# Child Second Language Acquisition: What Do We Know?

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## ABSTRACT

Despite the growing number of research studies in recent years, what is known about child second language acquisition (SLA) remains by and large a fraction of what is still to be known. In the present review, child SLA is defined as pertinent to both second language (L2) and sequential bilingual learners between the ages of two and twelve. Studies undertaken over the past 15 years are subdivided by paradigm (i.e., the generativists, the emergentists, the psycholinguists, and the neurocognitivists) and then thoroughly discussed. These studies are presented and critiqued in such a way that the significant holes persisting in our general understanding of child SLA will become apparent.

## INTRODUCTION

Child second language acquisition (SLA) has, in recent years, aroused an increasing amount of research interests, and not without reason. After all, beginning with the definition of what it constitutes, what we know amounts to a fraction of what we do not know. Definitions of child SLA typically follow the Critical Period Hypothesis (CPH) (Lenneberg, 1967), which postulates a temporal window of opportunity for both first and second language learners. Once bypassed, the window is thought to close, making native-like proficiency nearly impossible.

A more realistic definition, then, amounts to the establishment of an appropriate age-related range for the L2 learner. As a rule of thumb, child SLA is believed to pertain only to sequential learners who have already acquired the L1. McLaughlin (1978), in line with this logic, defines child SLA as "the sequential acquisition of two languages in childhood" (p. 99). In practice, most researchers pursuant to the CPH and the notion of sequential L1-L2 learning define precise upper and lower boundaries. Even so, there is little evidence of a consensus among child SLA researchers, which, in turn, renders such a definition elusive. Bhatia and Ritchie (1999) argue that the lower boundary should be set prior to the one-word stage, meaning that it should be as low as slightly more than one year of age. Their rationale is that many of the simultaneous bilinguals actually do not get exposed to the L2 sequentially until three years of age, a time when they have yet to fully acquire their first language (L1). Schwartz (2003) sets the lower and upper

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boundaries at four and seven years of age, respectively, based on the understanding that the latter reflects a late age of immersion, or age of acquisition (AoA), after which native-like attainment in the domain of morphosyntax is no longer possible. Gass and Selinker (2008) set the range between five and nine years of age, a period during which "the primary language is mostly settled, and before the effects from a critical or sensitive period begin to manifest themselves" (p. 123). On a somewhat different note, Lakshmanan (2009) posits a broader range that lasts from three years of age to puberty.

In an effort to provide the broadest picture possible that would address the theoretical and empirical concerns above, the present review classifies child SLA as pertaining to L2 learners as well as sequential bilingual learners between the ages of two and twelve. While a few early studies are reviewed, the focus is on the more recent studies undertaken within the past 10 to 15 years. The paper seeks to address the following questions:

(1) In what ways do the paradigms of (a) generativism, (b) emergentism, (c) psycholinguistics, and (d) neurocognitivism contribute to the current understanding of child SLA?

(2) In what ways do these paradigms complement one another in child SLA research?

## REVIEW OF THE LITERATURE

No single paradigm addresses all the issues raised by child SLA. However, each paradigm does address a unique set of concerns neglected by the others. The studies included in the present review are not intended to represent everything that is happening in the field of child SLA. What each of them does represent seminally, though, is the theoretical basis of a particular paradigm driven by its own brand of research questions. The competence-oriented generative paradigm, presented first, predates the other paradigms and also outsizes them. As can be seen below, it spawns the greatest number and breadth of child SLA studies within a single broad research perspective. The emergentist paradigm appears as a strong response to the inadequacies of its predecessor, the generative paradigm. The psycholinguistic paradigm, presented third, covers important cognitive performance issues to which the emergentists do not attend. Finally, the neurocognitive paradigm links acquisition and processing in children to brain physiology in a hitherto relatively unexplored fashion. Ultimately, the studies presented and critiqued in the present review expose significant holes that continue to endure in the general understanding of child SLA.

### The Generative Paradigm

The majority of studies in child SLA have been undertaken within the generative paradigm (Lakshmanan, 2009). The generative paradigm surfaced initially as an explicit reaction against behaviorist-inspired Contrastive Analysis (CA), widely popularized in the 1950s and early 1960s. Proponents of CA had assumed that acquisition results from experiential habit formation based on structural differences between the L2 and the L1. Chomsky (1965) founded the generative paradigm within the framework of child L1 acquisition by arguing that language knowledge has nothing to do with extrinsic habit formation and, instead, everything to do with innate, brain-based mechanisms that allow all learners to form mental representations of

morphosyntax. The mental representations were thought to be evidence of underlying linguistic competence on the part of the child learner. Dulay and Burt (1974) applied Chomsky's nativist perspective to child L2 acquisition and, specifically, to the question of the order in which particular L2 morphemes are acquired.

Dulay and Burt (1974) hypothesized that "universal innate mechanisms" (p. 37) activate creative construction in children, a process of rule-based learning founded on trial and error. To test their theory, Dulay and Burt investigated in cross-sectional fashion the order of acquisition of 11 functors: the nominative and accusative pronoun cases, indefinite and definite articles, the singular copula, *-ing*, the plural *s*, the single auxiliary, the regular past, the irregular past, the long plural, the possessive *'s*, and the third- person singular. The subjects included 60 Spanish-speaking and 55 Chinese-speaking L2 English learners, between six and eight years of age. The Bilingual Syntax Measure (BSM), consisting of cartoon-type pictures and questions, was adopted to elicit functor production. Utilizing a variety of scoring methods, Dulay and Burt argued for a universal order of L2 morpheme acquisition, and they concluded that, for child L2 English learners, creative construction proceeds identically across L1 populations.

Dulay and Burt (1974) were limited by multiple design-related factors. First, the elicited nature of the BSM implemented in an instructional setting possibly generated a biasing method effect; second, functors with different meanings, such as pronouns and articles, were grouped together artificially; third, Dulay and Burt failed to obtain a full picture of acquisition by not attending to instances of overuse; fourth, a very limited number of functors was studied; fifth, the study was cross-sectional, whereas a longitudinal approach might have been more appropriate for an examination of morpheme acquisition over time. Using a limited number of exemplars, Dulay and Burt present an early example of a top-down, theory-driven approach to child SLA in that they move directly from Chomsky's nativism, which is a conceptual hypothesis, to an empirical investigation into morpheme order, which is a specific aspect of acquisition.

