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## **ATTENTION, AWARENESS, AND INDIVIDUAL DIFFERENCES IN LANGUAGE LEARNING**

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### **Abstract**

The Noticing Hypothesis—an hypothesis that input does not become intake for language learning unless it is noticed, that is, consciously registered (Schmidt, 1990, 2001)—has been around now for about two decades and continues to generate experimental studies, suggestions for L2 pedagogy, conference papers and controversy. To many people, the idea that SLA is largely driven by what learners pay attention to and become aware of in target language input seems the essence of common sense. In the simplest terms, people learn about the things that they pay attention to and do not learn much about the things they do not attend to. Others consider the hypothesis to be undesirably vague, lacking in empirical support, or incompatible with well-grounded theories. In this talk I will review the evidence for the hypothesis, as well the major objections that have been raised against it, paying particular attention to learner characteristics such as motivation, aptitude, and language learning history that affect what learners notice and become aware of when processing L2 input.

### **1. Introduction**

The Noticing Hypothesis—an hypothesis that input does not become intake for language learning unless it is noticed, that is, consciously registered (Schmidt, 1990, 2001)—has been around now for about two decades and continues to generate experimental studies, suggestions for L2 pedagogy, and controversy. To many people, the idea that SLA is largely driven by what learners pay attention to and become aware of in target language input seems the essence of common sense. In the simplest terms, people learn about the things that they attend to and do not learn much about the things they do not attend to. Others consider the hypothesis to be undesirably vague, lacking in empirical support, or incompatible with well-grounded theories. In this paper I will review some of the evidence for the hypothesis, as well the major objections that have been raised against it from a variety of perspectives: linguistic, psychological, sociocultural, and philosophical. I will conclude the discussion by considering the role of individual differences in noticing and awareness and the ways that these may interact in the process of second language acquisition.

## **2. Origins of the Noticing Hypothesis and Evidence for It**

In the 1980s, the dominant theories of language and of SLA overwhelmingly emphasized the unconscious nature of linguistic knowledge and unconscious processes of learning. Two case studies that I carried out in those years led me to question those assumptions. The first was a case study of an adult naturalistic (uninstructed) learner of English, an artist from Japan who immigrated to the U.S. at age 30 for a mix of personal and professional reasons, to whom I gave the pseudonym “Wes” and whose acquisition of English I documented over a period of several years (Schmidt, 1983, 1984). Wes was a remarkably good learner of English in many ways. His pronunciation was good from the beginning, and he developed quickly along the dimensions of fluency, lexical development, listening comprehension, conversational ability, pragmatic appropriateness, and especially strategic competence, the ability to get his message across in spite of the limitations of his interlanguage. If language is seen as a medium of communication, as a tool for initiating, maintaining and regulating relationships and carrying on the business of life, then Wes was (and has continued to be) a very successful language learner. Looking at Wes through a sociocognitive lens, seeing language as social practice to accomplish social action and viewing SLA as alignment, fitting oneself to one’s environment, mediated and scaffolded by various actors and structures (Atkinson, 2010) also allows us to see Wes as a very good learner. His development in the area of grammar—morphology and syntax—was very limited, however. I did not know and still do not know the reasons for this for sure, but one possible explanation may be that he didn’t care much for the small grammatical details of

