLI: Evidence in support of an optionality constraint." Paper presented at IASCL-SRCLD, July, Madison, WI.

Stokes, S. F. & Fletcher, P. (2000). "Lexical diversity and productivity in Cantonese-speaking children with specific language impairment." *International Journal of Language and Communication Disorders, 35*, 527–541.

Stokes, S. F. & Fletcher, P. (2003). "Aspect markers in Cantonese-speaking children with specific language impairment." *Linguistics, 41*, 381–406.

Stokes, S. F., Fletcher, P., & Leung, S. (1997). *Language Development in Cantonese-speaking Children with Specific Language Impairment.* Hong Kong: Hong Kong Research Grants Council.

Stone, W. L. & Yoder, P. J. (2001). "Predicting spoken language level in children with autism spectrum disorders." *Autism, 5*, 341–346.

Stores, R., Stores, G., Fellows, B., & Bukley, S. (1998). "Daytime behaviour problems and maternal stress in children with Down's syndrome, their siblings and non-intellectually disabled and other intellectually disabled peers." *Journal of Intellectual Disabilities Research, 42*, 228–237.

Sudhalter, V., Cohen, I. L., Silverman, W., & Wolf-Schein, E. G. (1990). "Conversational analyses of males with fragile X, Down syndrome and autism: Comparison of the emergence of deviant language." *American Journal on Mental Retardation, 94*, 431–441.

Sudhalter, V., Scarborough, H. S., & Cohen, I. L. (1991). "Syntactic delay and pragmatic deviance in the language of fragile X males." *American Journal of Medical Genetics, 38*, 493–497.

Svirsky, M. A., Robbins, A. M., Kirk, K. I., Pisoni, D. B., & Miyamoto, R. T. (2000a). "Language development in profoundly deaf children with cochlear implants." *Psychological Science, 11*(2), 153–158.

Svirsky, M. A., Chute, P. M., Green, J., Bollard, P., & Miyamoto, R. T. (2000b). "Language development in children who are prelingually deaf who have used the SPEAK or CIS stimulation strategies since initial stimulation." *The Volta Review, 102*(4), 199–213.

Svirsky, M. A., Stallings, L. M., Lento, C. L., Ying, E., & Leonard, L. B. (2002). "Grammatical morphologic development in pediatric cochlear implant users may be affected by the perceptual prominence of the relevant markers." *Annals of Otology, Rhinology and Laryngology, 111*(5), 109–112.

Svirsky, M. A., Teoh, S., & Neuburger, H. (in press). "Development of language and speech perception in congenitally, profoundly deaf children as a function of age at cochlear implantation." *Audiology and Neuro-Otology.*

Swisher, M. V. & Christie, K. (1989). "Communication using a signed code for English: Interaction between deaf children and their mothers." *Monographs for the International Sign Linguistics Association Centre for Deaf Studies, 1*, 36–44.

Szagun, G. (1997). "Some aspects of language development in normal-hearing children and children with cochlear implants." *The American Journal of Otology, 18*, 131–134.

Szagun, G. (2000). "The acquisition of grammatical and lexical structures in children with cochlear implants: A developmental psycholinguistic approach." *Audiology and Neuro-Otology, 5*, 39–47.

Szagun, G. (2001). "Language acquisition in young German-speaking children using cochlear implants: Individual differences and implications of a 'sensitive phase'." *Audiology and Neuro-Otology, 6*(5), 288–297.

Tager-Flusberg, H. (1997). "The role of theory of mind in language acquisition: Contributions from the study of autism." In L. Adamson & M. A. Romski (Eds.), *Communication and Language Acquisition: Discoveries from atypical development* (pp. 133–158). Baltimore, MD: Brookes.

Tager-Flusberg, H. (1999). "A psychological approach to understanding the social and language impairments in autism." *International Review of Psychiatry, 11*, 325–334.

Tager-Flusberg, H. (2000). "Language and understanding minds: Connections in autism." In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding Other Minds: Perspectives from developmental cognitive neuroscience* (2nd edition, pp. 124–149). Oxford: Oxford University Press.