More recent child SLA studies undertaken in the generative paradigm avoid some of the methodological limitations of Dulay and Burt (1974). Zdorenko and Paradis (2008) and Ionin, Zubizarreta, and Philippov (2009) refrain from grouping morphemes together artificially by focusing entirely on article acquisition; similarly, Geckin and Haznedar (2008) constrain themselves to verbal morphology acquisition. Additionally, longitudinal approaches are favored by Zdorenko and Paradis and by Geckin and Haznedar, and the question of overuse is addressed directly in all three studies. These three recent studies appear as an outgrowth of Dulay and Burt's (1974) early competence-oriented nativism, on which they are implicitly based. More precisely, though, the studies are conducted in the wake of important advances in the generative paradigm, namely Chomsky's (1981) research on Universal Grammar (UG) principles and binary parameter settings and the discovery of modular interfaces, or the relationships between disparate domains of L2 knowledge (*i.e.*, morphology, syntax, semantics, phonology, and pragmatics) (White, 2009).

Chomsky (1981) established that languages are universally characterized by parameters and that children are programmed, despite the paucity of their linguistic environment, to choose the binary setting appropriate to their L1. Among the most accepted examples is the pro-drop parameter, where, in accordance with what their respective L1s require, native speakers of English and French, two [-pro-drop] languages, opt to insert grammatical subjects into their speech, while native speakers of Spanish and Italian, two [+pro-drop] languages, elect to omit them. A second, somewhat more complex parameter consists of article choice. Article choice embeds within itself a [+article / -article] parameter and a [+definiteness / +specificity]

parameter as a function of "whether articles in a given language are distinguished on the basis of definiteness or on the basis of specificity" (Ionin, 2003). In their early years, native speakers of English first determine that their L1 features a two-article system (definite and indefinite) and, subsequently, that articles in their L1 encode definiteness rather than specificity.

Applying the article choice parameter to child L2 learners, Zdorenko and Paradis (2008) sought to verify the Fluctuation Hypothesis (FH), according to which learners of a two-article language, such as English, oscillate between the definiteness and specificity settings until they choose the correct one based on the input. A central issue was whether UG-driven fluctuation or L1 transfer prevails in article acquisition. Additionally, Zdorenko, and Paradis explored the relevance of Full Transfer / Full Access (FT / FA) (Schwartz & Sprouse, 1994), which was thought to encompass and complement the FH. According to FT / FA, the L2 learner resorts to UG knowledge only after deciding that transfer of L1 knowledge is not an option. Relying on UG, the L2 English learner would then fluctuate.

More precisely, four hypotheses were posited. First, the FH was thought to predict the misuse in [+specific, -definite] contexts by subjects from a [-article] group of L1 backgrounds (Cantonese, Japanese, Mandarin, and Korean), while members of a [+article] L1 group (Arabic, Romanian, and Spanish) were judged under FT / FA to be able to transfer their understanding of definiteness. Second, Zdorenko and Paradis (2008) supposed that, under FT / FA, only subjects from the [-article] L1 group would omit articles entirely due to L1 transfer. Third, on the basis of previous research on directionality, it was guessed that the subjects in Zdorenko and Paradis would exhibit greater accuracy in using "the" in definite contexts than in using "a" in indefinite contexts. Finally, Zdorenko and Paradis predicted that their child subjects would acquire the English articles more quickly and successfully than adults in previous studies, but that subjects from the [-article] L1 group would acquire less article knowledge than subjects from the [+article] group. 17 child L2 English learners based in Canada and aged between 4;2 and 6;9 at the outset of data collection were tested. Data collected every six months over a two-year period included elicited oral descriptions of picture books featuring coherent narratives that unfolded along sequential sets of line drawings.

The results were mixed. As expected, subjects displayed greater accuracy with the definite article than with the indefinite article, and they appeared to acquire English articles more quickly and successfully than adults in previous studies, even though the rate of acquisition disparity between subjects from the [-article] and [+article] L1 groups was not as great as predicted. More importantly, however, contrary to predictions regarding FT / FA, it was established that [+article] subjects failed to transfer their L1 knowledge of definiteness and thus misused "the" as frequently as [-article] subjects. Zdorenko and Paradis (2008) raised the possibility that the misuse by subjects from the [+article] L1 group reflected transfer of the surface morphology of definiteness without the underlying semantics, indicative of a possible morphology and semantics interface. Finally, Zdorenko and Paradis claimed that the more frequent occurrence of article omission by subjects from the [-article] L1 group than subjects from the [+article] L1 group had little to do with the FH, as FT / FA was disproved.

Ionin, Zubizarreta, and Philippov (2009) addressed two issues raised in Zdorenko and Paradis (2008): 1) whether the overuse in [+specific, –definite] contexts could, with older children, result from non-UG-based learning strategies that lead to explicit knowledge; and 2) whether the lack of overuse in [+specific, +definite] contexts could have occurred due to a task

effect that masked either the importance of fluctuation for L2 English learners of all ages or the use of learning strategies, or both. To address these issues, Ionin *et al.,* (2009) asked whether child and adult L2 English learners from a single [-article] L1 (Russian) background commit the same overuse errors with "the" and "a." It was hypothesized that if learning strategies were involved, they would impact both definite and indefinite article use.

26 university students and fifty-eight school children, aged between 10 and 12 years, were tested. The children had between four and nine years of exposure to English at the time of testing. For the purpose of comparing child L2 learners to adult L2 learners within a single L1 population, a control group of 12 adult and 11 child L1 English speakers also was tested. Ionin *et al.,* (2009) adopted a written elicitation test of English article use for all subjects. The test featured 60 short dialogues, including 24 items targeting articles, among which were six items for each of four contexts: [+definite, +specific], [+definite, -specific], [-definite, +specific], and [-definite, -specific]. The adult L2 learners also completed a cloze L2 proficiency test.