language. Or perhaps he just didn't notice them. For example, after several years of exposure he continued to say things like *Yesterday I'm go beach* and *Tomorrow I'm go beach* (with no articles, no prepositions, and no tense marking), even though he surely heard people say things like *I went to the beach yesterday*, but apparently without registering the forms. In other cases, it seemed that he probably did notice grammatical forms in input and tried to figure them out, but his guesses were often inaccurate. For example, after some time I became aware that he never produced any utterances with the English possessive pronoun *our*, and eventually realized that this was not because of egocentrism or a fondness for the English word *my*, but simply because he did not know the form. Instead, he would say things like *We are come back here early, we are apartment* apparently meaning "We came back early to our apartment." My best guess is that this resulted from a mis-identification by Wes of *their* (as in *their apartment*) as "they are" and *your* (as in *your apartment*) as "you are" — therefore, *we are* meaning "our," an analysis supported by the fact that he also said things like *she's name* (meaning "her name") and *your friend is house* ("your friend's house"). More generally, looking nine English grammatical morphemes and taking 80% correct as a criterion for acquisition, I found that none moved from unacquired to acquired status in three years of observation. In trying to understand why Wes had such persistent problems with grammar (morphology, specifically), it seemed to me that affective factors such as motivation were probably not the answer. Indeed, his very good development in overall communicative competence seemed a reflection of his strong drive to communicate, coupled with a gregarious personality and willingness to take risks in speaking and learning. To explain why Wes did not develop much morphology, therefore, I considered two main possibilities: lack of aptitude and over-reliance on an implicit learning strategy, learning through interaction alone, with little attention to language form and little conscious reflection about language structure. I concluded by proposing that, at least in the case of adult learning of grammar, wholly unconscious learning of a language is probably not possible. Because "adults do seem to have lost the still mysterious ability of children to acquire the grammatical forms of language while apparently not paying attention to them" (Schmidt, 1983: 172), some level of conscious attention to form is required.

The second case study concerned my own learning of Portuguese during a five month stay in Brazil (Schmidt & Frota, 1986). I took a class for five weeks, and the rest of my language learning was through interaction with native speakers. The results of this study indicated that classroom instruction was very useful, but presence and frequency in communicative input were more important. In addition, based on comparisons among notes that I kept in a journal, records of what I was taught in class, and monthly tape-recordings of my developing L2 production and interaction abilities, Frota and I found that some forms that

were frequent in input were still not acquired until they were consciously noticed in the input. This was the origin of the Noticing Hypothesis, the claim that learner must attend to and notice linguistic features of the input that they are exposed to if those forms are to become intake for learning. In addition, we found that although I was frequently corrected for my grammatical errors in conversation with native speakers, in many cases this had no effect because I was unaware that I was being corrected. This suggested a slightly different hypothesis that we called “noticing the gap,” the idea that in order to overcome errors, learners must make conscious comparisons between their own output and target language input.

Subsequently I attempted to flesh out these descriptions and informal proposals by matching them with the psychological literature on conscious vs. unconscious learning, which turned out to be a complicated matter, with several different but partly overlapping distinctions in the psychological literature. Reviewing the literature up to the end of the 1980s, I framed the issues in terms of consciousness as intention, consciousness as attention, and consciousness as awareness (Schmidt, 1990), putting forth some claims about each. Consciousness as intention is reflected in the distinction between *incidental* learning, referring to the fact that people can learn things without having any particular intention to learn them, vs. *intentional* (goal-directed) learning. Incidental learning is certainly possible and often effective. The classic example is the fact that we learn most vocabulary through reading, although our goal in reading is usually understanding and enjoyment, not vocabulary acquisition. However, the facilitative effect of focused attention on stimulus detection is “all but undisputed” (Roehr, 2008: 83), and deliberately paying attention may be necessary in some cases, for example, when L2 learners fail to notice cues that are not salient or failing to notice cues that need to be processed differently from the way they are in the L1 (Ellis, 2006, 2008).

Consciousness as attention (whether intentional or not), then, seems to be heart of the matter, but like many psychological constructs based initially on common experience, attention does not refer to a single mechanism but to a variety of mechanisms or subsystems, including alertness, orientation, detection within selective attention, facilitation, and inhibition (Schmidt, 2001; Tomlin & Villa, 1994). What these have in common is the function of controlling information processing and behavior when existing skills and routines are inadequate. Learning, establishing new or modified knowledge, memory, skills, and routines is therefore largely, and perhaps exclusively, a side effect of attended processing. Still, the question of whether *all* learning requires attention remains problematic, and conceptual and methodological issues have combined to make a definitive answer elusive, even after a century of psychological experimentation. Some psychologists have expressed