Tager-Flusberg, H. & Cooper, J. (1999). "Present and future possibilities for defining a phenotype for specific language impairment." *Journal of Speech, Language, and Hearing Research, 42*, 1275–1278.

Tager-Flusberg, H. & Joseph, R. M. (in press). "How language facillitates the acquisition of false belief in children with autism." In J. Astington & J. Baird (Eds.), *Why Language Matters for Theory of Mind*. Oxford: Oxford University Press.

Tager-Flusberg, H. & Sullivan, K. (1994). "Predicting and explaining behavior: A comparison of autistic, mentally retarded and normal children." *Journal of Child Psychology and Psychiatry, 35*, 1059–1075.

Tager-Flusberg, H. & Sullivan, K. (1997). "Early language development in children with mental retardation." In E. J. Burack, R. Hodapp, & E. Zigler (Eds.), *Handbook of Development and Retardation* (pp. 208–239). New York: Cambridge University Press.

Tager-Flusberg, H., Calkins, S., Nolin, T., Baumberger, T., Anderson, M., & Chadwick-Dias, A. (1990). "A longitudinal study of language acquisition in autistic and Down syndrome children." *Journal of Autism and Developmental Disorders, 20*, 1–21.

Tager-Flusberg, H., Plesa-Skwerer, D., Faja, S., & Joseph, R. M. (2003). "People with Williams syndrome process faces holistically." *Cognition, 89*, 11–24.

Tait, D. M. (1993). "Video analysis: A method of assessing changes in preverbal and early linguistic communication after cochlear implantation." *Ear and Hearing, 14*(6), 378–389.

Tait, D. M. & Lutman, M. E. (1994). "Comparison of early communicative behavior in young children with cochlear implants and with hearing aids". *Ear and Hearing, 15*, 352–361.

Tait, D. M., Lutman, M. E., & Robinson, K. (2000). "Preimplant measures of preverbal communicative behavior as predictors of cochlear implant outcomes in children." *Ear and Hearing, 21*, 18–24.

Tallal, P. & Piercy, M. (1978). "Defects of auditory perception in children with developmental dysphasia." In M. A. Wyke (Ed.), *Developmental Dysphasia* (pp. 63–84). London: Academic Press.

Temple, C., Almazan, M., & Sherwood, S. (2002). "Lexical skills in Williams syndrome: A cognitive neuropsychological analysis." *Journal of Neurolinguistics, 15*(6), 463–495.

Thomas, M. S. C. (2003). "Limits on plasticity." *Journal of Cognition and Development, 4*(1), 95–121.

Thomas, M. S. C. (in press a). "Williams syndrome: Fractionations all the way down?: Commentary on Semel and Rosner." *Cortex*.

Thomas, M. S. C. (in press b). "Characterising compensation." *Cortex*.

Thomas, M. S. C. & Karmiloff-Smith, A. (2002a). "Are developmental disorders like cases of adult brain damage? Implications from connectionist modelling." *Behavioural and Brain Sciences, 25*(6), 727–780.

Thomas, M. S. C. & Karmiloff-Smith, A. (2002b). "Modelling typical and atypical cognitive development." In U. Goswami (Ed.), *Handbook of Childhood Development* (pp. 575–599). Oxford: Blackwell.

Thomas, M. S. C. & Karmiloff-Smith, A. (2003). "Modelling language acquisition in atypical phenotypes." *Psychological Review, 110*(4), 647–682.

Thomas, M. S. C. & Karmiloff-Smith, A. (in press). "Can developmental disorders reveal the component parts of the human language faculty?" *Language Learning and Development*.

Thomas, M. S. C. & Redington, M. (2004). "Modelling atypical syntax processing." To appear in *Proceedings of the COLING-2004 Workshop: Psycho-computational model of human language acquisition*. Geneva, Switzerland, 28 August 2004.

Thomas, M. S. C. & Richardson, F. (in press). "Atypical representational change." To appear in *Proceeding of Attention and Performance XXI: Processes of change in brain and cognitive development*. Denver, CO.

