Language Aptitude in Young Learners: The Elementary Modern Language Aptitude Test in Spanish and Catalan

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LANGUAGE APTITUDE IN YOUNG LEARNERS: THE ELEMENTARY MODERN LANGUAGE APTITUDE TEST IN SPANISH AND CATALAN

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CHAPTER 1: APTITUDE AS AN INDIVIDUAL DIFFERENCE IN LANGUAGE ACQUISITION

1.1. Introduction

It is no wonder that there exists a vast array of individual learner variables which have been proved to have an influence on learning outcomes and failures in mastering a second or foreign language (L2/FL)[1]. As it happens in FL acquisition (henceforth SLA), the process of acquiring a first language (L1) is also influenced by individual variables. However, although individual differences (IDs) in L1 verbal ability exist, all children are capable of acquiring their mother tongue unless a disability prevents them from so doing. This is not the case, though, of FL learning, as FL learners may never succeed in their endeavour to reach a native-like level of competence. Several variables have been suggested to play a role in this often quasi, yet rarely complete, mastery of a FL. However, much research is needed that clearly explains how these IDs interact in the FL learning process and how they also work in a different way depending on the method of teaching instruction FL learners are following or in which context (either formal or informal) learners are.

The present chapter begins by presenting how the cognitive development of children and adolescents is related to L1 acquisition processes. This allows us to have a general framework to refer to when dealing with milestones in L1 acquisition in middle childhood and puberty, milestones that could also affect the acquisition of a foreign language. In section 1.2.2, the reader will find an overview of ID research in both L1 and FL acquisition from a psycholinguistic perspective.

Then, the chapter sets out to give a detailed account of FL aptitude as the ID that plays the most important role in FL acquisition along with motivation (section 1.3). In the second place, the different components of language aptitude will be presented separately and in relation with information-processing accounts of SLA and learning styles (section 1.4). This distinction is of use when it comes to explaining the possible different types of FL learner profiles (section 1.5).

[1] In this dissertation, unless specified, Second Language Acquisition (SLA) is used to refer to the acquisition of a foreign language (i.e. FL/L2 learning in school/formal settings), not to the acquisition of a second language in informal environments (L2). In the literature review, “FL” and “L2” will be used as they are used in the papers mentioned.

The remainder of this chapter examines the relationship between aptitude and other factors related to FL language learning, giving special attention to those which are relevant to the current dissertation. Thus, in section 1.6.1, the reader will find different perspectives as to whether aptitude is innate and stable or, on the contrary, it can be trained, and what the effect of one's L1 skills is on FL aptitude is. In sections 1.6.2 and 1.6.3, the differences between aptitude in young learners and aptitude in adults are explored as regards not only age, but also the language learning context and implicit and explicit learning). Sex is also an ID considered in this dissertation (section 1.6.4), as there is the lay belief that females are better language learners but they do not appear to outstand in all the FL learning aspects, so perhaps their salience could be due to the status of their aptitude to learn a FL and/or how "apt" they are in some aptitude components. In the same way that females are thought to be better FL learners than males, so are bi- or multilinguals. Bilingualism and its positive and negative effects in relation to FL learning and aptitude are the issue dealt with in section 1.6.5. This section finishes with a brief mention to how aptitude interacts with intelligence (section 1.6.6.1) and to how some individuals have stood out because of their talent or lack thereof to learn a FL in spite of their (under)developed cognitive state.

1.2. First and Second / Foreign Language Acquisition

First and subsequent languages develop following very similar routes. However, what necessarily distinguishes them is that whereas the L1 is acquired while the individual experiences development at many other levels, L2(s) acquisition may start later, once the person has already grown up. In this section, different perspectives of cognitive development and the stages of which it consists are presented and related to one's L1 acquisition stages, highlighting two related aspects: L1 metalinguistic awareness and becoming literate. These are the topics dealt with in section 1.2.1.

Another aspect that makes L1 acquisition different from SLA is how IDs affect both processes, which is the topic of section 1.2.2. While it is unquestionable that IDs are determinant in SLA and may even hamper the success in FL learning — since everybody, given the right exposure, can acquire an L1—, IDs are seldom considered in relation to one's L1. However, IDs in L1 should not be left aside, as the right development of one's L1 may also be determinant in the acquisition of additional languages.

1.2.1. Cognitive development and L1 acquisition

In first language acquisition research, nativists defend the idea that language develops thanks to the language acquisition device (LAD) (N. Chomsky, 1965), which is a system of principles that allows language to develop innately, independent of the capacities underpinning broader cognitive development. Developmentalists, in contrast, consider language acquisition as more dependent on the learning mechanisms that underpin general cognition. From this perspective, language development is believed to be closely related to cognitive development. The cognitive developmental phases through which children and adolescents go and which reflect on language acquisition have been investigated from several theoretical perspectives.

One well-known division of cognitive developmental stages is Piaget's (e.g. Piaget, 1937, 1960, 1975, 1983; Piaget & Inhelder, 1955, 1966), which was once very popular and later on questioned or adapted to the latest trends in the research into cognitive development. For Piaget and his colleagues, children go through four main periods or stages: the sensory motor period (0-2 years), the pre-operational period (from 2 to 6-7 years), the concrete operational period (from 7-8 to 11-12 years) and the formal operational period (from 12 years on). These stages are established on the basis of the organisation and adaptation children apply to the information they receive. The concept of constructivism is fundamental within this framework. Depending on the developmental stage at which they are, children will assimilate and accommodate the information in one way or another to make it fit in their cognitive structure. Therefore, in front of any information or situation, a 6-year-old child will necessarily react in a way that would be different if he or she was 8 or 10 years old.

Young learners go through two developmental stages as defined by Piaget. These are the concrete operational and the formal operational stages. The concrete operational stage consists of several substages. The first one covers the period from around 6 to 8. During these years, from their egocentric perspective, children start being able to arrange things in series according to some set criterion and to notice invariance in numbers as well as in raw liquid or solid materials when these undergo some change. When children are 9, entering the second substage of this concrete operational stage, the sense of egocentrism they had in the previous stage disappears completely. This period lasts until the age of 10, approximately. Then, children are able to detect conservation and invariance in mass and surface extension and begin grasping the sense of reversibility, combinability and reciprocity in groups of objects, relations or dimensions. In the third period of the concrete operational stage, from 9-10

to 11-12 years of age, consolidation of the previous substage takes place. During these years, children become able to establish infralogical relations with time and space variables and to grasp the law of horizontality in liquids, meaning that when their shape changes, their volume or mass does not, as the amount of liquid stays the same.

In early adolescence, from 11-12 to 13-14, boys and girls start being able to think in abstract terms, to elaborate hypotheses, and to reason about propositions that cannot be contrasted with reality or in which they do not believe yet. It is then when formal reasoning or hypothetical/scientific understanding arises, so preadolescents enter the formal operational stage, the main feature of which is the ability of dealing with abstractions which are separated from reality. When facing a given problem, in the first substage of this formal operational stage, 11- to 12-year-old children begin working on a general theory that includes all the factors that could have an effect on a solution to this problem, and then they start deducing specific hypotheses from these factors about what may occur in this specific situation. Having done so, pre-adolescents test these hypotheses to see which ones are applicable in the real world by making use of their analogical reasoning. At this age, pre-adolescents also begin evaluating verbal affirmations without necessarily referring to the real world and are more flexible, accepting more than one interpretation and more than one outcome for a given situation are possible. In sum, “they move from the *actual* to the *possible*” (Ross, 1976:609). Evidence has shown, though, that formal operational reasoning is present before adolescence, as younger children have been found to be able to make analogies (e.g. Singer-Freeman, 2005) or to test scientific hypotheses in a more or less systematic way by controlling for irrelevant variables (Howe et al., 2000). The opposite is also true for some adolescents who, being older than what Piaget predicted, do not master certain formal operational tasks. Piaget (1972) himself admitted that if context (i.e. formal education, social interaction) does not favour the development of formal operational thought, it may not be attained at puberty.

Others, like Flavell and Wohlwill (1969), defend the idea that the stages in this period should be considered as a series of structures the development of which has different time-span requirements. At the same time, these structures are not independent, as some concepts need to exist before others can arise. In addition, during middle childhood the child’s strategies for memory storage increase significantly (R. Kail, 1990). First, children rehearse the new information by repeating it to themselves to remember it (Flavell, Beach & Chinsky, 1966). Later, they organise it in categories to make it more meaningful to themselves (Siegler, 1978/1991). Towards puberty, children start using more sophisticated information storage strategies, such as

associating information with previous experiences, realising that memory span is not infinite and incorporating linguistic cues in the memorisation process. Younger children have also been found to organise items on a list in many categories based on associations between elements or to not classify them if the items are not familiar (Best & Ornstein, 1986) while children from 9 years old on do classify the items on a given list with a certain criterion (Bjorklund & Jacobs, 1985). It is in middle childhood when the ability to use retrieval strategies arises and it develops gradually during this period, too.

According to Flavell (1985), the heterogeneity in cognitive developmental stages, especially in the case of concrete operational thought, is due to the hereditary differences in the individuals' aptitudes and the context in which they grow up. Context and the intervention from adults is a variable that Vygotsky (e.g. 1934/1962, 1978) included in his socioconstructivist theory of cognitive development. He defended the idea that development is originated in socially meaningful activity and that language and the development of mental concepts and of cognitive awareness are closely connected even though they are ontogenetically different. They intertwine when the child is around 2 and give way to verbal thinking and rational speech. These will develop progressively through social interaction in one's context. Vygotsky's theory explains the variability of cognitive development stages in children from different cultural, social and economic contexts, represented by their zone of proximal development, which can be defined as "what children can do with the assistance of others", which "might be in some sense even more indicative of their mental development than what they can do alone" (Vygotsky, 1978:85). Following this line of thinking, learning does not go hand in hand with one's cognitive development only but school context and interaction with adults have a strong effect on it too. Actually, Donaldson and colleagues (Donaldson, 1978), following Vygotsky's socioconstructivist theory but using the tasks proposed by Piaget, concluded that children were more cognitively competent if tasks were not disembedded from a meaningful context.

Metalinguistic awareness and metacognitive skills have also been noted to develop parallel to cognitive and social development (Clark, 1978; Sinclair, Jarvella & Levelt, 1978). For instance, Saywitz and Wilkinson (1982) studied the development and the age at which metalinguistic awareness is acquired in children between 2 and 8 years of age and found that metalinguistic awareness seems to develop gradually, starting as early as 2 years, but children are only fully consistent in different metalinguistic tasks when they are between 7 and 8 years old, coinciding with the beginning of the concrete operational stage. Further evidence of the arousal of

metalinguistic awareness at this stage was found by M. Kail (1980, in Pfaff, 1987). In Kail's study, it was found that children from 6;8 to 8;6 years considered acceptable sentences that contained the conjunction "but" but that did not introduce a contradiction with the previous clause. Children from 8;6 on, however, made comments on the sentence and were able to offer alternatives for this "but" so that the sentence became acceptable. It is also towards the age of 9 that children start using their metacognition consciously (Schneider, 1998), that is, they are capable of evaluating a cognitive task to determine which is the best way to deal with it and to control and adjust the results of this task. Metacognition becomes more salient as memory increases since, in the process, children also learn by themselves how to store the information they receive so as to accelerate its future retrieval (Berger, 2006).