Specificity was found to impact most of the child and adult subjects, the L1 Russian speakers more than the control group, and it was shown to reflect complex phenomena occurring in the L2 English learners' mental systems. With statistical analysis, Ionin *et al.,* (2009) uncovered distinct performance patterns between the L1 Russian-speaking children and adults with respect to specificity. It was concluded that the children's errors probably resulted from an ambiguous interaction between fluctuation and learning strategies, but that the adults' errors were due solely to explicit strategies. The most important potential limitation, according to Zdorenko and Paradis (2008) and Ionin *et al.,* (2009) would be the theoretical underpinning of the article choice parameter. Specificity, in particular, seems non-grammatical in nature; if so, it would be incompatible with definiteness as a binary setting. A more adequate theoretical model, then, should be considered. An additional limitation to Ionin *et al.,* (2009) might be the absence of naturalistic data to reinforce the findings from the elicited database.

Moving from parameters to interfaces, internal interfaces involve only those modules within the grammar of the child L2 learner's interlanguage. As a mental representation of the L2 grammar, the interlanguage exists strictly inside the learner's mind and is located between the actual L1 and the actual L2. Along with morphology, the modules relevant to internal interfaces of the type mentioned above in connection with Zdorenko and Paradis (2008) consist of syntax, phonology, and semantics. Geckin and Haznedar (2008) questioned the impact of the morphology and syntax interface on verbal morphology production. The following two hypotheses were investigated in an effort to discover which one applied: 1) the Failed Functional Features Hypothesis (FFFH), whereby errors in morphology result from an underlying deficit in the domain of functional syntactic categories and reflect the morphology and syntax interface, and 2) the Missing Surface Inflection Hypothesis (MSIH), whereby morphology errors reflect, not so much a permanent impairment in the L2 grammar, but rather a mapping conflict between overt morphology and the expression of phonological exponents.

Geckin and Haznedar (2008) studied three female L1 Turkish speakers, aged 4;5, who were exposed to English for approximately 6 hours per day over the year preceding the onset of the seven-month data collection period. The data were gathered three or four times per month from individual conversations with the researchers covering the subjects' friends, family, and school. The data were coded for four morphological elements in obligatory contexts: (1) the copula *be*; (2) subject-verb agreement involving the third-person singular *s*; (3) irregular and regular tense marking; and (4) overt subjects and nominative subject pronouns.

Geckin and Haznedar (2008) found that the copula *be* (along with overt subjects and

nominative subject pronouns) was consistently supplied correctly throughout the data collection period, in the past as well as the present tense. The suppliance in obligatory contexts by all three subjects of the third-person singular *s* and tense marking, however, occurred inconsistently and was characterized by significant backsliding throughout data collection. Significantly, however, the instances of overuse were rare, which indicates the intactness of the L2 grammar. It was claimed that the MSIH prevailed over the FFFH and the morphology and syntax interface. Geckin and Haznedar's findings should be interpreted with caution, nevertheless, because of the limited number of subjects and forms.

In addition to Geckin and Haznedar, Unsworth (2004) investigated the impact of the syntax and semantics interface on the acquisition of object scrambling in a comparative study of adult L1 English speakers learning Dutch as an L2. On the basis of surrounding context, phonological stress, and the definiteness or indefiniteness of the object, speakers of certain verb-final languages such as Dutch have the option of scrambling a direct object or of moving it toward the end of a sentence. For example:

> *Willem heft* [*de bal*]$_i$ *twee keer* $t_i$ *gegooid*.
> William has the ball two times thrown.
> *William threw the ball twice.* (Unsworth, 2004, p. 174).

Unsworth (2004) will not be reviewed in detail here, though, because of space constraints and because almost twice as many adults as children were included in the testing, 20 and 13, respectively. Nevertheless, it is noted that Unsworth (2004) did uncover a significant role for the syntax and semantics interface, as well as for L1 transfer, for both groups. Hopefully more and different types of internal interfaces, particularly ones involving phonology, will be examined in future child SLA studies.

In addition to internal interfaces, there exists the phenomenon of external interfaces entailing a module outside the grammar, such as pragmatics, "not part of the computational system" (White, 2009, p. 51) operated by the learner. External interfaces unfortunately have received little attention in child SLA. In a study involving a young simultaneous bilingual Turkish-English child, Haznedar (2010) discovered that cross-linguistic influence occurs precisely at the syntax and pragmatics interface. It remains to be seen if this finding can be replicated with sequential bilingual children.

Certainly the generative paradigm addresses an important piece of the puzzle of child SLA: the role of the learner's competence, *i.e.*, the accuracy of the learner's mental representations of the L2 grammar. It is important to credit the generative paradigm with heightening researchers' awareness of the limitations of CA, namely, the fact that it failed to explain certain widespread errors and that it predicted other errors that did not occur in actuality (Gass & Selinker, 2008). Finally, the recent work on interfaces offers significant insights and possible productive avenues for further exploration of the modular makeup of the child L2 learner's interlanguage.

Nevertheless, strict adherents to the generative paradigm face major hurdles. Their exclusively nativist, competence-based perspective sometimes leads them, unfortunately, to neglect other major factors. For example, the role of input is often given too little consideration in generativist research, as are performance-based questions relating to the learner's dynamic mental processor. The emergentist paradigm attempts to fill these gaps, and its disparate proponents typically find themselves united in their strong opposition to the generative

paradigm.

## The Emergentist Paradigm

Emergentists typically emphasize either input-related factors, such as type and token frequencies, or processor-related factors, namely, the cognitive interface between the learner's efficiency-driven mental processor and working memory. O'Grady, Lee, and Kwak (2009) insist upon the mutually complementary relationship between these two strands: loyalists of each strand assume the validity of the other strand. emergentist studies in child SLA are far fewer in number than studies in the generative paradigm; nonetheless, the emergentist literature that does exist is essential to researchers' efforts to solve the child SLA puzzle.