the opinion that this dispute will never be settled, because zero-point questions are not answerable (Baars, 1988). Baars argues that the important question is not whether there can be any learning without attention and conscious involvement (unanswerable) but rather whether more attention results in more learning. There does not appear to be any evidence at all against the weaker claim that people learn about the things they attend to and learn much less about the things they do not attend to (Logan, Taylor, & Etherton, 1996). Logan, Taylor and Etherton have also proposed a much more controversial hypothesis, that only those stimulus attributes that are attended in processing are encoded. This suggests that attention must be directed to whatever evidence is relevant for a particular learning domain, i.e. that attention must be specifically focused and not just global. In order to acquire phonology, one must attend to the sounds of target language input, especially those that are contrastive in the target language, and if one's goal is to sound like a native speaker, one must attend to phonetic details as well. In order to acquire vocabulary one must attend to both word form (pronunciation, spelling) and to whatever cues are available in input that can lead to identification of meaning. In order to acquire pragmatics, one must attend to both the linguistic form of utterances and the relevant social and contextual features with which they are associated. In order to acquire morphology, one must attend to both the forms of morphemes and their meanings, and in order to acquire syntax one must attend to the order of words and the meanings they are associated with.

The role played by consciousness as awareness in SLA is most controversial. On the one hand, awareness and attention are closely linked—what we are aware of is what we attend to, and what we attend to determines what enters phenomenal consciousness (Baars, 1988)—so if attention is required for learning then perhaps awareness is as well. On the other hand, awareness of abstract rules of grammar cannot be a prerequisite for learning, since native speakers have some intuitive understanding of subtle points of grammar that they cannot verbalize, and some advanced naturalistic L2 learners also have intuitive knowledge that is closer to native speaker intuitions than to the simplified “rules” that are taught in language classes (Rothman, 2008). In psychology, the usual term for this is implicit knowledge, knowledge that is acquired without conscious effort to learn, without awareness that learning has occurred, and without the ability to describe the acquired information (Reber, 1993). The solution I proposed (Schmidt, 1990, 2001) was to distinguish between “noticing” as a technical term limited to the conscious registration of attended specific instances of language, and “understanding,” a higher level of awareness that includes generalizations across instances. Knowledge of rules and metalinguistic awareness of all kinds belong to this higher level of awareness. My proposal is that noticing is necessary for SLA, and that understanding is facilitative but not required.

These notions are in wide circulation, do not belong to me, and surface (not always with the same definitions) in numerous accounts of SLA in the past few decades, including but not limited to the exploration of basic issues of implicit and explicit learning in SLA (Hulstijn, 2003, 2005; N. Ellis, 1994, 2005, 2006, 2008; Robinson, 1995a, 1995b, 1996, 2002); relationships between explicit/implicit learning and explicit/implicit teaching (R. Ellis, 2001, 2005; Ellis, Basturkmen, & Loewen, 2001; Thornbury, 1997); Swain's (1995) incorporation of the concepts of noticing and noticing the gap into a sociocultural model of learning; VanPatten's (1996, 2004) proposals for input processing instruction; Long's (1996) revised interaction hypothesis and the focus on form literature (Doughty, 2001; Doughty & Williams, 1998; Long & Robinson, 1998); and Gass & Mackey's (2006) model of input, interaction and learning.

Most empirical studies have been supportive of the Noticing Hypothesis. For example, using a clever crossword puzzle task to manipulate the focus of learners' attention when exposed to instances of Spanish stem-changing verbs, Leow (1997, 2000) found that those who exhibited a higher level of awareness ("understanding") learned the most; those who noticed instances but attempted no generalization learned next most; and there was no learning in the absence of noticing instances. Mackey (2006) used multiple measures of noticing and development to investigate whether feedback promotes noticing of L2 forms in a classroom context and whether there is a relationship between learners' reports of noticing and learning outcomes. The findings of this study were that learners reported more noticing when feedback was provided, and learners who exhibited more noticing developed more than those who exhibited less noticing. Izumi (2002) conducted an experimental study to compare the effects of output and enhanced input on noticing and development. Izumi found that subjects demonstrated more noticing and more learning than did controls, and that enhanced input subjects exhibited more noticing but not more learning.