Some psychologists interested in human cognitive development, such as Pascual-Leone (e.g. 1980), Siegler (e.g. 1978/1991), Fischer (e.g. 1980) and Case (e.g. 1985), have taken the basics of Piaget's stage theory adding an information-processing twist to it. They are the so-called neo-Piagetian. Some of them believe in the existence of stages but with some modifications, that is, combined with ideas from the information-processing approach (e.g. Case, 1981, 1985, 1992a; Fischer & Farrar, 1987; Fischer & Pipp, 1984). Their main criticism towards Piaget's stages is that they do not take into account the experience with different types of skills and tasks. The researchers who apply an information-processing approach to their studies focus on how children and adults deal with different types of information and how they code them, transform them and organise them in their cognitive system. They also study the cognitive changes that make these processes more reliable and efficient as the child matures. Theorists of this school show special interest in the age-related changes that occur in the child's attention, memory, processing capacity and cognitive and problem-solving strategies (Sternberg, 1988a). The main idea is that the human mind stores information in the brain in a symbolic state. Several internal processes operate on the information received, recoding it and modifying its structure so that storage and retrieval become more efficient. Then, decoding and interpreting its meaning allows us to compare it and combine it with information previously stored in our brain. When these cognitive operations are finished, output can be produced to give an answer to the problem that has triggered the functioning of these cognitive operations.

Fischer (1980) places more emphasis on the children's specific experiences. Children have an optimal level of processing capacity that will not develop until their brain is mature enough. Fischer distinguishes three levels of skills, which correspond to Piaget's stages: sensorimotor operations, concrete representations and abstractions.

Each period takes long, as its optimum level depends on the interaction with the environment, which allows skills to be acquired, to be integrated with former skills and to be transformed into more general skills, of a higher category. Both theories coincide in the fact that they consider the increase in memory the key for development to take place.

Pascual-Leone (e.g. 1970, 1978, 1980) believes that the quantity of information children can process depends on how developed their memory is and with how many items of information they can deal with simultaneously. Thus the problems with mass, weight and volume are solved at different ages because each task requires an increasing number of information items and an increase in capacity is needed to go from one Piagetian stage to another. Siegler (1978/1991, 1983) adds to this argument the complexity of the rules that each task entails. Stemming from Piaget's developmental stages, Pascual-Leone believes that there exists a series of operators, among which M-capacity can be found. Enough M-capacity at a given point in time is responsible for passing from one stage to another. M-capacity increases one unit in each substage proposed by Piaget, that is, every two years. Therefore, children in grade 3, when they are in the first substage of the concrete operational stage, would have their innate M-capacity plus three, children in the second substage of the concrete operational stage would have their M-capacity plus 4, children who are between 11-12 would add one more unit to their M-capacity and so on.

Nevertheless, the growth of operational capacity with age has been partially questioned by neo-Piagetian Case (1984, 1985, 1992b), who highlights the hierarchical integration of the intellectual operations that conform each stage proposed by Piaget. So, from Case's point of view, Piaget's stages should be subdivided into four substages each. This is because, for Case, the executive control strategies (not logical structures, as Piaget considered them) become more complex by adding new elements, which are dragged to the following stage, where one more operation comes into play. The transition between one stage and the following one is determined by changes in one's STM and the progressive capacity of automatising the cognitive operations at work, as Shiffrin and Schneider (1977) defended as well. In contrast with Pascual-Leone, Case does not believe that the total processing capacity (Pascual-Leone's M-capacity) increases with age, although he does not deny the existence of stages. Instead, he believes that, as time goes by, it is practice and efficacy that increase in such a way that more cognitive resources are available and so storage capacity is liberated.

School children are still in the process of acquiring their L1(s). As for language production and comprehension — and in relation to Piaget's stages —, children from 6 to 8 years old are egocentric in the way they tell stories and understand stories told by others, use deixis and ellipsis unsystematically and tend to avoid specifying how and why something happens by using juxtaposition instead (Piaget, 1926). This does not mean, though, that young children this age are totally incapable of reconstructing events (e.g. Peterson & McCabe, 1983; Stein & Glenn, 1981, in Sulzby, 1986). When children are between 8 and 9 years old, they start using connectors and adverbial conjunctions such as "then", "consequently", "suddenly" and start using pronouns to refer to characters already presented in stories. Also in relation to storytelling, 8-year-old children are incapable of retelling stories that have been told in an interleaved order, whereas from the age of 11, children are capable of retelling the story in the same way they have heard it although they do find it easier to do it following the normal sequence of events (Mandler & DeForest, 1979, in Mandler, 1983). It is also at the age of 8-9 that children accept the fact that words do not necessarily refer to things or actions and are more analytic and logical in their processing of vocabulary (Holzman, 1983). During this same age period, children's syncretistic understanding, which implies noticing only the most salient details and general effects of any event, disappears gradually although it remains partially crystallised in the child's abstract thought. The mid-stage is the syncretism of reason or of explanation, thanks to which children start to be able to understand abstract concepts and, for instance, they no longer interpret proverbs literally but through associations of meaning of the children's own, which may rely on the adults' judgment of analogy or not. If not, children adapt everything they hear to their own point of view and to whichever information previously stored in their mind. The moment will finally come when they will consciously realise the true meaning of what they thought they had already understood at the first moment.

Becoming literate contributes as well to one's L1(s) development. Literate children's vocabulary is much wider than that of children exposed to spoken input only. Literate children also experience a higher rate of vocabulary acquisition, sometimes rather specialised depending on their interests, than children who are only exposed to spoken input (e.g. Bernhardt et al., 1995; Duke, Bennet-Armistead & Roberts, 2002). It is also exposure to and production of written texts that makes it possible for children to think in abstract terms. Moreover, the increase and specialisation of children's vocabulary makes it possible for them to be more metalinguistically aware and to think abstractly, in such a way that it is easier for them to produce and understand the structures that are not common in spoken language, such as subordinate clauses, or to

use a higher number of prefixes and suffixes as well as of synonyms, antonyms and abstract categories (Menyuk & Brisk, 2005, in Montrul, 2008). Moreover, school children's semantic interpretations of some word sets have been found to differ from those of adults (Asch & Nerlove, 1960, in McLaughlin, 1978). For instance, Bradshaw and Anderson (1968, in McLaughlin, 1978) found that while 10-year-old children's conceptions of the gradation of a list of adverbial modifiers coincided with those of adults, 7-year-old children had a different conception of some of the adverbials on that list.

If in the first school years, one's L1(s) is still developing, it is in adolescence that all the linguistic knowledge acquired in the previous period is fixated (Braine et al., 1993; Jia & Aronson, 2003). C. Chomsky (1969) affirmed that between the ages of 5 to 10 important syntactic structures are still being acquired and that 9-year-old children still have trouble in disentangling syntax from semantics when they are asked catch questions. Also, passive structures in English and in Hebrew have been found to start being used between the ages of 6 and 8; they start being mastered at the age of 9 and are perfectly acquired at the age of 11-12 (Berman, 1993; Romaine, 1984). The later development of passives could be due to the fact that passive voice can be considered an alternative structure, as what is meant with a passive voice can be expressed by means of an active structure (Ravid, 2004). In English, 8-year-old children also have difficulty in using relative clauses, especially object relatives, which are not produced significantly before 7 years of age. Since object relatives are difficult for 8-year-olds to produce, they use passive structures instead (M. Kail, 1982). In Spanish, a gradual increase in the comprehension and production of relative clauses has also been observed in children from 7 to 10 years old (Barrera & Fraca, 1991), although there is no consensus as to which relative structures (subject or object) are more difficult to acquire (Aparici et al., 1996). Relative clauses embedded in prepositional phrases are used only sporadically until the age of 12. Before that, children use them, but they are formed incorrectly (Zorriqueta, 1998, in Serra et al., 2000), probably due to the low frequency of this structure in the input to which children are exposed and also due to the syntactic and psycholinguistic complexity that the production of this structure entails.

During school years, the verbal system is also in the process of being consolidated, as little by little children incorporate more tenses (imperfect, future, conditional), the subjunctive mode and periphrastic structures in their discourse (Fernández Martínez, 1994; Serrat, 1997, in Owens, 1996/2003). It has also been found that 6-year-old children, in contrast with 10-year-olds, hardly ever use multiple

subordination (Scott, 1988). In addition, they have difficulty in understanding subordinate clauses in which the canonical word order SVO has been inverted (Abrahamsen & Rigrodsky, 1984). It is in grade 7 when they are able to interpret this type of clauses resorting to the grammatical traits in them, which probably reflects their higher cognitive development as compared to younger children. For instance, in Abrahamsen and Rigrodsky's study, children in grade 4, in the concrete operational stage, interpreted the sentences in which word order or semantic role had been disrupted more accurately than grade-1 children (in the preoperational stage), providing identity and reversibility arguments. While derivational suffixes develop mainly during school years, they are only mastered in adolescence (Carlisle, 1987, 1988). Children this age also begin to understand that function words such as articles, despite not referring to any concrete entity, are also words (Berthoud-Papandropoulou, 1978; Silvestre & Solé, 1998), which proves that their metalinguistic awareness is applied "intentionally"[2] (Montrul, 2008:132). In their middle childhood, especially from the age of 10 on, children develop fast regarding their pragmatic competence, are aware of what information is relevant and helpful (e.g. Sonnenschein, 1986) and become aware of code- and register-switching depending on the communicative context (Goodwin, 1990; Holzman, 1983; Romaine, 1984). They also become quicker to realise when politeness formulae are required (Axia & Baroni, 1985).

Becoming literate is also a turning point in relation to phonological development and phonological awareness (Grunwell, 1986). Nowadays, Catalan children learn to read following the global constructivist model defended by Ferreiro (1979) and Teberosky (e.g. 2001; Teberosky & Tolchinsky, 1995). This model supposes that understanding the writing system of a language is a general cognitive activity which involves an interactive process in which bottom-up and top-down approaches are followed. In the bottom-up approach, the emphasis is placed on the child's decoding abilities. The child has to process a text starting by decoding the letters, then the words, then the sentences in a sequential and hierarchical process. The top-down approach is also unidirectional and hierarchical, but the importance is attached to the global recognition of words from the significant units they consist of, the unit being the whole text, not the graphemes. In the interactive approach, it is assumed that reading is the process by which the child understands the written language. Reading is considered to be a two-way process in which both the knowledge of the word and the

[2] Gombert (1990/1992) defends that children before the age of 6 are not metalinguistic but epilinguistically or intuitively aware (Karmiloff-Smith, 1979), that is, children before 6 are aware of the implicit grammatical rules they are using, but they are not metalinguistic aware of them yet, because they lack the metalinguistic knowledge to explain linguistic phenomena explicitly.

knowledge of the text itself (lexis, syntax, grapheme-phoneme correspondence) play a role. Therefore, not only decoding abilities, but also other more global comprehension strategies contribute in the processing of the text in which children make and verify their hypotheses about the meaning of the text and control the reading comprehension process themselves.