In a study emblematic of input-driven emergentism, Paradis, Nicoladis, Crago, and Genesee (2010) sought to apply usage-based (UB) theory to past tense acquisition by French-English bilingual children aged between 4;1 and 5;7. Acquisition sequences and rates, according to UB theory supporters, depend directly upon type and token frequency in the input. Paradis *et al.,,* (2010) asked: (1) whether French-English bilinguals are less accurate in their past tense production than French-speaking monolinguals; (2) whether the language of greater exposure at home impacts bilinguals' accuracy in each language; and (3) whether regular past tense accuracy exceeds irregular past tense accuracy in both languages and whether this difference correlates with differential exposure to either language. 23 French-English monolinguals, based in Edmonton, Canada and aged between 4;1 and 5;7, were recruited. Of the 23 bilingual subjects, 13 were simultaneous bilinguals, and 10 were sequential bilinguals. Also tested were 21 French monolingual children, based in Montreal and aged between 3;7 and 5;4. A parental questionnaire was adopted to determine language exposure in the home. Through picture description-based past tense elicitation tasks, Paradis *et al.,* (2010) targeted ten regular and eight irregular English verbs and eight regular and eleven irregular French verbs.

Results were generally consistent with UB theory. The bilingual subjects displayed less past tense accuracy than their monolingual peers, consistent with less exposure to L2 input; home exposure to French and English was determined to be a statistically significant frequency factor; finally, regular past tense accuracy was found to exceed irregular past tense accuracy in both languages, and this difference was established to correlate with differential exposure. Despite the largely confirmatory findings, Paradis *et al.,* (2010) noted a degree of inconclusiveness. First, there was a lack of difference between the bilingual and the monolingual subjects' accuracy with respect to the regular past tense in French, whereas UB theory normally would predict greater accuracy for the monolinguals due to exposure to an L1 with elevated type and token frequency for regular verbs. Second, Paradis *et al.,* (2010) discovered few bilingual-monolingual differences in the bilingual's language of greater exposure. In light of the discrepancies, it was acknowledged that bilingual acquisition encompassed more than the input.

Paradis *et al.,* (2010) can be critiqued in several regards. First, UB theory itself is problematic because often input has been established to play an indirect trigger role in SLA, rather than direct. Moreover, the application of UB theory to French-English bilinguals might lack coherence, given that UB theory just as strongly seems to predict ease of acquisition of regular French verbs for French-English bilinguals as it does greater accuracy for monolinguals because of frequency of exposure. Second, the generalizability of their findings to child SLA is in question, because fewer than half the bilingual child subjects were sequential L2 learners. Additionally, a number of questions relating to the simultaneous bilinguals' dominant language at

home and mental capacities in both languages remain unaddressed. Ultimately, it appears necessary to acknowledge the likelihood that child L2 acquisition depends on direct triggers other than frequent context-dependent input, and in future replications of Paradis *et al.,* it would be useful to recruit only sequential bilingual children.

Representing the processor-based strand of Emergentism, Mellow (2006) considered the longitudinal emergence of relative clauses (RCs) in the L2 production of a single 12-year-old L1 Spanish speaker learning L2 English. The subject was described as having had modest English skills as a result of foreign language (EFL) instruction in her home country and also as having acquired "moderate receptive abilities, but more limited productive abilities" (Mellow, 2006, p. 654).

Mellow (2006) investigated whether the emergence of the subject's RCs corresponded to the following three hypotheses: (1) RC acquisition is item-based, in that it is triggered directly by a small number of tokens in the input that eventually lead to the production and processing of a vast quantity and diversity of types; (2) RC acquisition is related directly to likely input frequency patterns; and (3) RC acquisition is compositional, in that it depends both on "the aggregate processability of their [the RCs'] formal and functional components," and on "the cumulative ordering that results from the developmental interrelations of the component forms and functions within each network" (Mellow, 2006, p. 647). Subject RCs, which place only a modest cognitive burden on efficiency-driven processors because of the lack of intervening words between the subject and verb, were thought to be less difficult to acquire and produce than adverbial and direct object RCs, both of which involve more intervening words. Bare direct object RCs were believed to present the greatest cognitive burden because they lack a relativizer. It was assumed, in connection with the compositional hypothesis, that RC types of greater processing complexity would emerge later and less frequently than types that placed a lighter burden on the processor.

Collected on a bi-weekly basis over a seven-month period, the data included written summaries of wordless picture books featuring child-friendly themes. The subject was given the opportunity to view each picture book with her mother days before completing each summary, and the writings were preceded and followed by brief informal conversations with an interlocutor about the picture books. The results generally supported the hypothesis that RC acquisition is item-based, and it was found that the emergence pattern of the subject's RC types followed the predicted hierarchy of processing difficulty; however, discrepancies arose as to whether RC acquisition was entirely compositional or linked strongly to likely input frequency patterns. Mellow (2006) himself acknowledged the limitation posed by his case study approach, observing also that his subject's RC production does not necessarily correspond to strict universal patterns.

It also should be remarked that the subject's RC production was perhaps facilitated by priming effects that might have derived from previous EFL instruction and also from exposure to the picture books and conversations about them in the L2 about, prior to summarizing them. Finally, little detail is provided about the subject's proficiency level or L2 AoA. Nevertheless, it can be assumed from the above-cited description of her background that proficiency probably was low-intermediate at best, and that her L2 AoA was relatively late (significantly > 7 years of age). As such, a potential priming effect, along with maturational factors and the subject's attentional resources and developmental readiness, none of which was discussed by Mellow (2006), possibly contributed as much to her RC production as the RCs themselves.

The emergentist paradigm clearly raises important pieces of the child SLA puzzle not attended to by the generative paradigm. Even in the face of methodological limitations and a lack

of generalizability, L2 input and the performance of the child learner's mental processor were found to be possible significant factors in acquisition. Broader performative issues concerning memory, storage, and the allocation of attentional resources, though, are left unaddressed by the emergentist paradigm, as is transfer, one of the classic problems of SLA. The studies reviewed below and undertaken from the perspective of the psycholinguistic paradigm contribute to the general understanding of child SLA by precisely covering these questions.