The claim that "noticing" but not "understanding" is required for learning implies that both explicit and implicit learning of generalizations are possible. In the case of explicit learning, attended and noticed instances become the basis for explicit hypothesis formation and testing. Implicit learning is also hypothesized to depend on attended instances in the input, but generalization beyond the instance is held to depend on a basic human learning mechanism that automatically detects regularities across instances, resulting in an intuitive form of knowledge that goes beyond what can be verbalized. Experimental evidence for implicit second language learning, in this sense of learning generalizations without awareness and without the ability to express them, is actually quite limited. Ellis (1993) failed to find implicit learning effects in a task designed to promote the learning of a Welsh soft-mutation rule, and DeKeyser (1995) found no implicit learning in an experiment involving a miniature

artificial language with rich inflectional morphology. In the classic miniature artificial grammar learning experiments in psychology (“sentences” in these experiments consisting of meaningless strings of letters), participants learn implicitly in the sense of being able to judge the acceptability of untrained items without being able to verbalize the rules the researcher used to generate the sentences, but the current consensus is not that subjects internalize the rules and abstract structure of the grammar, as originally believed; rather, people pick up lower-level knowledge about permissible chunks, repetitions, alternations, and so on that allow above chance performance (Schmidt, 1994, 1995; Williams, 2009). As Williams (2009) points out, to date very few language studies have even attempted to establish that implicit knowledge was acquired in the absence of awareness, so it is somewhat surprising that many SLA scholars assert that implicit learning is the default mechanism in adult SLA (Long, 2010; Ortega, 2009). However, Williams points out that “the term *implicit learning* is often simply used to refer to a mode of learning that is incidental and inductive ... even if the implicitness of the resulting knowledge was not actually established” (Williams, 2009, p. 327). If the question is just whether incidental inductive learning is possible, well yes, of course it is, although some learners do better at this than others. Implicit learning is also sometimes defined simply as uninstructed learning, “learning without the benefit of rule explanation” (Ortega, 2009, p. 157). Of course, it is also possible to learn without instruction, but that does not mean that the learning takes place without awareness (self-instruction) at the point of learning. However, more recently, evidence of implicit learning in the sense of learning without awareness has come from experiments in statistical learning, an approach that sees acquisition as the unselective and passive absorption of statistical regularities in the environment, for example, the transitional probabilities between phonetic units or syllables in speech, which leads to the discovery of phonemes and words (Kuhl, 2004). The dominant interpretation of these studies is that people unconsciously tally these probabilities (Ellis, 2006), and since subjects have no sense of doing so, the learning is unconscious in that sense.

### **3. Major Challenges and Objections to the Noticing Hypothesis**

Although the Noticing Hypothesis has generated interest and support from many in the fields of both SLA and language teaching (implications for teaching are beyond the scope of this paper), it has also encountered some strong objections. For reasons of space, here I will only summarize some of the more important objections, together with my responses.

Objection 1: The temporal granularity of diary studies is too coarse. This objection was raised early on, in a critique of the Noticing Hypothesis (Tomlin & Villa, 1994) that was sympathetic to the proposition that attention is essential for learning, but argued that diary

studies encompass spans of time as long as weeks or months, while attentional processes take place in seconds or microseconds. Response: the criticism was valid at the time —although one could also argue that a weakness of laboratory studies in SLA is that language learning in the real world takes place over days, months, and years— but is not any longer, since a wide range of methods have been brought to bear on these issues, including retrospective reports, stimulated recall, and online measures such as note-taking, think-aloud protocols, and the fine-grained analysis of eye-movements when reading (Godfroid, 2010; Godfroid, Housen, & Boers, 2010).