When learning to read and write, at the age of 5 or 6, children believe that a written text is not the graphical representation of any speech act but a symbol system that is indirectly related to what graphemes represent. For instance, the word “elephant” should have many letters and be big because it refers to a big animal (Leal, 1987). Later on, between the age of 8 and 9, children will understand the relationships between the speech sounds and the graphemes by which they are represented. In this method, graphemes, rather than treated isolated, are taught treating the syllable as the minimal unit. Therefore, after a period of internal analysis of the syllable, in which the child discovers that the syllable consists of a vowel as the nucleus and consonants that either precede or follow it, in grade 1 children start writing alphabetically (one sound, one letter) and it is not until they are 7 or 8 years old that children follow the orthographical conventions.

Learning to read also presents some stages, which develop parallel to cognitive developmental stages, as memory and lexical access are essential for reading development. The syllable as a unit is detected around the age of 5 or 6, and it is mastered in the first stage of learning to read, in which children pay special attention to the first letter and to word length (Marsh et al., 1981). In the second stage, between grade 3 and 4, children learn the correspondence between letter and sound, being able to decipher unknown words (Frith, 1985). From grade 4 until grade 6, in the third stage, readers understand texts holistically and reading becomes an automatic process (P. Smith, 1986).

To conclude, the cognitive and linguistic capacities of middle-childhood children are very different from pre-adolescents’. Variables such as metalinguistic awareness, memory storage capacity and memory strategies, L1 acquisition stages and the relationship with one’s context are factors that altogether could certainly affect one’s language aptitude and language performance both in L1 and L2.

1.2.2. Individual differences in psychological research: L1 and L2 acquisition

The study of differences between individuals concerns not only applied linguists, but also psychologists specialised in other fields, namely developmental, social and educational psychologists who, at some point, assumed that all children undergo similar developmental processes with a specific order. Actually, much L1 acquisition research has also emphasised universal processes of language acquisition such as the developmental order of certain morphemes (e.g. R. Brown, 1973, challenged by James & Khan, 1982; Paul & Alforde, 1993), the progressive acquisition of complex structures (Brown & Hanlon, 2004) or the role of maternal speech in language development, using from proximal (e.g. vocabulary, verbal intelligence) to distal measures (e.g. socioeconomic status) (e.g. Bornstein et al., 1998; Della Corte, Benedict & Klein, 1983; C. Snow, 1986). While it goes without saying that IDs in SLA exist, the study of IDs in L1 acquisition is not to be disregarded either, because important variation in rate and, to a lesser extent, in route (de Villiers, 1973, as compared to R. Brown, 1973) among individuals can pass unnoticed, as all human beings have a history of their own. That is, even though the general topic which concerns us now is IDs, the way it is approached is to be taken with caution, as there is no way to avoid generalising, yet no pattern can be determined that applies to an entire community either, not only due to the individuals' context variables, but also due to human developmental milestones.

ID research in general psychology, especially in studies on personality differences, is also relevant to the study of SLA, as shown in studies on cognitive styles, generally speaking, the way in which individuals process information or approach a task. The use of traditional intelligence (IQ) measures with minority-language children has been considered unfair. Consequently, psychological research into IDs related to L2 learning has turned towards a line of research more focused on the various cognitive style variables thought to relate to SLA (Ehrman & Leaver, 2003; McLaughlin, 1985). The most widely studied of these cognitive style variables is probably the dichotomy field dependence / field independence (FI/FD) (e.g. Chapelle & Green, 1992; Ehrman, 1996; Griffiths & Sheen, 1992; Hansen, 1984; Hansen & Stansfield, 1981; Johnson, Prior & Artuso, 2000; Reid, 1995), as well as personality types. Regarding personality types, along with other factors relating to the self and interpersonal variables (McLaughlin, 1985), one more dichotomy, introversion vs. extraversion, has started to receive more attention on the part of applied linguistics

researchers (Ehrman, 1990; Ehrman & Oxford, 1995; Ehrman, Leaver & Oxford, 2003). This recent interest contrasts with its former perception in the field, as it had been obliterated as an individual difference variable because of misleading inherited assumptions and weak research designs in which this variable was included, as Dewaele and Furham (1999) state. In general psychological research, however, the Big Five theory stands out as the most widely accepted trait theory at present. This five-component model includes agreeableness, extraversion, conscientiousness, openness to experience and emotional stability. Although these traits are used mainly in psychological research, they have also been used as variables to measure pragmatic aspects of communicative competence in first and second language learners (e.g., Larsen-Freeman & Long, 1991; Scarcella, Andersen & Krashen, 1990; Verhoeven & Vermeer, 2002). Verhoeven and Vermeer (2002) point out that "it is interesting to note that extraversion is positively related to the strategic competence of both L1 and L2 learners but negatively related to their organisational competence" (2002:373). Thus, extraverted learners may pass for communicatively competent, but their actual language skills may as well be weaker than those of introverted learners.

1.2.2.1. Individual differences in L1 acquisition

No matter the quality of the input, everybody can learn a language given the exposure at the appropriate age; that is, one cannot help but acquire a language no matter the quality of the model by which one is surrounded. Exceptions are feral and wolf children, the most famous case being that of Genie (Curtiss, 1977), who showed a clear lack of syntactic system in her utterances and whose communication lied basically on paratactics. In a nutshell, it is assumed that the acquisition of one's L1 results in automatic success, be it thanks to a language-specific acquisition device (N. Chomsky, 1965) or to other cognitive factors. This is not, however, the case of SLA, the success of which depends on a wide array of factors. While it is true that the differences in the ultimate attainment of acquiring an L2 and a FL necessarily bolster the influence of IDs on L1 acquisition, the way in which children not only acquire but also develop their L1, despite being all of them successful in it, also differs from individual to individual (see also sections 1.6.1 and 1.6.6). Moreover, although "children learning their L1 are eventually indistinguishable from other native speakers of their speech community" (Doughty, 2003:258), not everybody has the same level of competence in all linguistic skills.

Notice, incidentally, that as it happens with the distinction between L2 and FL acquisition with the controversy being often solved by using both terms interchangeably, there is also a considerable amount of literature which distinguishes L1 "acquisition" (which refers to the logical problem of language acquisition) from "development" of L1 (which refers to the passing from one stage to the following one) (Atkinson, 1982), used mainly by connectionists (e.g. Elman et al., 1996) and those who take a "general" nativist position (e.g. Tomasello, 1998).

Piaget's (e.g. 1972) philosophy of intellectual development in children was widely accepted on the grounds that it accounts for the outcomes arisen out of the child's intellectual interaction with the environment. So was Lenneberg's (1967) classic description of the developmental milestones in motor and language development, which imply a biological and maturational component in language development parallel to that of motor development. Numerous studies have shown that there also exist developmental milestones in infant speech production, syntax perception and production and semantics (see Lust, 2006:272-282, for an overview). However, one of the most robust findings in L1 acquisition studies is that there are significant individual differences, both in terms of route and rate of acquisition. As said before, generalisations regarding ID research are always questioned by sporadic cases. For instance, an exception to the assumption of invariant progression through a series of stages is Peters' (1977) work with Minh, whose spontaneous utterances when he was about one year old were surprisingly complex at his age. Peters concluded that Minh presented two distinct kinds of speech, the "analytic" one, which fitted the generally assumed route of development, and the "gestalt" one, in which most words per se were impossible for anybody to decode but the whole utterance did carry a meaningful message for Minh.

Besides Minh's occasional exception, substantial variation within the assumed developmental course has also been accounted for. This variation in language development responds to the influence of several factors which can be internal, such as deafness (e.g. Goldin-Meadow & Mylander, 1990; Locke, 1993; Marschark & Spencer, 2003), blindness (e.g. Andersen, Dunlea & Kekelis, 1984; N. V. Smith, 2002), abnormality, nonverbal cognition, problems in specific modules, etc.; and external, such as maternal variables, child-directed speech and environmental variables (e.g. Barnes et al., 1983; Iverson et al., 1999), to mention a few. Moreover, variations observed in the rate of early language development in healthy, normal children are so large that they even challenge the universal maturational pattern suggested by Lenneberg (1967, 1970). A deep study of this variation is, however, not feasible due to

the nature of the population involved (i.e. young children). Nevertheless, there is at least one study, the norming study for the MacArthur Communicative Development Inventories (Fenson et al., 1993; as reported in Bates, Dale & Thal, 1995:98-120), with a large sample of more than 1,800 children[3], which evidenced variation in rate in early language development in vocabulary perception and production, combination of words and sentence complexity as measured by Mean Length of Utterance (MLU).

Despite the limited evidence available, developmental asynchronies between general comprehension and production (e.g. Mills, Coffey & Neville, 1993) and between lexical production and grammar (e.g. Marchman & Bates, 1994) have also been found. These dissociations between components of early language are thought to be due to the fact that they are drawn on different cognitive resources and mediated by different neural systems.

Sex has been a difference observed in L1 acquisition although the results obtained lead to the conclusion that there are so many contradictions that it cannot be claimed that one sex is superior to the other or, at least, not significantly. A couple of examples are, for instance, Goldfield and Reznick (1990), who tested word comprehension in children between eight and twenty months; and Berko (1958, in Lust & Foley, 2004), whose focus of research was English morphology in children from five and one half to seven years old, at which boys were, if anything, slightly but not significantly better than girls. There is, however, a tendency for girls to acquire words at a slightly faster rate than boys (Fenson et al., 1993), which would be in accordance with the lay belief of female superiority in language.

Differences in cognitive styles are present both in L1 and FL acquisition. These differences show mainly in children's vocabulary and lead to a split in two main groups according to children's preferences: those who tend to use vocabulary of a referential kind and those who use one of a more expressive kind. The former group, children who use mainly nouns, show an interest in language as an instrument for talking about objects and categorising them. They tend to, first, use individual words and, later on, to combine them into multiword units. Conversely, the latter group, those children who use their vocabulary in a more expressive way, use words in phrases from an early stage and only later de-chunk them to build new utterances by themselves (e.g. Shore, 1995; see Bates, Dale & Thal, 1995 for a review).

[3] The Bristol Language Project (Wells, 1981, 1985), another study of rate of progress in L1 development in relation to FL aptitude and FL achievement, had a cohort of 125 subjects (see section 1.6.1 for further information).

Building upon the referential vs. expressive style distinction and synthesising it with syntax acquisition patterns in a correlational study, Bates, Bretherton & Snyder (1988) put forward another distinction as regards L1 acquisition styles: analytic vs. holistic (or "gestalt" or "rote"), dichotomy which could somehow be equated to the FI/FD dichotomy used in SLA research. Analytic children, who are word-oriented during the babbling period, would be those who tend to show nominal vocabularies and high rates of morphological overgeneralisation in their acquisition of grammar. On the other hand, holistic children, who are intonation-oriented during the babbling period, would be those who follow a formulaic style and are inconsistent in the application of grammatical rules. They are also different in terms of rate of grammar learning, as analytic children are found to be faster learners than holistic ones. It has been suggested that the choice of analytic or holistic strategies is influenced by the input and the kind of speech to which children are exposed (Klein, 1980; cited in McLaughlin, 1985:141) as well as by social-class differences (e.g. Della Corte, Benedict & Klein, 1983; Heath, 1983; Nelson, 1973) or cognitive factors such as intelligence (Bates, Bretherton & Snyder, 1988).