## The Psycholinguistic Paradigm

Although data-driven and descriptive in nature, in contrast to the vast majority of studies critiqued in the present review, Hakuta (1976) and Rescorla and Okuda (1984) appear as early precursors of more recent psycholinguistic studies to the extent that the child learner's cognitive performance surfaces as a focus of the discussion. Hakuta (1976) focused on the acquisition of three forms by his daughter Uguishu: the indefinite article, the catenative *be gonna*, and *wh*-clauses. Uguishu's naturalistic speech was observed and collected biweekly over a sixty-week period, extending from the ages of 5;4 to 6;5, and obligatory occasion analyses were conducted. Acquisition was found to be slow and marked by fluctuation, such as backsliding and other cognitive processes in which the subject appeared to be matching her speech either to the input or to related linguistic forms within her own interlanguage. As a case study, Hakuta (1976) lacks generalizability. Furthermore, like Dulay and Burt (1974), Hakuta (1976) is limited by the relative paucity of forms tested and by a failure to consider instances of overuse. Still, Hakuta (1976) manages to capture the connection between the learner's mental performance and the dynamic nature of acquisition.

Additionally, Rescorla and Okuda (1984) reported a comparative eleven-week investigation into the vocabulary acquisition of a single 5-year-old L1 Japanese learner of L2 English who had recently relocated to the United States. Data included Okuda's language diary of the subject's vocabulary acquisition, one-on-one interactions between Rescorla and the subject audiotaped on a weekly basis, and spontaneous play sessions between the subject and a native English-speaking peer. Based on the data collected, several contrasts were drawn between the subject's L2 vocabulary acquisition and L1 acquisition by native English-speaking children. Rescorla and Okuda (1984) concluded that their subject's vocabulary acquisition proceeded more rapidly, featured fewer nominals and more pronouns, modifiers, and verbs than the peer's. Additionally, the subject was found not to engage in overextensions or in overcategorizing as frequently as very young L1 English-speaking children. The mental activity of the child L2 learner is thus shown to lead to a relatively high level of cognitive maturity in comparison to that of L1 speaking counterparts.

An early example of a psycholinguistic approach in the domain of phonology appears in Winitz, Gillespie, and Starcev (1995), who investigated the Silent Period Hypothesis (SPH). The silent period previously had been observed in preschool L2 learners (Newmark, 1981; Scovel, 1981), during which subjects were found to remain silent in the earliest (4 to 6-month) phase of their speech development in order to "store accurately in auditory memory the canonical phonological units and phonotactic principles of the second language" (Winitz *et al.,*, 1995, p. 119). A single seven-year-old L1 Polish speaker learning L2 English was observed in his school environment over a six-year period. Winitz *et al.,* (1995) attributed their subject's early L2 speech development to the silent period. It remains to be seen if their findings can be replicated in a larger population of child L2 learners with varied L1 backgrounds. It also would be

interesting to recruit L2 learners whose AoA < 7, which Birdsong (1999) characterizes as early learning, in order to re-confirm the developmental SP for less mature learners in a variety of settings.

A more recent psycholinguistic child SLA study occurs in Anderson (2004), who examined the L1 / L2 knowledge relationship in phonology acquisition by five early L2 English learners aged between 3;9 and 4;9 at the outset of data collection. Of the five subjects, three were L1 Korean speakers, one spoke L1 Russian, and one spoke L1 French. Collected at three, four, or five monthly or bi-monthly intervals, depending on the subject, data included the pronunciation of target words in the L2 and in the respective L1s. Elicited by means of a picture description task, the words targeted singleton consonants and consonant clusters in the L2 and the L1. The data indicated that the subjects' L1 and L2 deep phonological knowledge systems were stored separately, but that the early stages of L2 phonology acquisition were nevertheless marked by L1 transfer at the articulatory level. The relatively small number of subjects and the inconsistencies characteristic of the data collection in Anderson (2004), however, conceivably limited the study's reliability. It would be helpful to replicate Anderson (2004) with more subjects and a more systematic data collection across subjects.

Another more prominent example of a psycholinguistic approach in child SLA is offered in Kwon and Han (2008), who investigated both substratum transfer from the L1 to the L2 and reverse transfer from the L2 to the L1 in a single L1 Korean speaker learning L2 English, aged 3;6 at the outset of the study. Kwon and Han (2008) based themselves conceptually on Foster-Cohen's (2001) Sliding Window model, whereby the cognitive development of the L2 learner's knowledge is best understood as an ongoing process marked more by continuities than by discrete discontinuities, both from the period of childhood into adulthood and within childhood.

Kwon and Han (2008) asked if transfer occurs at all and, if so, what type, and whether a relationship exists between transfer and changes that affect the L1 and L2 systems over time. Three morphosyntactic features were targeted because of the challenges they pose, each due to their different realizations in the L1 Korean and L2 English: negation, the regular plural, and the possessive. Naturalistic data on the subject's L2 and L1 production were collected over three phases, during which time instances of L1 and L2 use were recorded: Silent period (1) from March, 2003 until June, 2004, during which time the subject had first started living in the United States, was exposed to English in pre-kindergarten and kindergarten, and spoke Korean at home; 2) from July, 2004 through August, 2004, during which time the subject returned to Korea and communicated predominantly in her L1; and 3) from September, 2004 until April, 2005, by which time the subject had returned to the United States, where her dominant language inside and outside the home were again, respectively, the L1 and the L2.

Transfer in different directions was found to occur for each of the three features. Regarding negation, the subject was observed to follow developmental patterns through various stages of production that led Kwon and Han (2008) to argue for evidence of substratum transfer and reverse transfer in Phase 1. Concerning the regular plural, Kwon and Han (2008) uncovered patterns of development that revealed evidence of reverse transfer in Phase 3. Finally, with respect to the possessive, Kwon and Han (2008) claimed evidence of substratum transfer throughout the data collection. Significantly, with respect to possible relationships between transfer and changes in the L1 and the L2, direct correlations were found between substratum transfer and L1 dominance, on the one hand, and reverse transfer and L2 dominance, on the other hand.