Objection 2: Attention/awareness may be necessary for some kinds of learning but not others. Gass (1997) has countered the claim that attention is a necessary condition for all learning with the observation that some learning does not even depend on input. Citing studies showing that ESL learners who are instructed on one type of relative clause perform well on other types of relatives that are higher in the relative clause accessibility hierarchy, Gass points out that input on those constructions was not available to the learners in the study and asks, “If no input existed, how could attention to input be a necessary condition for all aspects of learning” (p. 16). Response: the Noticing Hypothesis needs to be more carefully formulated. The basic claim is that in order for input to become intake it must be attended and noticed. If there are true cases where input is not needed for learning (which is attributed instead to UG or some other internal resource), the Noticing Hypothesis is irrelevant rather than wrong. A somewhat different version of the argument that not all learning requires attention has been formulated by Schachter: “... although I (among many others) am perfectly willing to agree that learning individual words (the lexicon), individual sounds (the phonetic inventory), and writing systems must be via attentional focus, I am not the least willing to say that learning phonological, morphological and syntactic rules requires this attentional focus” (Schachter, 1998, p. 574). Response: although some implicit learning studies have claimed that some forms of learning do not require attention, the bulk of the evidence supports the opposite conclusion, that no learning occurs in these experiments without attention (Perruchet & Pacton, 2006). However, it is certainly true that some kinds of learning require more focused attention than others. For example, in statistical learning experiments participants are able to learn dependencies between adjacent stimuli (analogous to phoneme identification and word segmentation) easily, while learning non-adjacent dependencies (more analogous to syntax) is more difficult and seems to depend on whether the separated items can be brought into adjacency through attentional processes (Perruchet & Pacton, 2006; Williams, 2009).

Objection 3: Of the three functional subsystems of attention (alertness, orientation, detection), detection is crucial, but detection does not require awareness (Tomlin and Villa,

1994). Response: although it is true that detection (registration of a stimulus) can occur below the level of subjective awareness, this is generally the case only for already established representations, that is, while there is subliminal perception, there is no subliminal learning (Schmidt, 1995, 2001). However, Williams (2005) has reported a very interesting experiment examining the learning of form-meaning connections under conditions where the relevant forms (determiners) were attended and noticed but the contingencies (whether the head noun was animate or inanimate) was not. During the training, some participants became aware of this contingency, and performed nearly perfectly on a post-test with new items. Other subjects seem to remain completely unaware of the conditioning factor but still exhibited a small but statistically significant animacy bias in their responses. Even though it cannot be conclusively claimed that these subjects had no awareness whatsoever at the point of learning, and although both an earlier experiment by Williams (2004) and a recent replication study by Hama and Leow (2010) failed to find evidence of learning without awareness, Williams' findings are interesting and intriguing, suggesting that "implicit learning of form-meaning connections is possible, at least in principle" (p. 298). Williams' finding that implicit learning in these experiments was correlated with participants' prior knowledge of languages with grammatical gender is equally intriguing, suggesting that prior experience in language learning may play a role in implicit learning.

Objection 4: Attention to environmental stimuli does not play a direct role in acquisition because most of what constitutes linguistic knowledge is not in the input to begin with. This objection has been most elegantly expressed by Carroll (2006a, 2006b), who points out problems associated with the idea that "input" for language learning is something objective and observable in the environment, whereas in reality the stuff of acquisition (phonemes, syllables, morphemes, nouns, verbs, cases, etc.) consists of mental constructs that exist in the mind and not in the environment at all. If not present in the external environment, there is no possibility of noticing them. This argument is framed within a more general stance, common to many generativists, that acquisition is "not mediated by conscious awareness, explicit instruction, feedback, or correction" (Carroll, 2006a, p. 17). Similar arguments have been made by Truscott (1998) and by Schwartz (1993), who suggest that noticing is related to metalinguistic knowledge but not to linguistic knowledge (competence), to "learning" but not to "acquisition" in Krashen's (1981) sense. Response: In general, ideas about attention, noticing, and understanding are more compatible with instance-based, construction-based and usage-based theories (Bley-Vroman, 2009; Bybee & Eddington, 2006; Goldberg, 1995) than with generative theories. Bybee (2010), arguing for exemplar-based representations of language, comments that what learners experience is specific instances or tokens of constructions. Similar tokens (repeated occurrences) are mapped