Examples of atypical children as regards rate of language development are found in L1 and FL acquisition alike (see section 1.6.6.2 for an account of cases of talented and untalented FL learners). In L1 acquisition the group of disordered populations includes "early talkers" and "late talkers", children with Specific Language Impairment (SLI), children with cognitive deficits (Williams and Down syndrome) and children with focal brain injury.

Late talkers are the children who, by the age of 18 to 20 months, present a delay in the rate of expressive language comprehension and production development but eventually, after approximately one year, use language normally; that is the reason why they are not considered to belong to the SLI group of children but to be simply late talkers. Nevertheless, some of these late talkers continue to have some language difficulties later on in their life (e.g. Scarborough & Dobrich, 1990; Thal, Tobias & Morrison, 1991). This delay has been found to correlate with a delay in MLU (Scarborough, 1990), but not with the Index of Productive Syntax (IPSyn) one year later (Thal et al., 1997), as IPSyn scores appeared to match control groups. Strikingly, this delay seems to be parallel in both measures in Rescorla, Dahlsgaar & Roberts (2000), who studied 3- and 4-year-old toddlers, as well as in Rescorla (2002) and Thal and Katich (1996), whose cohorts were in the school-age period (from 6 to 9 years old). Therefore, there is much variation in these studies to be able to establish a fixed pattern in this population. Nevertheless, a consistent delay in some aspect of language development is present in late talkers at least for 2 years.

Unlike late talkers, early talkers are those children whose vocabulary production reaches the top of the Communicative Development Inventories scale. This precocity has been found to correlate positively with MLU and verbal reasoning (Robinson, Dale & Landesman, 1990). Conversely, and as it happens in the case of late talkers, some early talkers display a dissociation between production and comprehension. In the case of early talkers, their production appears to be outstandingly high, but their comprehension is just average.

It remains unclear whether IDs at an early stage of development have any consequences for language abilities at a later point in time. Research has proved so far that these differences are only stable for a six-month period between tests in children between the ages of 0;8 and 1;4 (Fenson et al., 1994), but it is not possible to determine so when both early and late talkers are between 20 and 26 months old (Thal et al., 1997).

Another particular population which deserves a brief mention regarding their L1 acquisition is children who suffer from SLI, children who may never achieve the language skills of language normal peers, even as adults (e.g., Bishop & Edmunson, 1987; Locke, 1994). This failure to acquire their L1 does not occur in all aspects of language (e.g. Fisher et al., 2007). The impairment in these children may be due to two main types of causes. On the one hand, genetic factors are a possible cause. One or more genes may have an influence on either general thinking abilities involved in language learning or specific brain systems dedicated to speech as well as intellectual problems. On the other hand, environmental causes are also a possible cause of their impairment, supposing these children may have suffered from pre- or postnatal traumas, disease processes or environmental deprivation. Yet again, there is a wide debate around this population as to whether their impairment is exclusively linguistic (e.g. Rice 1997) or, on the contrary, it goes hand in hand with other non-linguistic problems, which would deny the existence of language specific modules (e.g. Conti-Ramsden, 1997; Fazio, 1997).

While there is a controversy about whether FL aptitude as an individual difference is innate or not (see section 1.6.1), or whether it has some kind of relationship with IQ levels (see section 1.6.6.1), there is no doubt that children with Williams Syndrome have a rare genetic disorder which allows them to have a surprisingly good linguistic knowledge (better in vocabulary than in syntax) despite their intellectual disabilities. Their performance is always below that expected at their chronological age, as it happens with late talkers. Strikingly, their performance is qualitatively different from performances of normal individuals without mental

retardation in the ease they show at telling stories (e.g. Reilly, Klima & Bellugi, 1990; Reilly et al., 2004, 2005) and in their choice of low-frequency items (e.g. Reilly, Klima & Bellugi, 1990, Stevens & Karmiloff-Smith, 1997). In contrast with their linguistic performance, they tend to obtain low performance scores in other cognitive measures such as visual-spatial, problem-solving and reasoning tasks. They cannot be considered "language savants" (compare with the case of Christopher in section 1.6.6.2) because they are gifted, for instance, for music and show very good social skills, but they are, at the same time, inept at other matters. However, they are comparable to "language savants" in the fact that their IQ is low too (for a review on the issue of Williams Syndrome, see Brock, 2007).

Children with Down Syndrome also present a noticeable delay in L1 acquisition as their general language abilities also tend to be below those expected at their mental age (for a review, see Roberts, Price & Malkin, 2007). Although there is great variability among these individuals, a general pattern of problems they face could be summarised in difficulty in expressive language skills, which tend to be lower than receptive ones, in intelligibility of speech and articulation and in auditory processing. As warned above, generalising is always dangerous, and this is precisely shown by the case of a Down Syndrome adult woman (Rondal, 1995) whose expressive and receptive grammar were found to be close to normal. In the same study, this case is compared to a small number of other exceptional cases of language development in mental retardation. Cases like these and like Anthony's (Curtiss & Yamada, 1981) and Marta's, a hyperlinguistic retarded (Yamada, 1981), appear to challenge the claim that the acquisition of grammar is determined by prior non-linguistic cognitive achievements. One such achievement could be the substage of sensorimotor intelligence which, Piagetians argue, is a prerequisite for language, as it is in this period when the functional ability to represent something by means of a signifier appears (Piaget & Inhelder, 1966). Moreover, data analysis and comparison with other observations in language pathology (SLI children, aphasic syndromes, degenerative syndromes) suggest that linguistic knowledge consists of independent but interacting modules and that syntax (and, for that matter, language) can be acquired regardless of ordinarily or severely impaired or limited conceptual and cognitive development (N. Chomsky, 1986).

Children with focal brain injury also form a separate group regarding their L1 acquisition. They are children whose brain has been injured either before being born or before being six months of age. Contrarily to what happens in adults who are injured in their brain, these children are found to achieve normal or near-normal levels of

language ability, which evidences brain plasticity. Despite their eventual success, the early stages of language development of these children are affected by some difficulties regarding phonology and lexicon (e.g. Gupta et al., 2003) and MLU, it being even lower than that of late talkers (Thal et al., 2004).

1.2.2.2. Individual differences in Second/Foreign Language Acquisition

As it happens in L1 acquisition, universal tendencies have been observed in SLA processes, but it should not be forgotten that FL learners, like L1 acquirers, have a history of their own which makes them unique (Gardner & MacIntyre, 1992). Apart from the individuals' personal histories and patterns of exposure in which they may fit (Foster-Cohen, 2001), there is a large body of research in SLA that has focused on IDs, which often interact with one another and with the learning contexts (Robinson, 2002a) and which are believed to influence the learner's ultimate attainment to various extents. These IDs have received a vast range of labels which, at times, are used to describe similar (or not so similar) concepts interchangeably. For instance, "aptitude" appears equated to "learning style" in Foster-Cohen (1999:11), but stands on its own in Altman (1980) and Skehan (1989). IDs have also been classified in many ways, and they may even have been included or disregarded in such taxonomies depending on the degree of importance researchers attach to them, as Gilleece (2005) remarks, although "there are a number of dimensions of learner differences which are generally acknowledged (for example, age, aptitude, motivation, cognitive style, and learning strategies)" (R. Ellis, 1994:472).

Notice that, when compared to L1 acquisition, a new ID appears in SLA: motivation. This is so because of the unique ontogeny of both processes: no motivation is needed to acquire one's L1, as one's native language is acquired inevitably (except for the cases mentioned in 1.2.2.1), whereas motivation can be of much importance in FL learning. Apart from external factors, the processes of acquisition of an L1 and a subsequent second language differ in "the representations of linguistic structure", in the "procedures for accessing the knowledge" or "both" (Bialystok & Sharwood Smith, 1985:106). Likewise, IDs will play a different role depending on whether the language learner is acquiring a FL or an L2, as both processes are substantially different in several aspects, such as in the continuity and quantity of exposure to the L2, the nature of the input, the mechanisms used to take the input in, the teacher's role, the social and affective variables and the psychological and neurological underpinnings (memory, noticing, control, etc.). These situational differences inevitably affect the interactions

between the learners' IDs in terms of knowledge of the language (declarative knowledge), as opposed to control of it (procedural knowledge) (Faerch & Kasper, 1987). Knowledge of the language (relevant to FL acquisition) is believed to depend on a very large number of interacting factors (e.g. aptitude, motivation, styles and strategies, age, memory, effort and time spent on learning, amount of L2-input, socioeconomic, educational and family factors, knowledge of L1, among others) whereas control depends on the automatisation of this knowledge (the greater the automatization, the more effective the control) (Bialystok, 1987).

Going back to the beginning of this section, and as Selinker (1972) clearly stated, ID research is crucial to be able to give a complete account of the SLA phenomenon. Nevertheless, one of the pending issues in SLA research is precisely to link ID research with the cognitive processes which underlie it. This does not mean, though, that SLA theorists have consigned this relationship to oblivion. Actually, a number of SLA models have somehow integrated IDs into their theories (for a succinct summary of them, see Ranta, 1998). These are, according to Ranta (1998), Krashen's (1982, 1985) Monitor Model; Bialystok's (1978, 1979) three-stage model, which Bialystok herself (1991) changed to the Analysis/Control model; Gass' (Gass, 1988, 1991; Gass & Selinker, 1994) model of L2 acquisition; McLaughlin's (1987, 1990, 1995) Cognitive Theory; Segalowitz's (1997) adaptation of Ackerman's (1989) information-processing model; O'Malley and Chamot's (1990) insight on Anderson's (1980, 1983) and E. D. Gagné's (1985) cognitive models; Skehan's (1998) information-processing model; and Carroll's (1962, 1963) Model of School Learning. After Ranta's dissertation, at least two new models which also integrate IDs into an SLA mode have arisen: on the one hand, the Cognitive Ability for Novelty in Acquisition of Language (CANAL) (Grigorenko, Sternberg & Ehrman, 2000; Sternberg et al., 1999; Sternberg & Grigorenko, 2002), which stems from Sternberg's (1985a, 1988a, 1988b, 1990, 1997, 1999) triarchic theory of human intelligence; and, on the other hand, Robinson's (1995a, 1997a, 2001b) aptitude complexes in relation to the fundamental similarity of implicit and explicit second language learning.

It would be beyond the scope of this dissertation to focus on the way these models integrate all the existent IDs; however, some of them will be tackled when relevant in following sections inasmuch as they have been related to aptitude, the ID of direct concern to this dissertation.

1.3. Approaches to language aptitude: a historical overview of language aptitude research and measurement

Language aptitude has been considered one of the most influential IDs in relation to FL learning success (Skehan, 1989, 2002). Before reviewing the treatment it has received along the history of SLA research, it is perhaps convenient to define what "general aptitude", i.e. cognitive ability, means in general psychological research. One of the main researchers in the field, J.B. Carroll (1983:4), defines it as "any of the one or more non-ephemeral characteristics of an individual that determine the level of the individual's performance on a cognitive task when maximal performance is attempted." From this definition it can be inferred that, for Carroll, one's abilities are fairly stable. This is, though, a controversial topic, as will be seen below. Later, Carroll himself restated this relative stability by saying that

> "to the extent that cognitive abilities are at least relatively stable and relatively resistant to attempts to change them through education or training and at the same time are possibly predictive of future success, they are often regarded as aptitudes."
>
> (Carroll, 1993:16)

Within this group of aptitudes, we are now going to focus on language aptitude in particular, the measurement of which in relation to other IDs and to L1 is one of the main goals of this dissertation.