Thomas, M. S. C., Dockrell, J. E., Messer, D., Parmigiani, C., Ansari, D., & Karmiloff-Smith, A. (submitted). "Naming in Williams syndrome."

Thomas, M. S. C., Grant, J., Gsödl, M., Laing, E., Barham, Z., Lakusta, L., Tyler, L. K., Grice, S., Paterson, S., & Karmiloff-Smith, A. (2001). "Past tense formation in Williams syndrome." *Language and Cognitive Processes, 16*, 143–176.

Thordardottir, E., Ellis Weismer, S., & Evans, J. (2002). "Continuity in lexical and morphological development in Icelandic and English-speaking 2-year olds." *First Language, 22*, 3–28.

Tingley, E. C., Gleason, J. B., & Hooshyar, N. (1994). "Mothers' lexicon of internal state words in speech to children with Down syndrome and to nonhandicapped children at mealtime." J*ournal of Communication Disorders, 27*, 135–155.

Tjus, T., Heimann, M., & Nelson, K. E. (1998). "Gains in literacy through the use of a specially developed multimedia computer strategy: Positive findings from 13 children with autism." *Autism, 2*, 139–156.

Tobey, E. A. & Geers, A. E. (1995). "Speech production benefits of cochlear implants." *Advances in Otorhinolaryngology, 50*, 146–153.

Tobey, E. A. & Hasenstab, M. S. (1991). "Effects of a Nucleus multichannel cochlear implant upon speech production in children." *Ear and Hearing, 12*(4), 48–54.

Tobey, E. A., Angelette, S., Murchison, C., Nicosia, J., Sprague, S., Staller, S. J., Brimacombe, J. A., & Beiter, A. L. (1991a). "Speech production performance in children with multichannel cochlear implants." *The American Journal of Otology, 12*, 165–173.

Tobey, E. A., Geers, A. E., & Brenner, C. (1994). "Speech production results: Speech feature acquisition." *The Volta Review, 96*(5), 109–129.

Tobey, E. A., Geers, A. E., Douek, B. M., Perrin, J., Skellett, R., Brenner, C., & Toretta, G. (2000). "Factors associated with speech intelligibility in children with cochlear implants." *Annals of Otology, Rhinology and Laryngology, 185*, 28–30.

Tobey, E. A., Pancamo, S., Staller, S. J., Brimacombe, J. A., & Beiter, A. L. (1991b). "Consonant production in children receiving a multichannel cochlear implant." *Ear and Hearing, 12*(1), 23–31.

Tomasello, M. (1998). "The return of constructions." *Journal of Child Language, 25*, 431–442.

Tomasello, M. (2000a). "Acquiring syntax is not what you think." In D. V. M. Bishop & L. B. Leonard (Eds.), *Speech and Language Impairments in Children* (pp. 1–15). Hove: Psychology Press.

Tomasello, M. (2000b). "Do young children have adult syntactic competence?" *Cognition, 74*, 209–253.

Tomasello, M. (2003). *Constructing a Language: A usage-based theory of language acquisition.* Cambridge, MA: Harvard University Press.

Tomasello, M. & Brooks, P. (1998). "Young children's earliest transitive and intransitive constructions." *Cognitive Linguistics, 9*, 379–395.

Tomasello, M. & Stahl, A. (2004). "Sampling children's speech: How much is enough?" *Journal of Child Language, 31*, 101–121.

Tomblin, J., Hafeman, L., & O'Brien, M. (2003). "Autism and autism risk in siblings of children with specific language impairment." *International Journal of Language and Communication Disorders, 38*, 235–250.

Tomblin, J. B., Records, N., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). "Prevalence of specific language impairment in kindergarten children." *Journal of Speech, Language, and Hearing Research, 40*, 1245–1260.

Tomblin, J. B., Spencer, L., Flock, S., Tyler, R., & Gantz, B. (1999). "A comparison of language achievement in children with cochlear implants and children using hearing aids." *Journal of Speech, Language and Hearing Research, 42*, 497–511.

Trask, R. L. (1993). *A Dictionary of Grammatical Terms in Linguistics.* London: Routledge.