together to establish exemplars, which according to Bybee are “rich memory representations ... [containing] at least potentially, all the information a language user can perceive in a linguistic experience” (Bybee, 2010, p. 14), including phonetic detail, lexical items, their meanings, properties of the physical and social context, even sometimes voice quality (Ibid, p. 21). These exemplars are subsequently grouped together to form categories that represent both fixed and open slots in constructions. This suggests a role for both “noticing,” in the registration of exemplars (because rich memory representations require extended attentional processing), and both explicit (aware) and implicit (unaware) processes of generalization as constructions acquire more abstract meaning. In addition, nowadays even some generativists find an important role for noticing, explicit learning and form-focused instruction in SLA, especially for the learning of functional morphology, increasingly identified as the “bottleneck” in SLA. Ladiere (2009) proposes that the basis for detectability of both interpretable and uninterpretable features in SLA (as defined by the Minimalist Program of the generative paradigm) is the noticing of any formal contrast, such as the difference between *student-students*. “In other words, the learner will associate a difference in a minimally contrasting form with some difference in meaning or grammatical function and construct some sort of representation for it” (p. 214). Slabakova (2008) goes further, endorsing a return to explicit grammar practice in the language classroom, and suggesting that practicing inflectional morphology “should happen in meaningful, plausible sentences where the syntactic effects and the semantic import of the morphology is absolutely transparent and non-ambiguous” (p. 281).

In summary, none of these objections to the Noticing Hypothesis can be easily dismissed and some clearly have merit. Some forms of learning do require more focused attention and higher levels of awareness than others. For example, a considerable amount of learning has to take place before learners can successfully segment the stream of speech into words that can be noticed by the learner. In this case the input stream is clearly attended, but whether one subscribes to an account of this learning that stresses an innate rich inventory of potential cues (Carroll, 2006a) or one that proposes a non-language specific ability to compute statistical probabilities across instances, most of the learning will be thought of as unconscious (Perruchet & Pacton, 2006). One can mount a similar argument, that attention is necessary but awareness is not, for the gradual learning of other sequential phenomena, including the recognition of common collocations and semantic valence phenomena such as the fact that the English verb *cause* is more commonly associated with negative outcomes than positive ones (Onnis, Farmer, Baroni, Christiansen, & Spivey, 2008). On the other hand, to the best of my knowledge, no study has ever shown that people learn better in dual task conditions than in single task conditions, or that ignoring grammatical forms in input results

in better learning outcomes than noticing forms and forming hypotheses about them. Indeed, explicit knowledge (whether gained through instruction or through conscious induction) should have mostly positive influences on learning through exposure and interaction, since “learning with advance organizers and clues is always better than learning without cues” (MacWhinney, 1997, p. 278). In addition, since many learners who rely on learning through interaction and exposure alone fail to come close to native-like norms of grammatical accuracy (as in Wes’ case), there remains more than sufficient reason to hypothesize that individual differences in the degree to which learners pay attention to and notice grammatical features of the input may partly account for their relative success in this aspect of language learning.

#### **4. Individual Differences in Noticing and Awareness**

Do some second language learners notice more than others? If so, do individual differences in noticing ability correlate with rate of learning and/or ultimate attainment? The evidence from case studies suggests that the answer is yes to both questions. A comparison of Wes with another well-known language learner, “Julie,” a native speaker of English who emigrated to Cairo at the age of 21 when she married Egyptian, is instructive. As reported by Ioup, Boustagui, El-Tigi and Moselle (1994), who studied Julie’s acquisition of Arabic after 26 years of exposure, Julie is a purely naturalistic learner who has had no formal instruction in Arabic. Like Wes, she obtained abundant comprehensible input and is socially outgoing. Like him, she also has good pronunciation and excellent communicative skills. Unlike Wes, however, she displays native-like grammatical competence in her second language, not only passing as a native speaker in everyday life but performing at native-like or near native-like levels on grammaticality judgment tests that tap intuitions on some of the most remote properties of the language. Why has Wes acquired English grammar so slowly, while Julie acquired Arabic grammar rapidly and essentially perfectly? Many of my students, after reading my detailed report of Wes’ personality, motivation, daily life and accomplishments in language learning, comment that he probably did not acquire a lot of grammar because he didn’t need to, the grammatical trimmings being mostly unnecessary for communicative interaction. However, the idea that people learn just what they need to learn doesn’t hold up well to the evidence. Wes’ grammatical competence in English is not really adequate for all his needs, a fact he is well aware of, and Julie’s accomplishments go well beyond any argument from need.