Generalizability of the results could be in question because of the case study approach.

Kwon and Han (2008) themselves acknowledged this issue: "For one thing, the linguistic environments and the changes therein that [the subject] experienced may not be generalizable to those of many child learners, not to mention potential differences on many other fronts, such as cognitive capabilities" (p. 325). Moreover, given the exclusively naturalistic database, as Kwon and Han (2008) acknowledged, it is difficult to disentangle L1 and L2 behavioral changes from cognitive ones. A possible solution to the problem would be to vary the database by obtaining elicited samples of language production in tandem with naturalistic ones (Kwon & Han, 2008). Despite methodological limitations in the studies critiqued above, the psycholinguistic paradigm delves further into the child L2 learner's mental activity than do the generative and the emergentist paradigms. Nevertheless, it leaves untouched the question of neural physiology, namely, the issue of what changes in brain activity during acquisition reveal about the learner's psycholinguistic processes and, more generally, about the success of acquisition.

## The Neurocognitive Paradigm

Research questions posed within the neurocognitive paradigm tend to address relationships between brain anatomy and the psycholinguistic aspects of L2 / L1 acquisition, i.e., comparisons of L1 and L2 neurological representations, sometimes as a reflection of processing, storage capacity, and cognitive workload in each language. The convergence hypothesis (CH) holds that overlapping substrates are activated during L1 and L2 processing and that proficiency is the principle variable, i.e., higher L2 proficiency predicts greater similarity between neurological representations, and lower proficiency predicts greater activation during L2 processing than during L1 processing. In contrast, the divergence hypothesis (DH) holds that different substrates are activated, depending on AoA and learning modality, where an AoA of > 7 years and a traditional instruction setting predict, again, greater activation during L2 processing than during L1 processing. In the two studies reviewed below, proficiency is the most significant independent variable.

Xue, Dong, Jin, Zhang, and Wang (2004) tested 12 late, low-proficiency L1 Chinese-speaking L2 English learners, aged between 10 and 12 years. The authors adopted a block design semantic decision task requiring subjects to judge the semantic relatedness of forty pairs of single-character Chinese words and forty pairs of monosyllabic English words. Pairs in the L1 and the L2 were presented on a computer screen for 2,500 milliseconds (ms) in alternation and separated by 500-ms periods of a blank screen. Half the pairs in both languages were semantically related, and the data were coded for accuracy and patterns of neural activation.

Xue *et al.,* (2004) determined that the L1 pairs were processed more quickly and more accurately than the L2 pairs. Brain imaging led to the finding that the neural activation patterns in the left inferior prefrontal cortex, the left parietal lobule, and the left fusiform cortex were similar for L1 and L2 processing. It was argued that proficiency effectively predicts the degree to which neurological representation of the L1 resembles that of the L2. It should be noted that their conclusion lends support neither to the CH nor to the DH. Additionally, the findings should be interpreted with caution, since they cannot be generalized across proficiency levels.

Mondt *et al.,* (2009) focused explicitly on the CH in their testing of sixteen sequential bilinguals based in Belgium and aged between 7;5 and 11;0, almost half of whom were learning an L3 in school (French, English, Italian, or Dutch). Of the 16 subjects, seven were L1 French

speakers learning L2 Dutch, and six were L1 Dutch speakers learning L2 French. Two of the three remaining subjects were L1 Dutch speakers learning either L2 English or L2 Portuguese. The third remaining subject was tested in her L1 French and her L3 Dutch, as she had acquired her L2 Spanish before 3 years of age. Mondt *et al.,* (2009) divided the subjects into two groups: (1) an early (E) bilingual group consisting of eleven subjects, whose L2 AoA was slightly > 3, and who were learning their L2 at home; and (2) an early-late (EL) bilingual group consisting of five subjects, whose L2 AoA was significantly > 3 but still < 7, and who were learning their L2 or L3 at school. Of the 11 subjects in the E group, four were low proficiency (LP) L2 users, one was a moderate proficiency (MP) L2 user, and six were high proficiency (HP) L2 users; of the five subjects in the EL group, three were LP L2 users, and the other two were an MP L3 user and an HP L2 user. Subjects in the E group acquired their L2 at home, whereas subjects in the EL group utilized their L1 at home and acquired their L2 at school.

As in Xue *et al.,* (2004), a block design was adopted. Data collection entailed three conditions repeated in five blocks: (1) the control task of passive viewing of a non-figurative drawing; (2) covert reading of nonsense words, which eventually was discarded from the analysis; and (3) the experimental task of coverting verb generations from visually presented nouns. Each task contained thirty stimuli, fifteen in each of the two languages represented by the participants' L1 and L2 or L3 backgrounds. Subjects encountered six stimuli per condition, each of which was viewed for 4,250 ms with a 750-ms interstimulus interval. The nouns for the third condition were chosen on the basis of their high frequency of occurrence in the languages represented.

Findings supported the CH except in two major instances. First, few differences in L1 and L2 neurological representations were found across the LP L2 users in both experimental groups, whereas the CH typically predicts that significant differences will be found for LP users and that the differences will diminish inversely to increasing proficiency in the L2. Second, important differences were discovered for the HP user (L1 Dutch-L2 French) in the EL group, whereas the CH posits that no such differences should exist at this proficiency level, regardless of learning mode or AoA. More precisely, and in contrast both to the CH and to the DH, it was established that during L1 processing, the HP users in the EL group displayed activation in the right ventrolateral prefrontal cortex, in the dorsal motor area, in the superior temporal gyrus, and in the left median frontal area, whereas no such activation occurred during L2 processing. Mondt *et al.,* (2009) argued that the second discrepancy reflected unexpected active inhibitions in the above-noted four regions during L2 processing. The inhibitions were believed to have resulted from increases in the L1 processing workload due to the subject's status as a somewhat late (AoA = 6 years) sequential HP bilingual undergoing immersion in the instructional setting. Mondt *et al.,* (2009) essentially implied that the HP EL subject's L1 attentional resources were depleted as a consequence of the conditions under which his L2 learning occurred.