Tuchman, R. F. (1997). "Acquired epileptiform aphasia." *Seminars in Pediatric Neurology, 4*, 93–102.

Tye-Murray, N. & Kirk, K. I. (1993). "Vowel and diphthong production by young users of cochlear implants and the relationship between the phonetic level evaluation and spontaneous speech." *Journal of Speech and Hearing Research, 36*, 488–502.

Tye-Murray, N., Spencer, L., & Woodworth, G. G. (1995). "Acquisition of speech by children who have prolonged cochlear implant experience." *Journal of Speech and Hearing Research, 38*, 327–337.

Tye-Murray, N., Spencer, L., Bedia, E. G., & Woodworth, G. (1996). "Differences in children's sound production when speaking with a cochlear implant turned on and turned off." *Journal of Speech and Hearing Research, 39*, 604–610.

Tyler, R. S., Fryauf-Bertschy, H., Kelsay, D. M. R., Gantz, B. J., Woodworth, G. P., & Parkinson, A. (1997). "Speech perception by prelingually deaf children using cochlear implants." *Archives of Otolaryngology, Head and Neck Surgery, 117*, 180–187.

Ullman, M. T. & Pierpont, E. I. (in press). "Specific language impairment is not specific to language: The Procedural Deficit Hypothesis." *Cortex.*

van der Lely, H. K. J. & Ullman, M. (1996). "The computation and representation of past tense morphology in normally developing and specifically language impaired children." *Proceedings of the Annual Boston University Conference on Language Development, 20*(2), 804–815.

van der Lely, H. K. J. & Ullman, M. T. (2001). "Past tense morphology in specially language impaired and normally developing children." *Language and Cognitive Processes, 16*, 177–217.

Vicari, S., Carlesimo, G., Brizzolara, D., & Pezzini, G. (1996). "Short-term memory in children with Williams syndrome: A reduced contribution of lexical-semantic knowledge to word span." *Neuropsychologia, 34*, 919–925.

Vicari, S., Caselli, M. C., & Tonucci, F. (2000). "Asynchrony of lexical and morphosyntactic development in children with Down syndrome." *Neuropsychologia, 38*, 634–644.

Vihman, M. M., Ferguson, C. A., & Elbert, M. (1986). "Phonological development from babbling to speech: Common tendencies and individual differences." *Applied Psycholinguistics, 7*, 3–40.

Volterra, V., Capirci, O., & Caselli, M. C. (2001). "What atypical populations can reveal about language development: The contrast between deafness and Williams syndrome." *Language and Cognitive Processes, 16*, 219–239.

Volterra, V., Capirci, O., Pezzini, G., Sabbadini, L., & Vicari, S. (1996). "Linguistic abilities in Italian children with Williams syndrome." *Cortex, 32*, 663–677.

Wagner, K. R. (1985). "How much do children say in a day?" *Journal of Child Language, 12*, 457–487.

Waller, N., Putnam, F., & Carlson, E. (1996). "Types of dissociation and dissociative types: A taxometric analysis of dissociative experiences." *Psychological Methods, 1*, 300–321.

Waltzman, S. B. & Cohen, N. L. (1998). "Cochlear implantation in children younger than 2 years old." *The American Journal of Otology, 19*, 158–162.

Waltzman, S. B., Cohen, N. L., Gomolin, R. H., Green, J. E., Shapiro, W. H., Hoffman, R. A., & Roland, J. T. (1997). "Open-set speech perception in congenitally deaf children using cochlear implants." *The American Journal of Otology, 18*, 342–349.

Waltzman, S. B., Cohen, N. L., Gomolin, R. H., Shapiro, W. H., Ozdamar, S. R., & Hoffman, R. A. (1994). "Long-term results of early cochlear implantation in congenitally and prelingually deafened children." *The American Journal of Otology, 15*, 9–13.

Warburton, P., Baird, G., Chen, W., Morris, K., Jacobs, B., Hodgson, S., & Docherty, Z. (2000). "Support for linkage of autism and specific language impairment to 7q3 from two chromosome rearrangements involving band 7q31." *American Journal of Medical Genetics, 96*, 228–234.

