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Mapping at the interface

The cross-overs between monolingual–bilingual and typically atypically developing children are a goldmine for research on language development. The four permutations of language exposure and language abilities create "natural experimental conditions" for investigating the nature of the language capacity and how this is shaped by input in typical development, and importantly, in specific language impairment (SLI). Paradis has played a prominent part in identifying and exploring this rich source of evidence. Her Keynote Article provides a valuable review of findings from her own and others' research, a carefully considered evaluation of their compatibility with competing theories of language development, and an excellent catalyst for debate.

I enter this debate with some reflections on the clearly demarcated theoretical and empirical scope of Paradis' Keynote. The focus of the paper is on morphosyntax and, more specifically, the acquisition of finite verb morphology. This focus is both empirically and theoretically motivated. Morphosyntax has been identified as "the most highly affected domain of SLI," with acquisition of finite morphology "extraordinarily affected." This domain has therefore been the focus of empirical studies and associated debates on SLI. These have polarized around two theoretical perspectives: domain-general theories attributing deficits to limited processing capacity (LPC), and domain-specific theories attributing deficits to genetically determined limitations in the maturation of language acquisition mechanisms. The extended optional infinitive (EOI) account is a key example of a syntax-specific maturational theory of SLI. Strong and competing theoretical claims put to the test in empirical investigation of theoretically identified domains are fundamental to scientific enterprise and advance, as illustrated by Paradis' Keynote: theoretically motivated research on finiteness in second language (L2) and SLI has generated a wealth of intriguing data. However, as expected in scientific research, these data have created paradoxes and thus new challenges for the theories that underpin them. In my commentary, I argue that these paradoxes and challenges expose the limitations of the theoretical polarisation that continues to dominate the field, and put forward a different theoretical direction. The "mapping theory" I propose is maturational and domain specific, but with a different notion of maturation, and a different specification of relevant domains.

The central issue for the mapping theory is the developmental trajectory through which children discover the mappings between phonology and semantics that constitute their native language (Chiat, 2001; Chiat & Roy, 2008). According to this theory, the complex language outcomes typically observed by age 4 depend on phonological, semantic, and mapping abilities. In the first year of life, infants demonstrate impressive skills in segmenting phonological forms, registering and storing the details within these forms, and recognizing these forms when they recur in different contexts. This recognition of phonological forms is crucial for establishing the semantic and syntactic functions they encode: only by recognizing a form when it recurs in different contexts, and identifying commonalities between the contexts in which it occurs, can the child discover its precise meaning and its

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syntactic relation to other forms. This is particularly true for forms whose meaning does not have a directly observable correlate and therefore cannot be determined from the observable context. Tense provides an extreme example. Even if the syntactic category of tense is "hard wired," children have to discover the specific tense forms and distinctions of their language. They can only achieve this if (a) they perceive and recognize recurrent phonological chunks (e.g., *-s* and the verb phonologies to which it attaches) and (b) they notice the temporal contexts in which this phonological form recurs (largely with present-time states as in *wants, needs, seems*).

A deficit in any one of these complex phonological skills, semantic skills, and skills in mapping between the two would impact on the child's acquisition of tense marking. In addition, in the case of third person *-s*, children must register the linguistic context in which this phonological form recurs to establish that overt marking of present states is confined to subjects with singular heads. A deficit in registering the full phonological chunk containing the head noun and verb would affect acquisition of agreement; so would a deficit in noticing the recurring pattern within this chunk, that is, "singular head noun . . . verb *-s*."

A model couched within this mapping theory is distinguished from a maturational model focusing exclusively on syntactic outcomes, with little attention to precursors and trajectories that lead to those outcomes. A mapping model is also distinguished from LPC theories. These are generally vague about the domain and nature of the hypothesised limitations, so do not yield specific predictions about strengths and difficulties in SLI that can be tested against SLI data. In contrast, the mapping theory seeks to specify the domains in which processing is limited, the nature of domain-specific limitations, and the repercussions for other domains. I now revisit the findings on L2 and SLI acquisition of finiteness that Paradis has addressed and consider what a mapping perspective can contribute at "the interface."