There is little discussion as to the first discrepancy, although it seems plausible that the covert verb generation condition may have strained the LP subjects' L2 attentional resources, and it might have required more than what their developmental readiness allowed. If so, neural activation during L2 processing by the LP subjects could have been inhibited. It remains to be seen what could have been established if the experimental condition had been designed as a simpler semantic decision task, as in Xue *et al.,* (2004). With regard to the second discrepancy (and also to the first), typological differences between the subject's L1 and L2 might also have been a contributing factor. These are empirical questions that require further investigation.

Additionally, the role played by L3 learning seems unclear. As for the first discrepancy, one of the LP EL subjects was an L3 Italian learner, and, concerning the second discrepancy, the HP EL subject was an L1 French, L2 Dutch, and L3 English learner. Whether L3 learning impacted L2 attentional resources remains undetermined. More generally, the principle variable of proficiency seems confounded with AoA and learning mode, raising a methodological issue that could have been avoided if the study had been designed to verify only the CH or the DH. In the former case, proficiency could have been varied and the AoA and learning mode kept constant; conversely, in the latter case, the AoA and learning mode could have been varied and proficiency could have remained constant. In either case, keeping L3 learning out of the design might also provide clarification.

Generally, the neurocognitive paradigm is in its infancy, having appeared in the child SLA literature only in the past two decades. Much work remains to be done on the connection between brain physiology and L2 acquisition, particularly in the area of child SLA. Furthermore, the CH and DH seem somewhat problematic from a theoretical standpoint, due to their failure to take more than one or two factors into account. Proponents of the CH concern themselves with proficiency level, leaving AoA aside, whereas the DH supporters consider AoA and learning modality at the expense of proficiency. The likely reality is that proficiency, AoA, and learning modality all contribute to varying unknown degrees to the crucial relationship between neural activity and the L2 acquisition process. More robust theories and more reliable experimental designs are needed to uncover it.

## DISCUSSION

The present review has as its purpose the goal of articulating what is known about child SLA, what remains to be understood and why these areas of uncertainty matter, and how a full understanding of child SLA might advance the field of SLA in general. The paradigm-based approach to child SLA literature above brings into relief researchers' collective awareness of some of the factors behind the acquisition process. It seems probable that, in accordance with the generative paradigm, the child L2 learner, to a certain degree, draws on innate language competence, which manifests itself in certain cases through creative construction and in other cases through correct parameter settings and the successful negotiation of modular interfaces. It also appears that, in addition to competence, and as emergentists would argue, L2 input plays an important role, as does the performance of the learner's dynamic mental processor. The learner's development is impacted by memory, which is itself affected by substratum transfer and reverse transfer, according to the psycholinguistic paradigm. Neurocognitive studies have shown that processing in the L2 sometimes differs from processing in the L1 and that these differences, as evidenced by brain imaging, display themselves in comparisons of children's L1 and L2 neural activation patterns.

What remains unknown is the extent to which a child L2 learner's innate competence determines acquisition, *i.e.*, whether and to what degree the impact of competence on acquisition outweighs the impact on acquisition of input, transfer, and the learner's mental processor and memory. In short, we recognize the pieces, but we still are uncertain as to how they fit together, which is the key to solving any puzzle, including that of child SLA. It seems important to focus on the connections between these factors in order to arrive at a fuller understanding of child SLA. In general, such knowledge would advance the field of SLA in that it might "bring new empirical evidence to bear upon questions being debated within linguistic theory, child L1

acquisition (monolingual and bilingual) and adult L2 acquisition" (Lakshmanan, 2009, p. 380), areas all either within or directly pertinent to SLA.

## CONCLUSION

The findings in the above-reviewed studies help identify the major factors in child SLA; however, they reveal little about the relationships between them. The findings, in most cases, lack generalizability, due to empirical design flaws, or issues with the theoretical models on which the studies are based, or both. To return to a theme articulated at the beginning of the present review, what we know in child SLA amounts to a fraction of what we do not know. A need for further research along at least five distinct avenues exists.

First, addressing theoretical questions seems important, particularly in the neurocognitive paradigm, where, in the CH and DH models, proficiency or AoA is taken into account at the expense of the another. Of the four paradigms covered, the neurocognitive paradigm is the youngest, having emerged only in the past two decades, and it appears accordingly ripe with opportunities for further research. Second, early and later child SLA research primarily addresses morphosyntax. Much uncertainty regarding morphosyntax endures in the generative, Emergentist, and psycholinguistic paradigms, and reliable replications involving large samples of sequential bilingual children are necessary. Third, it would be useful to undertake studies from a variety of theoretical perspectives in domains other than morphosyntax, notably phonology and the lexicon. Fourth, with rare exception, the L2 studied is English, when it would seem vital to work with a range of L2s from different language families in order to achieve a greater degree of generalizability. Fifth, in most of the above-reviewed studies, a single source consisting either of naturalistic or elicited data is adopted for the database. Kwon and Han (2008), though, embrace the value of enriching the database with both sources, where possible, to fortify conclusions. These possible research directions are not meant to be exhaustive, but they provide a starting point from which to continue efforts to solve the puzzle of child SLA.

What remains unknown is the extent to which a child L2 learner's innate competence determines acquisition – that is, whether and to what degree the impact of competence on acquisition outweighs the impact on acquisition of input, transfer, and the learner's mental processor and memory. In short, we know the pieces, but we still are uncertain as to how they fit with each other, the key to solving any puzzle, including that of child SLA. It seems important to focus on the connections between the factors in order to arrive at a fuller understanding of child SLA. In general such knowledge would advance the field of SLA in that it might "bring new empirical evidence to bear upon questions being debated within linguistic theory, child L1 acquisition (monolingual and bilingual) and adult L2 acquisition" (Lakshmanan, 2009, p. 380), areas all either within or directly pertinent to SLA.