In my description of Wes’ learning and Ioup et al.’s discussion of Julie’s learning we find a number of candidates for differences that may have made the difference. From the

beginning, Julie kept a copybook that she filled with notes, lists of verbs, nouns and adjectives, and observations about gender, number and person. I never observed Wes doing anything similar and although he owned an English-Japanese dictionary he told me that he seldom if ever consulted it. Julie reported that consciously manipulated the grammatical structure of the language, paid attention to morphological variation, and kept careful track of corrections and expanded repetitions from native speakers and greatly appreciated the feedback. Wes, in contrast, has never appreciated being corrected. One of the things I have admired about him is his attitude that if native speakers don't understand him, it's as much their fault as his and they need to try harder, but this attitude may not be ideal for language learning. In their analysis of the reasons for Julie's success, Ioup et al. identify two factors that they believe were decisive: attention to form, and innate talent. They conclude, as I did when analyzing Wes' linguistic development, that "adults, unlike children, appear to require conscious attention to grammatical form" (p. 93). But even with attention to form, most L2 learners do not achieve native-like proficiency, and Ioup et al. note that Julie reported having all the traits associated with the "Geschwind cluster," identified in a study of another exceptionally talented language learner, "C. J." who was studied by Novoa, Fein, and Obler (1988), including left-handedness, allergies and a family history of twinning.

For the rest of us—for whom twins, allergies, left-handedness, and exceptional talent for languages may not run in our families—there are still likely to be differences in both inclination and abilities that affect what we notice (Godfroid, 2010) and what we learn. Consider motivation. Virtually everyone would agree that motivated learners learn more (all else being equal) than unmotivated learners. But why? How does motivation work? What is the mechanism? It seems to me that there are two somewhat competing accounts. Motivation may act as part of an affective filter that prevents input from reaching that part of the brain where the language acquisition device (by some accounts, more-or-less equivalent to the human capacity for implicit learning) is located, as Krashen (1985) proposes. Or, motivation may be viewed as something much less passive, as Gardner (1988) would have it: motivated learners are successful because they are active learners. Gardner proposes that motivated learners learn better than unmotivated ones because they pay attention more and selectively attend to morphosyntactic information, not only content information. Paying attention results in more noticing, and motivated learners may also try harder and more persistently to understand the significance of noticed language, achieving higher levels of awareness and enhanced learning as a result. Tremblay and Gardner (1995), arguing that models of motivation can be improved by the identification of mediators that explain why one variable effects another, proposed that three motivational behaviors mediate between distant factors such as language attitudes and motivation and achievement: effort, persistence, and attention.

Other studies (e.g. MacIntyre & Noels, 1996; Schmidt, Boraie & Kassabgy, 1996) have found links between motivation and learning strategies, particularly cognitive and metacognitive strategies, which are either strategies for focusing attention on some aspect of the target language or for sustaining attention while doing something else in addition: inferencing, looking for patterns, or monitoring —paying attention to output, as well as one's progress in learning.

As for aptitude, various theories have proposed different relationships among aptitude, noticing, and SLA. According to one account, the fundamental difference between first language acquisition and adult language learning, is that child first language acquisition depends on implicit learning, which is unaffected by differences in aptitude, while adult language learning depends more on explicit learning, which is affected by aptitude (Bley-Vroman, 1989; Krashen, 1981; Reber, 1993). A different account has been proposed by Robinson (1995b, 2002), who argues that for adults aptitude will matter across all conditions of learning (implicit, explicit, incidental) because the same basic cognitive abilities (including noticing and rehearsal) are involved in all learning.