OVERLAP AND DIFFERENCES BETWEEN L2 TYPICAL DEVELOPMENT (TD) AND FIRST LANGUAGE (L1) SLI

The results of studies comparing L2 TD and L1 SLI children are surprisingly consistent. The evidence points to "highly similar profiles even though they have dissimilar input experiences and internal learning mechanisms," and "the possibility of robust longitudinal parallels between L1 and L2 profiles." It is not altogether clear from Paradis' discussion how these results bear on the (E)OI maturational model. The parallels between L2 TD and L1 SLI are difficult to reconcile with a model of biological maturation proposing a syntactic trajectory whose onset and progress are determined by biological age. However, they are compatible with a maturational model in which the syntactic trajectory is determined by mapping skills that are triggered when a child receives sufficient exposure to a language. If maturation is determined by language-relevant processing skills rather than biological age, the trajectory would be essentially the same in L1 and L2 despite differences in age of onset and amount of exposure. This interpretation does not rule out the possibility of biological limits on mapping skills, and hence on the potential to achieve native-level competence in the phonology, semantics, and

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syntax of a language. Indeed, difficulties of acquiring a language in adulthood provide strong evidence for such constraints. Nonetheless, there are important differences between maturation conceived as a biological program for the emergence of syntax, and maturation conceived as a biologically constrained program of mapping processes that give rise to native competence in syntax (as well as phonology and semantics). I would argue that this shift in the interpretation of maturation resets the "problem space" for models of language acquisition in all its guises, monolingual and bilingual, typical and atypical, and can account for observed parallels between these.

However, what about the *differences* that are observed between L2 and typical development? According to Paradis, "L2 acquisition patterns have characteristics distinct from the (E)OI profile, and thus, the (E)OI profile is not too broad and only applies in all its details to L1 acquisition." The qualification "in all its details" is crucial, because the observed differences are subtle. In both groups, error patterns reveal a predominance of omission over commission errors. However, there is a difference: L2 children produce a significantly higher rate of commission errors than L1 children, signaling greater creativity in production. These errors include overgeneration of BE morphemes in utterances such as "I'm got sevens" and "yes, but if I was hurt my teeth." It is possible that such errors occur because the L2 children are attempting to mark time or tense distinctions that are not overtly marked in the target constructions in English. In line with this possibility, Paradis suggests that overgeneration of BE morphemes may be attributable to these children's experience of grammatical morphemes in their L1, plus the more demanding communicative contexts and frequency of BE encountered by children at a later age. Such factors lie beyond the scope of the maturational model of tense acquisition: the greater creativity observed in L2 TD children cannot be explained within this model, because these children are showing a degree of creativity not observed in L1 TD children. To be compatible with this model, explanation must therefore appeal to extrinsic factors influencing L1 development of the sort Paradis invokes.

In considering possible explanations, it is important to recall that these differences between L1 and L2 error distributions are a matter of degree. Commission errors occur less frequently in L1, but they do occur. In the language samples I collected in research on children's pronouns, I was struck by "rare" patterns of error, including BE errors, that occurred in individual children and reported these in a paper entitled "Specificity in the development of language structure" (Chiat, 1981). A case in point was a 3-year-old who produced the forms *I'm is* and *I'm isn't* over six recording sessions spanning 6 weeks (after which they were ousted by *I am* and *I'm not*):

SC: And he's gonna make the tea.
G: No, I'm is—think.
SC: Huh?
G: Think [əm] is.

SC: And I'm finished.
G: I'm isn't.