Language aptitude has been defined in many ways and its conceptualisation has undergone several changes since it began to be studied. Carroll (1973) defines it as some characteristic of an individual which controls, at a given point of time, the rate of progress that he will make subsequently in learning a foreign language. He also says that

> "research suggests that individual differences in foreign language aptitude are universal and highly generalized in two senses: first, in the sense that aptitude is equally relevant to any foreign language that the individual might choose to study, and second, in the sense that individual differences in foreign language aptitude are found equally among the native speakers of different languages."
>
> (Carroll, 1973:5)

Later on, Carroll himself (1981, 1984) refines his definition of aptitude by suggesting that it is separate, on the one hand, from motivation or interest and, on the other hand, from achievement, both conceptually and empirically. Thus, he defines

aptitude as the capability of the individual that depends on some combination of "more or less enduring characteristics", whereas achievement corresponds to the notion that the individual can have acquired certain specified capabilities of actual FL acquisition, among other basic capacities. Carroll adds that it is distinct from general intelligence, although some have argued that verbal intelligence is actually indispensable to answer language aptitude tests (Oller & Perkins, 1978a). This is the reason why Oller (1983a) equates aptitude with "expectancy grammar", i.e. the anticipation of what comes next in speaking and listening. In the same line as Carroll (1981), other researchers, such as Skehan (1989, 1991), point out that the study of language aptitude presupposes the existence of a talent specific for language learning that is independent from intelligence and of other previous learning experiences, i.e. this talent is not the same as the one found in other learning processes. It is also relatively stable and it helps us find the individual strengths and weaknesses between people due to its multidimensionality.

The different approaches to language aptitude research during the 20th century go hand in hand with the evolution of language teaching methods occurred during the same period. Although the origins of the study of aptitude are to be found in the first half of the 20th century, it must be acknowledged that it has only received intermittent attention from researchers over this period.

The earliest investigations had a practical aim (the prediction of how well FLs could be learned and who might not benefit from FL instruction) and were first planned by universities and colleges. In order to measure this ability, different "prognosis" tests began to be designed (Hunt et al., 1929; Luria & Orleans, 1928; Stoddard & Vander Beke, 1925; Symonds, 1930a, 1930b, cited in Carroll, 1981 and in Sparks & Ganschow, 2001). At that time, both one's ability in the L1 and general intelligence were considered to be centrally important in the study of language aptitude.

The first attempts to design FL aptitude tests proved, in general, to have low correlations with FL performance and were dependent basically on grammar translation methodology. Besides, there was the belief that IQ scores were better predictors of FL performance than those aptitude tests were (Kaulfers, 1931; in Sparks & Ganschow, 2001) and that the effectiveness of those tests was very much dependent on the instructional situation (Kaulfers, 1939; in Sparks & Ganschow, 2001).

In the 1960s, as Spolsky (1995) reports, institutional and governmental organisations became widely interested in language aptitude research, as effective language training of the Army was fundamental to succeed in military actions. A little earlier, in the late 1950s, Carroll had begun to work on the Psi-Lambda Foreign Language Battery for high-school, college and adult populations (Carroll, 1955, 1958,

1959; Carroll & Sapon, 1955; Sapon, 1955, as cited in Carroll, 1962, 1981), which would finally become the most widely used FL aptitude test to date: the Modern Language Aptitude Test (MLAT) (Carroll & Sapon, 1959). Carroll's rationale when working on language aptitude was based on two main premises: first, he believed that language aptitude is a specific talent, or talents, which are independent from general intelligence; and second, he pointed out that strong language aptitude is not common in the general population (Carroll, 1962). By means of a factor analysis, Carroll found that four independent variables proved most relevant to FL learning: phonetic coding ability, grammatical sensitivity, inductive language learning ability and rote learning ability for FL materials (for further information on these variables, see section 1.4). Later, based on the MLAT, Carroll and Sapon designed the *MLAT-Elementary* (henceforth MLAT-E) (1967), which is a version of the MLAT in English for young children.

The next well-known aptitude test designed was the Pimsleur Language Aptitude Battery (PLAB), developed by Paul Pimsleur in 1966. This test, validated using French high-school students aged 13-19, with a median validity of .52 (Pimsleur, 1968), consists of six parts:

1) estimated previous grade point average in four major subjects
2) a foreign language interest test
3) an English vocabulary subtest
4) a language structure subtest
5) a sound discrimination subtest
6) a sound-symbol discrimination subtest

Although the PLAB aims at similar abilities to those aimed at by the MLAT, it differs from the latter in the fact that it includes a part aimed at inferring language structure from artificial language stimuli; in the fact that it does not include a test of grammar sensitivity or memory; and in its emphasis on the analysis of inductive language learning capacities, verbal intelligence (through its vocabulary subtest) and auditory abilities at the expense of memory. That is the main reason why the PLAB has been used to detect hearing-impaired children as well as to detect potentially exceptional language learners and to help poor learners whose difficulties in learning a FL are thought to be a consequence of poor auditory skills (Pimsleur, 1968, Pimsleur et al., 1964). These days the PLAB is still being used for selection, placement or guidance of learners of an FL and to diagnose FL learning disabilities.

Other test batteries were designed in the 1970s, such as the York Language Analysis Test (Green, 1975a, Green 1975b, in Skehan 1989, 1991); Horne's Assessment of Basic Linguistic Abilities (HABLA) (Horne, 1971, in Grigorenko, Sternberg & Ehrman, 2000), in which the learner has to associate texts in an artificial language with their corresponding picture; and the Al-Haik Foreign Language Auditory Aptitude Test (AFLAAT) (Al-Haik, 1972, in Petersen & Al-Haik, 1976). Both the HABLA and the AFLAAT were used in the American Army to predict learner success in learning both to speak and read Western Indo-European languages, despite the fact that they use artificial languages. They are highly speeded and relatively short.

The Defense Language Aptitude Battery (DLAB) (Petersen & Al-Haik, 1976) was also developed to be used for the selection of military personnel for training at the Defense Language Institute, in which the audiolingual approach was followed as an instructional method. This test, which was constructed from two of the experimental batteries mentioned above (the AFLAAT and HABLA), used an artificial language and contained mainly inductive reasoning items. It was designed so that it was rapid to administer (80 minutes), to score and to interpret, since it had to meet the requirements of the military testing system. The main aim in the creation of this test was the possibility to discriminate at the top end of the ability range, where the MLAT had been proved to be not so effective. However, its utility for assigning students to training in different languages did not appear to be high.

While the aptitude tests viewed so far reliably predicted the success or failure of instructed L2 learning in classrooms that followed traditional teaching methods successful in the 1960s, they were found to lose validity when administered to subjects that were learning following a more communicative approach, which began to be popular in the 1970s. Because of that, Cook (1991) considered that predictions about success need to take into account the teaching method the classroom involved follows rather than assuming that aptitude is monolithic and, therefore, independent of the learning context. There is, though, an even more radical point of view on the matter: Krashen's (1981a, 1981b, 1982, 1985). Grounded in his distinction between "learning" and "acquisition", he considered aptitude completely irrelevant to unconscious language acquisition, as it could only predict conscious learning under conditions that favour monitoring. To Krashen, unconscious acquisition following the "natural order" was the key to ultimate L2 attainment and communicative ability; therefore, from his point of view, aptitude is not correlated with success in "acquisition" settings or tasks that rely on "acquired knowledge". That was one of the factors that contributed to the decline of language aptitude research in the years to follow.

The interest in other individual difference variables in the late 1960s, 1970s and 1980s contributed to the gradual lack of interest in language aptitude research during those decades, as researchers became gradually engaged in the study of other individual differences involved in FL learning. Some researchers interested in individual difference variables other than aptitude were H. Brown (1973), Hubbard (1975) and Roeming (1966; in Carroll, 1981), who focused their research into the role of personality; Genesee, Tucker and Lambert (1978) and Middleton, Tajfel and Johnson (1970), who analysed the influence that the development of social identity and understanding of other social groups have on FL learning; and Scovel (1978) and Horwitz, Horwitz and Cope (1986), who began to examine the influence of anxiety on the FL learning process. Other factors that were suggested to be important at that time apart from aptitude were cognitive styles (e.g. McDonough, 1981) and the degree of acculturation (Neufeld, 1978; Schumann, 1978), among others. Also in the 1970s and 1980s, Gardner and Lambert (1972; R.C. Gardner, 1985; Gardner, Lalonde & Moorcroft, 1985) drew their attention to the role played by affective variables in FL achievement, namely motivation and attitude, as they found them to correlate positively with FL achievement. Thus, motivation was considered to influence acquisition in a quantitative way, which fits with the SLA models proposed by Krashen, Bialystok and Gass, and to be independent from aptitude. Nevertheless, it must be remarked that other researchers did not agree with this new view put forward by Gardner and Lambert (e.g., Au, 1988; Javorsky, Sparks & Ganschow, 1992; Oller, 1981; Sparks & Ganschow, 1991, 1995; Sparks, Ganschow & Javorsky, 1993). This neglect of aptitude in the 1970s is a direct consequence of the separation from behaviourist models and the appearance of an interest in the similarities regarding input processing in the acquisition of an L1 and a FL.

In the 1980s it was also speculated that learning strategies and the learner's cognitive style affected FL learning. Oxford (1990) offered a classification of language strategies and, as well as other learning strategy researchers, found that good language learners use more efficient strategies than poor FL learners and suggested that poor FL learners can be trained to use strategies to improve their learning (see, e.g. O'Malley & Chamot, 1990; Oxford & Crookall, 1989). This new suggestion concerning the role of cognitive styles and learning strategies in FL learning was questioned by Tiedemann (1989), Skehan (1991), and Sparks and Ganschow (1993a, 1995), among others.

As Skehan (2002) reports, there are many other reasons as to why the study of aptitude was dismissed. First of all, the concept of aptitude began to be seen as anti-

egalitarian because, if aptitude was considered to be a fixed endowment, it undermined the individual's effort to learn a FL. Secondly, with the introduction of the communicative language teaching approach in the FL classroom, aptitude began to be associated with audiolingualism and grammar-translation teaching methodologies, which were obsolete at that time. Apart from that, with the development of SLA studies, aptitude was seen as irrelevant, as the learner's capacity to deal with input in communicative contexts as well as the naturalistic engagement of acquisitional processes grew in importance. In fact, that is the main argument derived from Krashen's (1981a, 1981b, 1985) learning/acquisition dichotomy, mentioned above. Finally, Skehan (2002; Dörnyei & Skehan, 2003) highlighted the fact that "catering for individual learning preferences, styles, or aptitudes is not an attractive commercial option" (2002:73) because this would mean that there should exist as many editions of published FL learning material as preferences, styles or aptitudes FL learners have.