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## REFERENCES

Anderson, R. (2004). Phonological acquisition in pre-schoolers learning in a second language via immersion: A longitudinal study. *Clinical Linguistics and Phonology, 18*, 183-210.

Bhatia, T., & Ritchie, W. (1999). The bilingual child: Some issues and perspectives. In T. Bhatia & W. Ritchie (Eds.), *Handbook of child language acquisition* (pp. 569-643). San Diego, CA: Academic Press.

Birdsong, D. (1999). *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Lawrence Erlbaum.

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

Chomsky, N. (1981). *Lectures on government and binding*. Dordrecht, The Netherlands: Foris.

Dulay, H. C., & Burt, M. K. (1974). Natural sequences and child second language acquisition. *Language Learning, 24*, 37-53.

Foster-Cohen, S. First language acquisition…second language acquisition: What's Hecuba to him or he to Hecuba? *Second Language Research, 17*, 329-344.

Gass, S. & Selinker, L. (2008). *Second language acquisition: An introductory course* (3rd Ed.). New York: Routledge.

Geçkin, V, & Haznedar, B. (2008). The morphology/syntax interface in child L2 acquisition: Evidence from verbal morphology. In B. Haznedar & E. Gavruseva (Eds.), Current trends in child second language acquisition: A generative perspective (pp. 237-267). Philadelphia: John Benjamins.

Hakuta, K. (1976). A case study of a Japanese child learning English as a second language. *Language Learning, 26*, 321-351.

Haznedar, B. (2010). Transfer at the syntax-pragmatics interface: Pronominal subjects in bilingual Turkish. *Second Language Research, 26*, 355-378.

Ionin, T. (2003). Article semantics in second language acquisition [Abstract]. Ph.D. dissertation, MIT. [Distributed by *MITWPL*.]

Ionin, T., Zubizrreta, M., & Philippov, V. (2009). Acquisition of article semantics by child and adult L2-English learners. *Bilingualism: Language and Cognition, 12*, 337-361.

Kwon, E. Y., & Han, Z-H. (2008). Language transfer in child SLA: A longitudinal case study of a

sequential bilingual. In J. Philp, R. Oliver & A. Mackey (Eds.), Second language acquisition and the younger learner: Child's play? (pp. 303-332). Amsterdam: John Benjamins.

Lakshmanan, U. (2009). Child second language acquisition. In W.C. Ritchie & T. K. Bahtia (Eds.), The new handbook of second language acquisition (pp. 377-399). Bingley: Emerald Group.

Lenneberg, E. H. (1967). *Biological foundations of language*. New York: John Wiley & Sons.

McLaughlin, B. (1978). *Second language acquisition in childhood.* Hillsdale, NJ: Erlbaum.

Mellow, J. D. (2006). The emergence of second language syntax: A case study of the acquisition of relative clauses. *Applied Linguistics, 27*, 645-670.

Mondt, K., Balériaux, D., Metens, T., Paquier, P., Van de Craen, P., Van den Noort, M., & Denolin, V. (2009). An fMRI 00study of level of proficiency as a predictor of neurocognitive convergence for L1/L2 during a lexicosemantic task in in a pediatric population. *Second Language Research, 25*, 107-134.

Newmark, L. (1981). Participatory observation: How to succeed in language learning. In H. Winitz (Ed.), The comprehension approach to foreign language instruction. Rowley, MA: Newbury House.

O'Grady, W., Lee, M., & Kwak, H-Y. (2009). Emergentism and second language acquisition. In W.C. Ritchie & T.K. Bahtia (Eds.), *The new handbook of second language acquisition* (pp. 69-88). Bingley: Emerald Group.

Paradis, J., Nicoladis, E., Crago, M., & Genesee, F. (2010). Bilingual children's acquisition of the past tense: a usage-based approach. *Journal of Child Language, 38*, 554-578.

Rescorla, L., & Okuda, S. (1984). Lexical development in second language acquisition: Initial stages in a Japanese child's learning of English. *Journal of Child Language, 11*, 689-695.

Schwartz, B. D. (2003). Why child L2 acquisition? In J. van Kampen & S. Baauw (Eds.), Proceedings of GALA 2003 (Vol. 1, pp. 47-66). Utrecht: Netherlands Graduate School of Linguistics.

Schwartz, B. D., & Sprouse, R. (1994). Word order and nominative case in non-native language acquisition: A longitudinal study of (L1 Turkish) German interlanguage. In T. Hoekstra and B. D. Schwartz (Eds.), Language Acquisition Studies in Generative Grammar: Papers in Honor of Kenneth Wexler from the 1991 GLOW Workshops (pp. 317-368). Amsterdam: John Benjamins.

Scovel, T. (1981). The recognition of foreign accents in English and its implications for psycholinguistic theories of acquisition. In Proceedings of the 5th Congress of L'Association Internationale de Linguistique Appliquée (pp. 389-400). Québec: Les Presses de L'Université de Laval.

Unsworth, S. (2004). On the syntax-semantics interface in Dutch: Adult and child L2 acquisition compared. *IRAL, 42*, 173-187.

White, L. (2009). Grammatical theory: Interfaces and L2 knowledge. In W.C. Ritchie & T.K. Bahtia (Eds.). *The new handbook of second language acquisition* (pp. 49-68). Bingley: Emerald Group.

Winitz, H., Gillespie, B., & Starcev, J. (1995). The development of English speech patterns of a 7-year-old Polish-speaking child. *Journal of Abnormal and Social Psychology, 24*, 117-143.

Xue, G., Dong, Q., Jin, Z., Zhang, L., & Wang, Y. (2004). An fMRI study with semantic access

in low proficiency second language learners. *NeuroReport, 15*, 791-796.

Zdorenko, T., & Paradis, J. (2008). The acquisition of articles in child second language English: Fluctuation, transfer or both? *Second Language Research, 24*, 227-250.