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SC: What?
G: I'm isn't finish—fi—[ən] not finished.
SC: I think you're finished.
G: No [am] isn't . . . [mɪzə̃ʔ]

Likewise, I have recorded rare commission errors involving auxiliaries in children with SLI, as exemplified by a 10-year-old reported in Chiat and Hirson (1987):

SC: I've got to start?
R: Oh yes you are.

SC: Shall we go out now?
R: Course we are.

SC: Is she at home?
R: Yeah, in the morning she's does.

SC: No you won't.
R: Yes I am.

These L1 data illustrate doubling of BE (child G) and substitution of auxiliaries (child R). According to Paradis (2008), L2 commission errors also include substitution of wrong person/number, double marking of auxiliaries, and substitution of DO for BE, suggesting at least partial overlap with L1 errors. This overlap between groups supports the view that the higher rate of L2 errors is the product of different language experience rather than different language acquisition mechanisms.

The second difference of detail in L1 and L2 profiles that Paradis highlights is the precocious production of BE relative to inflectional morphemes in L2 children, both TD and SLI. Precocious BE again eludes explanation within the (E)OI maturational model: as Paradis points out, appeal to differences in syntactic markedness of BE and inflectional morphemes (attributed to Ionin & Wexler, 2002; Zobl & Liceras, 1994) are untenable because they would predict the same advantage for BE in L1 development, when the observed discrepancy between L1 and L2 groups is the issue. Paradis again alludes to the differential learning situation and communicative demands facing L2 children.

Appeal to these factors is an open invitation to reconsider precocious BE and rate of commission errors in L2 from a mapping perspective that focuses on the application of underlying skills (in phonology, semantics, and their linkage) to the language input the child receives. This multilevel perspective offers a theoretical framework for considering the contribution of factors Paradis proposes, yielding testable hypotheses about the observed differences between L1 and L2 profiles. Given the differences in communicative contexts experienced by L1 and L2 children because of differences in their age, it is possible that input to L2 children differs in ways that make certain finite morphemes more accessible through contexts as well as frequency of their use. This possibility could be investigated through detailed comparison of samples of L1 and L2 input from key interlocutors,

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be they parents, teachers, or peers. Taking into account the claims of the mapping theory, it would be important to compare prominence as well as frequency of target forms. For example, because BE and auxiliaries have full and reduced/contracted forms, and full forms are prosodically more accessible, it would be important to distinguish contexts that do and do not allow reduction of BE and auxiliaries.

As Paradis points out, differences may also stem from the greater learning experience of L2 children, and the outcomes of this experience. How might such differences be construed from a mapping perspective? We would expect L2 children to have a more advanced understanding of time; they will also have developed specific temporal distinctions dictated by their L1. Given their enhanced conceptual and semantic categorization of time, they will start with a semantic advantage over their younger L1 counterparts. This would make them more sensitive to temporal markers in L2 input, particularly those that are most phonologically accessible, and therefore least challenging in their application of phonological skills to L2 in the early stages. In contrast, underlying phonological skills required for acquisition of finite morphology would not be expected to change as a result of greater life experience or acquisition of L1 phonology. Hence, we would not predict a phonological advantage in L2 relative to L1 acquisition. These hypotheses about the skills and understanding of L2 children could be put to the test by comparing their performance on different tasks. For example, word and nonword repetition tasks could be used to compare phonological skills, where we would expect discrepancies between TD and SLI children to match those observed in L1. Sentence judgement and repetition of phrases/sentences could be used to compare recognition of temporal distinctions, and to determine how performance is affected by phonological prominence (full vs. reduced/contracted forms). Here, we would expect advantages in L2 relative to L1 on time distinctions that are phonologically more accessible. Ideally, cognition of time would also be compared to see if, as predicted, L2 children show a consistent advantage over younger L1 children; I leave it to others to suggest how relevant temporal distinctions can be assessed without recourse to language!