In spite of this loss of interest in FL language aptitude, the design of language aptitude tests did not completely stop in the 1970s and 1980s, and even some validation studies of existing batteries were carried out (Culhane, 1971; Natelson, 1975, in Skehan, 1989). One example of the creation of a new test is that of Esser and Kossling (1986), who designed a diagnosis FL aptitude test considering that FL acquisition lies on information processing directly related to universal cognitive principles and processes. Since they considered it reasonable to simplify and make abstractions about the complex cognitive systems involved in FL acquisition, Esser and Kossling created a special language which consists of a sign system equivalent to the target language in order to analyse the processes of paired-associate learning, inductive rule acquisition, semantic integration and analogy formation. To validate their test externally, they took the subjects' final marks at the end of course examination and the outcome of an objective test of vocabulary and grammar. Broadly speaking, the different subtests correlated to a certain degree with vocabulary, grammar knowledge and performance in listening and reading comprehension, as well as in speaking. Therefore, the researchers' assumption that FL acquisition is a process of information processing equivalent to general cognitive processes was confirmed.

The mid- to late 1990s meant the rebirth of language aptitude research into three basic lines: first, the influence of personality and linguistic variables on aptitude was studied; second, the dynamicity and potential trainability of aptitude was suggested; and third, the conditions of L2 learning depending on the context and the tasks used began to be studied from a psycholinguistic point of view. In this period several studies analysed the influence of personality variables such as anxiety,

motivation, and learning styles and strategies on aptitude (e.g. Ackerman, 2003; Dörnyei, 2002; Ganschow et al., 1994; Javorsky, Sparks & Ganschow, 1992; MacIntyre & Charos, 1996; Olshtain et al., 1990; Sparks, Ganschow & Javorsky, 1993).

Aptitude was also "(re)considered" (Parry & Stansfield, 1990) in a cognitive frame in which linguistic variables such as the learners' skill with the phonological/orthographic rule system of language and their facility with languages in general were taken into account. In relation with these two variables, the Linguistic Coding Differences Hypothesis (LCDH) was put forward (see section 1.6.1).

The "reconsideration" of language aptitude as a cognitive construct also involved the reuse of the MLAT in FL aptitude studies. This test, yet again, has proved to be a reliable measure of FL aptitude in different contexts and with various kinds of subjects (for a list of references, see Sparks & Ganschow, 2001). In addition, a new variety of test batteries was designed or further modified. Among these, Parry and Child (1990) report the study the US Federal Government conducted in 1986 to compare the intercorrelations between an aptitude test named VORD and the MLAT and to determine, on the one hand, whether VORD performance was related to other variables such as gender, motivation, age, time-in-training and overall satisfaction with language training and, on the other hand, whether VORD and/or MLAT were significant predictors of oral reading proficiency test outcomes and if so, which subtests were the strongest predictors. VORD, which means *word* in the artificial language used in this test, was developed after previous experiments with another test, the Army Language Aptitude Test (ALAT), already validated in the 1950s though only predictive in Western European languages (Horne, 1971). The innovation that VORD offered was the use of an artificial language similar to Turkish, which is markedly different from the Western Indo-European languages in terms of syntax, in order to measure analytic skills, as MLAT subtest 4 Words in Sentences does.

What Parry and Child highlighted of this project using VORD is the fact that, despite the need for further research of this study, subtest 4 of VORD, the cloze-like model, innovates, in a way, the field of language aptitude measurement since, by contextualising language, it does measure language aptitude and not just linguistic skills, as the other subtests in VORD and other language aptitude batteries do. Nevertheless, Skehan (1989) considered that the raison d'être of language aptitude tests is precisely the fact that they test the ability to handle decontextualised language material in such a way that, Masny (1991) added, the results can thus be generalised to all linguistic competences.

One of the latest approaches to the measurement of FL learning ability in the 1990s was the Canal-F Theory and Test (Sternberg et al., 1999; Grigorenko, Sternberg & Ehrman, 2000; Sternberg & Grigorenko, 2002). The CANAL-FT, which stands for Cognitive Ability for Novelty in Acquisition of Language (Foreign Test), stems from a cognitive theory of knowledge acquisition the core of which is the claim for the centrality of the ability to cope with novelty and ambiguity in FL acquisition (Ehrman, 1993, 1994, 1996; Ehrman & Oxford, 1995), an ability that is included in Sternberg's triarchic theory of human intelligence (Sternberg, 1985a, 1988b, 1990, 1997, 1999), which focuses on recall and inferencing with linguistic material under immediate and delayed conditions. The designers of the CANAL-FT defined it as "naturalistic", in the sense that FL learning occurs naturally and gradually; "dynamic" rather than static, as FL learning occurs at the same time of testing; "multifunctional", as it provides information on both the learners' levels of ability and their strengths and weaknesses; and "simulation-based", thus allowing adaptive testing and new item development. It consists of five sections (learning meanings of neologisms, understanding the meaning of passages, continuous paired-associate learning, sentential inference and learning language rules). The first four sections are to be done with immediate and delayed recall whereas the last one involves only immediate recall questions. These sections were designed to assess the five cognitive processes thought by the authors to be involved in knowledge acquisition processes (selective encoding, accidental encoding, selective comparison, selective transfer and selective combination). This test proved to have external construct validity against the MLAT and some relation to two difficult tests of intelligence, the Concept Mastery Test (CMT.; Terman, 1970) and the Cattell Culture-Far Test of *g*, Level III (CFT; Cattell, 1940; Cattell & Cattell, 1973).

In a similar line, as R. E. Snow (1987, 1994) argued, the study of aptitude cannot go without taking into account the situation specificity, i.e. the demands that academic tasks, treatments, and the situational or academic context make on the learner. Aptitude, therefore, results in "aptitude complexes", which contribute to the adaptation to tasks through practice, thus leading to learning. What is more, as long as aptitude complexes and tasks are matched properly, Snow believes, both practice and learning lead to a life-lasting degree of mastery of what has been learned. However, "readiness" on behalf of the learner's cognitive state is also required to reach that mastery.

Robinson's Aptitude Complex / Ability Differentiation framework for researching the effects of IDs in cognitive abilities on L2 learning and for developing a new theoretically-motivated measure of language learning aptitude, stems from Snow's

(1994) Aptitude Complex Hypothesis (ACH), the Ability Differentiation Hypothesis (ADH) (Deary et al., 1996), Bley-Vroman's (1990) Fundamental Difference Hypothesis (FDH) and Robinson's (1996b, 1997a) Fundamental Similarity Hypothesis (FSH). In his framework, Robinson takes advantage of the child-adult differences in language learning suggested by the FDH, of the fact that information processing demands of tasks draw differentially on cognitive abilities (the ACH), and of the fact that adult learning under any condition is fundamentally similar as it is a consequence of the interaction between cognitive abilities and the processing demands of the task (the FSH). Through these hypotheses, he explains variation in adult L2 learning outcomes taking into account the learners' differentiated abilities (the ADH) and justifies the need to match these patterns of abilities to learning tasks and conditions so that this aptitude-treatment interaction (ATI) results in more successful L2 learning outcomes.

Within this line of research, several aspects related to tasks have been researched in depth in order to be able to provide a more thorough description of the kinds of aptitude(s) needed depending on task features. With this aim, research has drawn its attention towards, for instance, the information-processing demands of tasks and their relationship with features of task design (e.g., Bygate, 2001; Robinson 1995b, 2001a, 2005a; Skehan, 1998), the learner's focus on form (Doughty, 2001; Doughty & Williams, 1998), and the cognitive processes involved in instructed SLA (e.g., Robinson 1996b, 2001a, 2001b; Schmidt, 2001; Skehan, 1998).

The interest in language aptitude research did not diminish during the first decade of the 21st century, as new lines of research began to be explored anew. Along with the latest research focused on the effects of individual differences in cognitive abilities on FL learning and ATI, several experts are working at the moment on new FL aptitude testing measures to fulfil the needs in the field. Among these, the tasks by the American Second Language Testing Foundation, Inc. (SLTF) (http://www.2lti.com), founded by Charles W. Stansfield are worth mentioning. Not only does this foundation research already existing and new second language tests, but it also reedited the Elementary version of the MLAT for junior high and high school students, the MLAT-E, in 2006, and released the Spanish version of the Elementary (henceforth MLAT-ES). This test is further validated with bilingual Spanish/Catalan subjects and is compared to a Catalan version of it (Suárez & Stansfield, 2007). In this foundation's agenda there also figures the development of language learning aptitude tests for speakers of several languages other than English.

Another language aptitude test published in this period is Meara's and colleagues' (2001, 2003) Language Aptitude Test Lognostics (LAT), a predictive

language aptitude test aimed at profiling learner strengths and weaknesses, which has been followed by the Llama Language Aptitude Tests (Meara, 2005a, 2005b). The novelty of the LAT is that it is computer-based and, according to the test takers, it is "fun, challenging, quick and eye-catching" (Meara, Milton & Lorenzo-Dus, 2001:4). It contains five subtests aimed at testing aural memory for sound strings, visual memory of paired associates and people's ability to infer rules, to recognise unfamiliar words and to make connections between unfamiliar sounds and symbols. Of all the subtests, LAT-A, the test that measures aural memory, is considered to be the simplest one since learners find it easy to repeat back the sentences proposed. There is also a subtest considered to be the hardest of the five: LAT-C, designed to determine one's ability at inferring grammatical rules. The very designers of LAT admit that this subtest may not be so difficult for experienced linguists, who are used to dealing with languages whose grammar can be very different from that of their mother tongue. However, those people lacking metalanguage or inexperienced language learners do find it hard.

Milton and Alexiou (2004a, 2004b; Alexiou, 2005) and Kiss and Nikolov (2005) have been working on the design of language aptitude measures as well. In their case, their research is focused on language aptitude in young children, given the fact that existing language aptitude tests are inadequate for younger children as they do not take into account that these children's cognitive skills are still developing. Although Carroll and Sapon developed a version of the MLAT suitable for younger learners aged from 8 onwards, the MLAT-E (1967), there is still a gap in language aptitude tests for learners younger than 8 (for further information, see 2.3.5).

Given the fact that the existent aptitude measures have shown to be reliable only at early stages of learning, and have only been used for the most commonly taught foreign languages, the research group directed by C. Doughty at the Center for Advanced Study of Language (University of Maryland) is carrying out an innovative research project (Long, Doughty & Kor, 2007). This group has designed the High-Level Language Aptitude Battery (HiLAB) so as to identify individuals with potential to obtain advanced abilities in less commonly taught languages such as Arabic, Korean, Farsi, Urdu and Russian, and make expensive training programmes less expensive. These are not the only purposes of this research project, though. On the grounds that the existing aptitude measures were designed to predict success on a traditional (explicit-deductive) teaching methodology, it is believed that these measures lose validity when used to predict and foster success in FL teaching following a more inductive kind of teaching methodology. In addition to this, this project intends to explore further the role

of working memory — following the "Noticing Hypothesis" by Schmidt (1990, 1993, 1994, 1995, 2001; Schmidt & Frota, 1986) — and other memory abilities in FL learning. They also intend to do research into other innovative aptitude constructs such as induction, processing speed, pragmatic sensitivity and fluency. Besides, their agenda includes finding reliable measures to predict speaking proficiency, which has been found to be neglected or not sufficiently tapped by existing aptitude measures as compared to written proficiency, and making use of current technology, which may eventually replace the administration of traditional paper-and-pencil tests.