Webelhuth, G. (1995). "X-bar theory and case theory." In G. Webelhuth (Ed.), *Government and Binding Theory and the Minimalist Program* (pp. 18–95). Oxford: Blackwell.

Whitehurst, G. & Fischel, J. (2000). "Reading and language impairments in conditions of poverty." In D. Bishop & L. Leonard (Eds.), *Speech and Language Impairments in Children* (pp. 53–71). Hove: Psychology Press.

Wilkinson, K. & Mazzitelli, K. (2003). "The effect of 'missing' information on children's retention of fast-mapped labels." *Journal of Child, Language 30*, 47–73.

Williams, K. T. (1997). *Expressive Vocabulary Test.* Circle Pines, MN: American Guidance Service.

Wing, L. (1971). "Perceptual and language development in autistic children: A comparative study." In M. Rutter (Ed.), *Infantile Autism: Concepts, characteristics and treatment* (pp. 173–195). London: Churchill.

Wisbeck, J. M., Huffman, L. C., Freund, L., Gunnar, M., Davis, E. P., & Reiss, A. L. (2000). "Cortisol and social stressors in children with fragile X: A pilot study." *Developmental and Behavioral Pediatrics, 21*, 279–282.

Wishart, J. G. & Pitcairn, T. K. (2000). "Recognition of identity and expression in faces by children with Down syndrome." *American Journal on Mental Retardation, 105*, 466–479.

Wolf-Schein, E. G., Cohen, I. L., Fisch, G. S., Brown, W. T., & Jenkins, E. C. (1987). "Speech-language and the fragile X syndrome: Initial findings and directions for study." *Journal of the American Speech and Hearing Association, 29*, 35–38.

Wolk, L. & Edwards, M. L. (1993). "The emerging phonological system of an autistic child." *Journal of Communication Disorders, 26*, 161–177.

Wolk, L. & Giesen, J. (2000). "A phonological investigation of four siblings with childhood autism." *Journal of Communication Disorders, 33*, 371–389.

Wong, A. M.-Y., Leonard, L. Fletcher, P., & Stokes, S. (in press). "Questions without movement: a study of Cantonese-speaking children with and without language impairment." *Journal of Speech, Language and Hearing Research.*

Wong, A. M.-Y., Stokes, S. F., & Fletcher, P. (2003). "Collocational diversity in perfective aspect zo2 use in Cantonese children with SLI." *Journal of Multilingual Communication Disorders, 1*, 132–140.

World Health Organization. (1993). *Mental disorders: A glossary and guide to their classification in accordance with the 10th revision of the International Classification of Diseases: Research Diagnostic Criteria* (*ICD-10*). Geneva: Author.

Wright, M., Purcell, A., & Reed, V. A. (2002). "Cochlear implants and infants: Expectations and outcomes." *Annals of Otology, Rhinology and Laryngology, 111*, 131–137.

Yirmiya, N., Erel, O., Shaked, M., & Solomonica-Levi, D. (1998). "Meta-analyses comparing theory of mind abilities of individuals with autism, individuals with mental retardation and normally developing individuals." *Psychological Bulletin, 124*, 283–307.

Yoshinaga-Itano, C. & Snyder, L. S. (1985). "Form and meaning in the written language of hearing-impaired children." *The Volta Review, 87*, 775–790.

Yoshinaga-Itano, C., Sedey, A. L., Coulter, D. K., & Mehl, A. L. (1998). "Language of early- and late-identified children with hearing loss." *American Academy of Pediatrics, 102*(5), 1161–1171.

Zelazo, P. D., Burack, J. A., Benedetto, E., & Frye, D. (1996). "Theory of mind and rule use in individuals with Down's syndrome: a test of the uniqueness and specificity claims." *Journal of Child Psychology and Psychiatry, 37*, 479–484.

Zhang, X. & Tomblin, J. B. (in preparation). "Developmental language disorder: A categorical or dimensional construct?"

Zukowski, A. (2001). Uncovering Grammatical Competence in Children with Williams Syndrome. Unpublished Ph.D. dissertation, Boston University.