THE LIMITS OF FINITENESS

My comments so far demonstrate that the focus on finite versus nonfinite morphemes at the bilingual–SLI interface has provided an impetus for research with intriguing results. At the same time, this focus has deflected attention from other important patterns in language development. Finite morphemes are not the only challenge for children with SLI, and nonfinite morphemes are not uniformly easier than their finite competitors.

Looking at the data from the two children Paradis presents, KVNL, with language delay, appears to be on a par with TD children on all grammatical morphemes at 10 and 29 months of exposure, but lags behind on *nontense* morphemes at 16 months of exposure and on the *tense composite* at 16 and 23 months. WLLS, with SLI, performs below the TD group on all grammatical morphemes, apart from tense morphemes at 10 months, although the discrepancy is greater for tense than nontense morphemes. As in L1 then, tense morphemes emerge later than nontense morphemes in TD, and are disproportionately affected in SLI. Thus far the results

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are in line with predictions of both the (E)OI and mapping accounts of TD and SLI grammatical morpheme acquisition. However, the two accounts diverge when we look at performance *within* the sets of nonfinite and finite morphemes. Here, the (E)OI account makes no predictions: because it identifies finiteness as the critical factor, it would not account for greater difficulty and poorer attainment of some nonfinite morphemes relative to others.

In contrast, the mapping theory predicts greater phonological accessibility of grammatical morphemes that are whole syllables (*-ing*, prepositions, determiners), especially those following the stressed head of the phrase (*-ing* suffixed to and modifying verbs), than subsyllabic morphemes (including plural *-s*, suffixed to and modifying nouns). The mapping theory also predicts greater semantic accessibility of grammatical morphemes that encode observable meanings such as here and now events (progressive verbs) and spatial relations (spatial prepositions). These factors conspire to make the phonologically consistent, syllabic *-ing* referring to here and now events most accessible; likewise, they conspire to make subsyllabic tense endings and contracted auxiliaries that relate to nonobservable temporal and modal meanings least accessible. Phonological and semantic factors are less convergent in other grammatical morphemes, possessive being a case in point: although it takes the same phonological form as the plural, it encodes a relation between items, making it less accessible than the plural, which encodes a property of the noun to which it attaches. Working in its favor, though, it encodes the semantic relation of possession. The concept of possession is cognitively more basic and accessible than the function of homophonous third-person singular. As pointed out above, this primarily serves to situate state predicates in present time, but simultaneously relates the predicate expressing state to the head noun of the subject noun phrase (agreement). This predicted hierarchy of difficulty of nonfinite and finite morphemes is consistent with order of emergence in TD (Brown, 1973) and relative vulnerability in SLI (Chiat, 2001; Rvachew, Gaines, Cloutier, & Blanchet, 2005): plural mastered before possessive, mastered before third person *-s*. Based on the data in Paradis' Keynote, we do not know whether L2 TD and SLI children replicate this hierarchy in order of emergence and vulnerability of nonfinite morphemes. Finding the same hierarchy in these children would raise questions for an exclusively syntactic maturational model of TD and SLI hinging on the (E)OI.

To my mind, the strongest evidence for the (E)OI model, and the strongest challenge for the mapping theory, is the stage of acquisition where SLI and L2 part company, with L2 children not only overtaking L1 SLI children, but relinquishing the (E)OI to attain fully nativelike command of finiteness. How can we account for this intriguing divergence between typical and atypical development: full compliance with the syntactic obligations of a language that is a hallmark of TD, and above chance but persistently inconsistent compliance that is a hallmark of SLI? The (E)OI maturational theory appears to provide an answer: finiteness is biologically programmed, and impairment in this biological program is responsible for children with SLI stalling at the OI stage.