Since there has been a steady flow of aptitude research during the last years and several lines of research in the field still remain unexplored, the 21st century appears to be a promising and productive time for FL aptitude research and development of "more contextually sensitive measures of aptitude (...) linking IDs in cognitive abilities to the daily conditions of classroom learning and practise in a useful way" (Robinson, 2007:270).

1.4. Components of language aptitude and stages of L2 processing

From a preliminary study (Carroll & Sapon, 1959; see section 2.2.1), Carroll (1962, 1965, 1971a) suggested that aptitude consists of 4 subcomponents:

Table 1.1. Carroll's four-component model of aptitude (adapted from Dörnyei & Skehan, 2003:592)

Component name	Nature and function
Phonemic coding ability	Capacity to code unfamiliar sound so that it can be retained over more than a few seconds and subsequently retrieved or recognised.
Grammatical sensitivity	Capacity to identify the grammatical functions that words fulfil in sentences.
Inductive language learning ability	Capacity to extract syntactic and morphological patterns from a given corpus of language material and to extrapolate from such patterns to create new sentences.
Associative memory	Capacity to form associative bonds in memory between L1 and L2 vocabulary items.

This division does not imply that the components within are independent. On the contrary, with this division, Carroll (1973, 1979, 1981, 1991) clarified the relationship they maintain and gradually refined their conceptualisation, apart from taking a major step from previous research into aptitude.

Regarding Carroll's conceptualisation of auditory abilities, it can be said that it differed from previous approaches in the fact that it did not only take simple sound-discrimination tasks into account, but coding sounds in a streamline, whether masked or not, and retaining them so that they can be recalled later. In this way, phonemic coding ability was linked up to memory capacity as well as to the processes of encoding and retrieval of phonemic material.

Grammatical sensitivity was seen as the capacity to see the functions that words perform in sentences, which is a passive capacity. In contrast, inductive language learning ability was seen as an active ability, since the learner has to reason the linguistic material and then make generalisations and extrapolate them to new linguistic content.

Finally, associative memory (also known as "rote memory for foreign language materials") was at first seen as independent from phonemic coding ability, thus keeping it with the prevailing psychological trends of the time. Then it was conceived as just the ability to link native language words with their corresponding equivalent, which would be of relevance mainly for speed in vocabulary growth, strictly speaking. Consequently, later on Carroll (1990) acknowledged that some other factor or test of memory ability should be used when measuring aptitude.

Dörnyei and Skehan (2003:593; Skehan, 1998) remark that Carroll's division may sometimes give the impression of statistical convenience since "the actual test battery (...) consisted of five sub-tests, but those sub-tests were mainly hybrid mixtures of the different underlying components". Actually, this is a recurrent issue in assessment, as it reflects the difficulty of producing "pure" tests. In contrast, Stern (1983) believes that these tests are interesting not only because of their practical usefulness, but precisely because of their theoretical claims, since they measure aptitude considering it a cluster of factors. Although Carroll (1968) considered these factors to be more or less independent from each other, others argue, in a more or less stark way, that aptitude consists of a unitary factor. Among these, despite refining it in several editor's notes (Oller, 1983d), Oller (1983a) put forward his "unitary competence hypothesis" as opposed to the "divisible competence hypothesis" (Farhady, 1983; Spolsky, 1978). Farhady (1983) rejects the strongest possible version of a general factor hypothesis but, nevertheless, he does not deny the possibility of a non-

exhaustive general factor, arguing that statistical measures such as factor analysis are very complex and not always reliable unless all the required steps to carry out the statistical analysis are completed. For further references of relevant studies into these hypotheses and the controversies around them, see Vollmer and Sang (1983).

Skehan (1986a, 1989) reduces Carroll's division of aptitude into three components. He considered auditory ability essentially in the same way as Carroll's. However, he merged Carroll's grammatical sensitivity and inductive language learning ability as he considered that keeping the distinction only leads to slightly different patterns of correlation and that they essentially draw upon the same ability of manipulation, the only difference being one of degree of consciousness in doing so.

As far as memory is concerned, it remained unchanged in Skehan's model, but he stated that it should be reconsidered taking into account the developments in research outside aptitude, which tackle not only the problem of explaining how learners assimilate new materials but also how these materials are coded, stored and retrieved, which necessarily implies different aspects of memory.

Skehan (1998) sees the components of aptitude in relation to FL proficiency levels. Despite admitting that more research is needed in this field, he affirms that phonemic coding ability is especially relevant at the first stages of learning and hence it plateaus at an early stage. He also puts forward the monotonic and linear relationship that language analytic ability has with aptitude at all stages of learning, although this property reaches a plateau and stops being useful at higher proficiency levels. Memory, in contrast, is important at all stages but reaches its highest usefulness at advanced levels. Skehan (1998:203) relates this new three-component view of aptitude to the three main stages within a flow of information processing, consistent with a cognitive view of SLA:

Table 1.2. Aptitude and processing stages (adapted from Skehan, 1998:203)

Aptitude factor	Stage	Operations
Phonemic coding ability	Input	Noticing
Language analytic ability	Central processing	Pattern identification Generalisation Restructuring Dual-coding organisation
Memory	Output	Retrieval -"computed" performance -exemplar-based performance

This analysis can be extended at a more detailed level in which the components, both the "existing" and the "potential" ones, are further explored from an information-processing perspective (see section 1.4.4).

1.4.1. Phonemic Coding Ability

The definition of phonemic coding ability ("a capacity to code unfamiliar sound so that it can be retained") (Skehan, 2002:71) necessarily implies that it is not just an ability to discriminate sounds (basically minimal pairs) and that it is independent of other components, but also that it is very much related to memory, as coding unfamiliar sounds properly facilitates their retention and retrieval.

This ability, which plateaus at an early stage, depends on the nature (quality and quantity) of the exposure to input, the driving force for interlanguage (IL) development and change (e.g. Dulay, Burt & Krashen, 1982; Krashen, 1985; Long, 1985). L2 learners have to, essentially, pay attention to the input (Hulstijn, 2001; Robinson, 1995a, 1995c; Schmidt, 1990, 1994, 1995, 2001; Shiffrin & Schneider, 1977; Tomlin & Villa, 1994) and notice it (Doughty, 2001; Robinson, 2001a; Schmidt, 1990, 1993, 1994, 1995, 2001; Skehan & Foster, 2001) so that it can be processed and integrated in their IL system, in spite of the noise input may be affected by. This is the reason why both Pimsleur (1966, 1968) and Skehan (2002) stress the importance of phonemic coding ability, especially in informal contexts, where the input received is often unstructured, segmented and of bad quality.

N. Ellis (2001) points out that having good phonological abilities is a constitutional factor which can be related to phonological short-term memory (STM), as individuals differ in their performance in phonological STM span tests, which are tests that measure the ability to repeat phonological sequences. Actually, language-impaired and dyslexic individuals show poor phonological STM spans (N. Ellis, 1990, 1996; N. Ellis & Large, 1987; Gathercole & Baddeley, 1993). A short span makes it more difficult for them to build chunks from the input received so that it can be retrieved and segmented more easily. Therefore, not only is phonemic coding ability related to pronunciation but also to lexical, semantic and grammatical learning (for further references, see N. Ellis, 2001), as well as to some psycholinguistic abilities (visual and auditory channels of communication ability; representational and automatic levels of

communication ability; and receptive, organising and expressive processes of communication ability) (Anderson & Novina, 1973).

There is also the lay belief that a “good ear” for music is related to good auditory language ability. Although some studies do relate these two abilities (Anvari et al., 2002), some relate them only partially (Leutenegger, Mueller & Wershow, 1965; Purcell & Suter, 1981, in Brutten et al., 1985; Tucker, 2000) and some others do not (Karlin, 1942; in Brutten, Angelis & Perkins, 1985; Purcell, 1983). One popular case is that of CJ, a talented learner who scored only in the average range in musical ability tests (Obler, 1989).

If, on the one hand, phonemic coding ability and sound discrimination are not independent but linked to memory and, on the other hand, memory is also related to musical skills, perhaps this “lay belief” should be taken more seriously. In this line, Gilleece (2005) took the stance of what she calls "the traditional view of language and musical aptitude" (i.e. musical aptitude as a group of separate abilities and language aptitude as understood in Carroll’s MLAT). She used, on the one hand, a modified version of the MLAT containing sections related to Number Learning, Minimal Pair Discrimination and a Grammar Sensitivity test in English (L1) and, on the other hand, she used the Bentley Measures of Musical Abilities (Bentley, 1966). Gilleece found a significant correlation between musical and linguistic aptitude in language and musical receptive skills even when the effects of non-verbal intelligence were also taken into account and only a moderate correlation between productive skills in language and music.

Very much related to phonological processing skills in L1 is word recognition in L1 reading. The orthographic processing of segmenting sounds and decoding words has been found to be similar in first and second languages (Geva, 2000; Geva & Wang, 2001). Therefore, both L1 and FL word recognition and L1 and FL reading comprehension are also dependent on one another (Khan-Horwitz, Shimron & Sparks, 2005; Koda, 1992, 1996). Other measures that have been proved to be related to phonological processing skills are vocabulary (Cheung, 1996; Service & Kohonen, 1995), word recognition in FL (Durgunoglu, Nagy & Hancin-Bhatt, 1993) and overall proficiency (Sparks et al., 1997). To sum up, L1 phonological/orthographic skills, along with syntactic skills (not semantic ones), have been found to be significantly related to success in FL learning (N. Ellis, 1996). This is one of the main findings by Sparks and Ganschow (1991) in their research regarding the LCDH (Linguistic Coding Differences Hypothesis). Using this framework, they have found out that there are several factors that relate L1 skills with FL proficiency (see section 1.6.1).

1.4.2. Analytic Ability

Skehan (1986a, 1989) draws together in this factor Carroll's grammatical sensitivity (the ability to recognise the grammatical functions of words in sentence structures) and inductive language learning ability (the ability to infer or induce rules from a set of language materials) on the grounds that there is not extensive evidence requiring Carroll's distinct factors. Actually, Carroll himself (1990) admits that inductive learning ability is only weakly represented in the MLAT, and that other tests measure it better than the MLAT does. According to Skehan (1998:201) the difference only lies in the fact that "grammatical sensitivity allows concentration on one word (though in a larger structure), and only requires the test taker to recognise, no matter the way, the function the word fulfils" whereas inductive language learning "operates upon longer structures and involves manipulation of a pattern at a greater degree of consciousness". That is, what makes grammatical sensitivity different from inductive language learning ability is that the former is of a more passive kind whereas the latter is considered to be more active, as "it requires learners to go beyond the information given and to generalise, so that new language can be produced" (Dörnyei & Skehan, 2003:592).

In his model of information processing, Skehan (1998) places this ability in the central processing stage, in which learners are supposed to identify linguistic patterns and are able to generalise and restructure their IL system with the introduction of new rules. Depending on whether UG is still active or not, this ability will, in the first case, operate with primary data or with the "residue" of its first language operation (Carroll, 1973). If the second case is true, as Skehan believes, language analytic ability then functions as a general cognitive process of induction and deduction.