Recent studies have produced significant evidence that aptitude, noticing and learning are indeed linked, even if the patterns among components of aptitude and learning outcomes in different studies have been quite variable (Ortega, 2009; Skehan, 1998). Mackey, Philp, Egi, Fujii and Tatsumi (2002) reported relationships between individual differences in working memory, hypothesized to be a component of language aptitude and the noticing of interactional feedback (recasts). It has been suggested, in fact, that the name “working memory” may be a misnomer, and that a more appropriate label may be “working attention” (Baddeley, 1993). In a larger scale study of L1 Spanish learners of Swedish, Abrahamsson and Hyltenstam (2008) reported small yet significant aptitude effects in child SLA, and very large effects for adult SLA, confirming the hypothesis proposed by DeKeyser (2000) that a high degree of language aptitude is required if adults are to reach near-native proficiency. In this study, language aptitude was measured by a battery of tests assessing phonetic memory, lexical-morphological analytic skills, aural memory, and the ability to form sound-symbol associations. Abrahamsson and Hyltenstam also comment that an outstanding characteristic of their two highest proficiency participants was an unusual interest and devotion to language structure and language learning: “Their professional lives have provided them with extraordinary opportunities to reflect consciously and explicitly on the linguistic structure of Swedish, which has made it possible for them ... to beat the predictions of the critical period hypothesis” (p. 502). For example, their participant with the highest score on their proficiency measures had lived in Spain, France, Ireland, and Sweden, studied German, English, Latin, and Italian as foreign languages, worked professionally for 10 years as an

interpreter, and described herself as very communicative, linguistically observant, sometimes preferring to listen to the linguistic structure rather than the content when someone speaks beautifully.

It would seem that most of these cases of very successful learners illustrate the use of explicit modes of learning to compensate for age-related declines in implicit learning abilities. However, to the degree that noticing is hypothesized to also be involved in at least some kinds of implicit learning (Perruchet & Pacton, 2006), it is possible that individual differences in implicit learning abilities may exist and that these are also related to noticing. Research on individual differences in implicit and statistical learning is in its infancy but appears promising. Although it is generally thought that individual differences in implicit learning are minor compared to differences in explicit learning ability (Reber, 1993; Stanovich, 2009), Hoyer and Lincourt (1998) have reported age-related declines in the efficiency of instance learning; and Feeney, Howard and Howard (2002) have demonstrated age-related deficits in implicit learning of higher order sequences. These studies concerned differences between middle aged and elderly people compared with college students, but among younger populations as well, some recent research has shown that implicit learning is an ability with meaningful individual differences that may be linked to language processing and language learning. In a study of English 16-17 year olds, Kaufman, DeYoung, Gray, Jiménez, Brown and Mackintosh (2010) investigated associations between individual differences in implicit learning (measured by a probabilistic sequence learning task) with a variety of cognitive and personality variables. In this study, implicit learning was found to be related to two components of psychometric intelligence (verbal analogical reasoning and processing speed) as well as performance on French and German foreign language exams. In another recent study, Misyak and Christiansen (in press) investigated the relationship between individual differences in statistical learning and language comprehension. Participants were administered statistical learning tasks involving adjacent and nonadjacent dependencies, along with a language comprehension task and a battery of other measures assessing verbal working memory, short-term memory, vocabulary, reading experience, cognitive motivation, and fluid intelligence. Strong relationships were found among statistical learning, verbal working memory, and language comprehension, establishing an empirical link between individual differences in statistical learning and (L1) language processing.

## **5. Conclusions**

Attention and noticing (the subjective correlate of attention) are crucial concepts for understanding second and foreign language learning. As Baars (1997) puts it, "Paying

attention – becoming conscious of some material – seems to be the sovereign remedy for learning anything ... It is the universal solvent of the mind” (Baars 1997, P. 304). For SLA, the allocation of attention is the pivotal point at which learner external factors (including the complexity and distributional characteristics of input, the discoursal and interactional context, instructional treatment, and task characteristics) and learner internal factors (including motivation, aptitude, learning styles and strategies, current L2 knowledge and processing ability) come together. What happens then within attentional space largely determines the course of language development, including the growth of knowledge (establishment of new representations) and the development of fluency (access to those representations). Evidence continues to accumulate that noticing has a strong impact on second and foreign language learning. Individual differences are an important part of the story, and both inclinations and abilities affect who notices what. Aptitude for explicit learning plays a role in overcoming age-related weaknesses in implicit learning. Much remains to be done to relate “noticing” to related constructs such as cognitive style, depth of processing, self-regulation, and executive attention. Individual differences in implicit learning ability also seem to exist. These have hardly begun to be explored, but this is a promising area for future research, which could also profitably include a research plan to identify the ways that both explicit and implicit learning ability are affected by life histories and literacy (Bigelow, Delmas, Hansen, & Tarone, 2006), and multilingualism.

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