Recall that morphosyntax is not the only domain of impairment in SLI, nor is nonfinite morphology the only mountain children with SLI fail to conquer. As has frequently been noted, immature morphosyntax is readily identifiable because

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children produce utterances with syntactic contexts that demand grammatical morphemes, enabling researchers to chart the percentage of omissions or substitutions of the morphemes required in a sample of utterances. Furthermore, children can be presented with relevant syntactic contexts to elicit specific grammatical morphemes, and provided the child responds with appropriate lexical content, the presence or absence of target grammatical morphemes can be identified and measured, as in the TEGI. Other limitations in children's language performance are less readily identifiable, because they do not result in unambiguous omissions or substitutions. Nevertheless, detailed analyses of SLI samples have exposed other limitations, and systematic elicitation tasks have confirmed these. Most notably, L1 children with SLI have been found to show disproportionate difficulty with verbs and verb structures (Conti-Ramsden & Jones, 1997; Rice & Bode, 1993; Watkins, Rice, & Moltz, 1993). Such difficulties are to be expected from a mapping perspective, because verbs are phonologically and semantically more challenging than nouns, and entail verb structures that are challenging on all levels (for detailed argument of this case, see Black & Chiat, 2003; Chiat, 2001). Recent research on older children with SLI has demonstrated that constraints on production of verbs and verb argument structure are still present in SLI in the teenage years (Ebbels, van der Lely, & Dockrell, 2007). In the light of such evidence, it seems more than likely that acquisition of verbs and verb argument structure, like finite morphology, reaches a plateau short of full native competence. Given the phonological and semantic challenges of both domains, this is not surprising for the mapping theory. It is less clear how a maturational theory focused on the (E)OI profile would account for the nonoptimal acquisition of verb argument structures.

LPC THEORIES AND THE SURFACE ACCOUNT

The mapping theory is clearly distinct from LPC theories that do not specify domains on which limitations are defined. However, the emphasis on children's capacity to process details within phonological structures is surely reminiscent of the surface account put forward by Leonard and colleagues. Paradis identifies this as an LPC theory, and selects it as the most relevant exemplar because it addresses deficits in grammatical morphology that are the focus of her paper. It is questionable whether the surface account truly qualifies as an LPC, because it proposes downstream effects of surface difficulties on morphosyntactic categories because of their distinct phonetic properties; the justification for placing it in the LPC camp is that the proposed constraints on surface processing are at times equated with reduced speed of processing with effects that are functionally equivalent to infrequent exposure (as in the statements Paradis cites from Leonard, 1998).

Because language exposure of bilingual children is already reduced relative to monolingual children, Paradis takes the LPC theories of SLI to predict a double whammy, with L2 SLI children disproportionately affected by the reduced level of input they receive. The evidence is largely at odds with this prediction: at least where the social context of the two languages is similar, L2 children with SLI show similar profiles of performance to their L1 SLI counterparts. This evidence surely argues against accounts proposing purely quantitative limits on the speed or volume of information children can manage. In contrast to the surface account,

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the mapping model is quite clear on this issue: the proposed deficits and their effects are qualitative, and cannot be traced back to purely quantitative constraints on low-level processing of speech.

According to the mapping theory, proposed constraints on phonological processing are defined in terms of prosodic structure: children have a reduced ability to recognize and/or store details within prosodic units. This provides an account for the differential difficulty with homophonous forms that Paradis mentions. A prosodic analysis of direct object clitics and determiners in French would reveal that they occupy different positions in prosodic structure favoring the latter (see also discussion of plural, possessive, and third person *-s* in English above). Furthermore, as illustrated above, these constraints interact with demands and constraints on semantic processing, together determining the scope and limits of children's capacity to acquire morphosyntactic and syntactic structures. When a phonological form encodes a directly observable meaning, the child may be able to identify the referent directly from the observational context and link this to the form. In contrast, where phonological forms convey nonobservable properties and relations, the child can only establish their function by recognizing the form when it recurs in different contexts and recognizing the commonalities between the contexts in which it recurs. Hence, difficulties in phonological processing that impact on the acquisition of phonological forms will, in turn, impact on acquisition of semantics and syntax. So will difficulties with relevant conceptual categories and relations that map onto these forms. Greater exposure might reduce the effects of such constraints, but as Paradis' review of evidence on SLI in L1 and L2 shows, these constraints transcend the type of gains that occur with increased input.

CLINICAL IMPLICATIONS

Paradis' discussion of clinical implications invites some observations about another interface: the meeting between theoretically based research and clinical practice. Her measured evaluation of research at the bilingual–SLI interface highlights the valuable contribution of her own and others' findings to the identification of SLI in bilingual children. The unexpected parallels between L2 TD and L1 SLI in the domain of morphosyntax go some way to explain why bilingual children are overrepresented in special education and SLT and why diagnosis of SLI in these children requires caution. As Paradis points out, detailed evidence of typical periods of overlap between L2 TD and L1 SLI, and timing and nature of differences, provide foundations for new guidelines, and potentially norms for assessment of L2 children, taking into account age and length of exposure to L2. This detailed evidence would not have emerged without the theoretically motivated focus on morphosyntax. For reasons outlined above, morphosyntactic production lends itself to quantitative measurement, making similarities and differences in group profiles and individual deficits more readily identifiable in expressive morphosyntax than other, less measurable aspects of language. Thus, maturational theories advancing finite morphology as a marker of SLI have made an important contribution by bringing to light subtle and informative characteristics of L2 and SLI children. Note that the clinical implications adduced by Paradis arise from

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the descriptive data generated by these theories, and it is not clear what the maturational account of the data adds to this contribution.

Theoretical explanations locating finite and nonfinite morphology within the broader process of mapping between phonology and semantics open up new avenues for assessment, identification, and potentially intervention. Because they shift the focus from outcomes to precursors of syntax, they shift the focus from assessment of children's knowledge to assessment of their processing abilities and learning potential. Recent and current research on differentiating language disorder from language disadvantage is exploring tasks that make fewer demands on knowledge and experience, and may therefore reveal underlying language capacity. These include nonword repetition, tapping skills in phonological processing, storage, and production; new word learning, tapping skills in longer term phonological storage, and/or mapping to semantics; and sentence repetition, tapping core knowledge of syntax, and morphosyntax (Campbell, Dollaghan, Needleman, & Janosky, 1997; Horton-Ikard & Ellis Weismer, 2007; Roy, Chiat, & Dodd, 2009). Investigation of performance on these processing-targeted tasks in children at the L2–SLI interface might complement findings and clinical implications arising from the rich body of research on finite morphology.

CONCLUSION

Paradis' Keynote Article has crystallized the insights gained from theoretically targeted research; her balanced discussion of alternative theoretical explanations has provided a springboard and framework for fruitful debate. From my perspective, they strengthen the case for moving beyond the polarized theories that Paradis addresses, to develop theories that embrace the demands of the mapping task children face, whether they are starting with L1, L2, TD, or SLI. By taking on board the complexity of early phonological and semantic processing and their linkage, and considering their role in the trajectory to abstract syntactic outcomes, the mapping approach opens up theoretically motivated questions and programs of research that mine the deeper seams underlying the bilingual–SLI interface, and hold promise for the development of sharper clinical assessment tools.

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Summing up problems in bilingual specific language impairment: Why multiple influences may not be additive

The Keynote Article is a very welcomed, timely, and incisive review article that examines theoretical and clinical implications of research on bilingual development and specific language impairment (SLI). Paradis provides a considered examination of the available evidence and takes into account a number of potential influencing factors. In particular, I want to commend her discussion of potential compensatory mechanisms that may play a role in bilingual development in SLI. This is often a neglected area in discussions concerning SLI. I also want to highlight that I agree wholeheartedly with her conclusion that the evidence to date "leans toward a positive attitude toward dual language learning for children with SLI who are in a supportive context for bilingualism." This message is by no means universally accepted, nor is it put into action in therapeutic contexts across the United Kingdom and Europe. There is still much debate as to what type of advice should be given to parents and what the target language or languages of therapy

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