Besides Skehan's fusion of grammatical sensitivity and inductive language learning ability, analytic ability is also said to be a manifestation of some common underlying capacity in which learner styles and metalinguistic skills take part as well (Ranta, 1998). Before giving concrete examples of studies into this relationship, it is necessary, though, to state clearly what is meant by each concept since, as it often happens in the field, different labels are used to refer to overlapping or very closely related concepts.

On the one hand, "learner style" is known as the predisposition to process information in a specific way, as opposed to "learning style", which points at the typical preference for approaching learning in general. Thus, there exist different types of learners according to the different types of learner styles and the salience of some of

their abilities over others, which make it possible to characterise patterns of aptitude profiles (see section 1.5). The FI/FD stylistic differences, present as well in L1 acquisition (see section 1.2.2.1), are also found in SLA studies, though they have not been found in isolation, but are suspected to be a disguised form of intelligence (Griffiths & Sheen, 1992).

Hatch (1974) coined new labels for the distinction between FD and FI learners: "rule-formers" would be the equivalent of FI learners while "data-gatherers" would be the FD ones, although, as Ranta (1998) warns, there is never a clear-cut correspondence between labels that come from studies of different nature. The distinction FI-FD has also been related to field sensitivity (Ehrman, 1996); to perceptual learning styles such as auditory, visual or kinesthetic (e.g. Reid, 1987); and to aptitude, in which FI learners have been associated with analytic dependent types (see section 1.5).

As seen in section 1.2.2.1, the acquisition of an L1 can follow either an FI or a FD pattern. This pattern can be related to results in the learners' performance on aptitude tests. The Bristol follow-up study (Skehan, 1986b, 1989) is a revealing example in this sense, as the longitudinal data in it provide strong evidence for relating L1 and SLA. The L1 measures used in Skehan's (1986b, 1989) follow-up study included qualitative, linguistic indices which form the basis of what Peters (1981) referred to as the "analytic" strategy for language acquisition. Skehan found that L1 development and FL aptitude are significantly related at a moderate level and that aptitude seemed to have two dimensions, involving grammatical ability and auditory ability. Later on, Skehan (1998) suggested instead another division of learner types which includes those learners who create rule-based representations of the L2 (i.e. analytic-oriented learners) and those who learn from foreign language chunks using, therefore, their memory skills. This division, though, is not exclusive, since one learner can be strong in both analytic abilities and memory skills or can be weak in both of them, or else can have mixed abilities. At the same time, the preference for one style or another does not necessarily correspond to one's abilities. Hence, it could happen that someone having strong memory abilities would prefer an analytic orientation or the other way round. Besides, no-one uses one cognitive style exclusively but they may be used differently to suit different tasks demands (H. Brown, 1987).

FL learners of an FI kind are those who show a greater facility in perceiving patterns and regularities and in disembedding linguistic ambiguity. They also tend to focus deeply and systematically on some specific aspect of the material being learned. Therefore, FI learners should, in principle, be more analytic than FD ones. FD learners

are, according to Ehrman (1996), those who lack the ability to discriminate language analytically and, therefore, tend to engage in communicative language use without necessarily having mastered the FL rules. This is the pattern in Hansen and Stansfield (1981). In their study, FI learners showed higher results in tests of linguistic and integrative competence while they were not so salient in their acquisition of communicative competence. However, mixed findings as regards patterns of learning have been found in investigations that have FI and FD learning styles as independent variables (for further references, see R. Ellis, 1994; Oxford, 1990), although Skehan (1991:288) remarks that "most actual studies have found results in favour of FI learning". For instance, FI learners have been found to do well on integrative tests and tests of communicative competence, a competence which in principle should favour FD learners (Carter, 1988; Chapelle & Roberts, 1986; Hansen, 1984). In fact, although FD learners are thought to be more communicative-oriented, in Seliger (1977), FI learners were the more interactive.

The terms "metalinguistic" and "analytic" are also used ambiguously in the literature. As Titone (1996) points out, researchers are hesitant when using terms such as "language analytic ability", "language awareness", "metalinguistic consciousness", "metalinguistic abilities" and other related terms, such as Bialystok's dichotomy "analysis" and "control". This overlapping of terms may partly explain the fact that studies correlating the MLAT Words in Sentences (alone or together with other subtests) or PLAB's Language Analysis with very diverse kinds of metalinguistic tasks always find from moderate to strong correlations (e.g. Alderson, Clapham & Steel, 1997; Bialystok & Fröhlich, 1978; Elder et al., 1999; Masny, 1987; Masny & d'Anglejan, 1985).

Bialystok, for instance, defines "analysis" as "the ability to construct explicit representations of linguistic knowledge" (Bialystok, 1987:155), as opposed to "control", which is "the ability to control linguistic processes by intentionally selecting and applying knowledge to arrive at a solution" (Bialystok, 1987:155). She also notices that the term "metalinguistic" is used to name at least three different entities: "metalinguistic knowledge", which "includes the abstract structure of language that organises sets of linguistic rules without being directly instantiated in any of them" (Bialystok, 2001:123); "metalinguistic ability", which "describes the capacity to use knowledge about language as opposed to the capacity to use language, which does not necessarily mean that it is completely independent of language ability" (Bialystok, 2001:124); and "metalinguistic awareness", which "implies that attention is actively focused on the domain of knowledge that describes the explicit properties of language" (Bialystok, 2001:125).

Therefore, “metalinguistic ability” is close to linguistic ability though distinct, since it develops thanks to two processing components, analysis and control.

In the line of the analysis/control dichotomy, Bialystok classifies the metalinguistic tasks in terms of their processing demands, which are not completely independent, since tasks requiring analytic processing must be considered previous to those requiring a high degree of control. Ranta (2002) also remarks that there are hardly any tests that measure analytic ability exclusively. She also considers that language analytic ability and metalinguistic awareness are related to each other in an “epigenetic” way, as already advanced by Gombert (1990/1992). That is to say, they are both so closely related that language analytic ability “is likely to be involved in both the implicit analysis of naturalistic input and the explicit analysis required by metalinguistic tests” (Ranta, 2002:163).

Ranta (1998, 2002) considers that analytic ability as measured in tasks such as the MLAT subtest Words in Sentences, whose main focus is form, requires the previous development of metalinguistic skill. In order to measure analytic abilities in a communicative teaching setting, Ranta (2002) designed a metalinguistic task in French. Correlations between this metalinguistic task and other L2 proficiency measures (a listening comprehension test, a cloze passage, vocabulary tests and a metalinguistic task) were performed. The strongest correlations were found between the L1 test designed by Ranta and the two English proficiency measures requiring focus on form. Since many variables were involved, a principal components analysis was carried out so as to reduce the correlations. Finally, a cluster analysis was also run in order to identify subgroups of students sharing similar abilities. Four clusters were then found: the learners belonging to the first one were strong on all tests; the learners of the second cluster were weak on all the L2 tests and average on the L1 metalinguistic task; the learners belonging to the third cluster were average on the measures of L2 vocabulary and listening and below average on both the cloze passage and the metalinguistic tasks in L1 and L2; finally, the learners who had scored low on all tests were assigned to the fourth cluster. The results of the analytic ability task were only weakly related to L2 proficiency in a communicative teaching setting, thus seeming to confirm Krashen’s (e.g. 1985) claim that aptitude is only relevant in formal contexts. However, the cluster analysis was more illuminating than the correlations performed. Apart from showing that learners with higher analytic abilities were superior in the L2 measures, it profiled two distinct types of learners: memory-based (cluster 3) and more analytical (cluster 2). This is, though, difficult to confirm because of either the early stage of learning at which the participants were or because the analytic measure

could not have been discriminatory enough for participants in cluster 2 and 3. As for cluster 1 learners, they were considered “good language learners” with “strategic competence” (Bachman, 1990; Canale & Swain, 1980), since they performed well on the metalinguistic measures despite the novelty these tasks represented for them due to the language teaching approach these learners were following.

Analytic ability has been the focus of several studies in the SLA field besides Ranta's (2002). One of the studies in which this ability is central is Harley and Hart (1997). One of their purposes was to prove whether or not analytic abilities were more closely related to L2 achievement in L2 learners belonging to a late-immersion programme than those who belonged to the early immersion one. Previous studies had defended that memory-oriented learners are more often found in children belonging to early-immersion programmes who memorise chunks without analysing them (e.g. Hakuta, 1974; Peters, 1977/1981). After administering tests of aptitude (associative memory, memory for text and analytical ability tests) and several L2 proficiency measures including an individual oral test, it was found that, for the early immersion group, both the memory for text and the language analysis measures were predictors of L2 achievement. However, this group was not significantly better than the late immersion group on the aptitude scores despite their earlier exposure to the L2. On the contrary, as predicted, the late immersion learners were better at language analytic abilities and at L2 outcomes, but only language analysis was a statistically significant predictor of L2 proficiency scores for this group. Nevertheless, Harley and Hart remark that the significant role of language analytic ability found in the late immersion group may have been due to the initial focus on the language teaching method these learners had been exposed to.

In another study into language analytic ability, DeKeyser (2000) hypothesised that those adult acquirers scoring within the range of child acquirers on a grammaticality judgment test would all have high language analytic ability that may have allowed them to learn the L2 grammar explicitly. The correlation between the Hungarian adaptation of the Words in Sentences (Ottó, 1996) and the grammaticality judgment test was .33, $p<.05$ for adult arrivals and .07, $p<.05$ for participants who arrived before the age of 16. Besides, aptitude scores did not correlate with the age of arrival. These results are in line with Bley-Vroman’s (1990) FDH and similar to those in Harley and Hart (1997).

Roehr (2008) also used an adaptation of the MLAT Words in Sentences as a measure of language analytic ability in a study intended to explain the relationship between L2 proficiency and L2 metalinguistic knowledge seen as the ability to correct,

describe and explain L2 errors (e.g. Renou, 2000). Another relationship explored in this study is the one between language analytic ability and metalinguistic knowledge. The subjects were advanced first-year and fourth-year university-level L2 learners. The novelty in this study is that, unlike previous studies, language analytic ability was measured in the subjects' L2 (German). All the correlations between the language measures, the metalinguistic measures and the analytic measures were high and significant for all learners together, ranging from .667 to .966 $p<.001$.

With regard to the first objective of this piece of research in relation to the first-year students, all the correlations between the metalinguistic measures and the proficiency test were high and significant (between .745 and .791, $p<.001$, one-tailed); and moderate and significant between the language analysis measure and the language test (.468, $p<.05$, one-tailed). The correlations of the fourth-year group were even higher (between .638 and .804). The results in this study show a stronger relationship than the one found in previous research (Alderson, Clapham & Steel, 1997; Elder et al., 1999) and a similar strong relationship to the one found in Elder and Manwaring (2004). However, as Roehr ventures, the strong positive correlation found between the metalinguistic measures (except for the language analysis measure) and L2 proficiency may well be due to the correspondence between the nature of the items in the L2 proficiency test and the items to be described and explained. The correlation between the correction test and the L2 proficiency measure was also strong. Actually, it was stronger in first-year learners than in fourth-year ones. Roehr suggests that this result could be due to the use of both explicit and implicit knowledge by first-year learners, as they were novice in linguistic matters. However, the correlation between the language analysis measure (MLAT Words in Sentences) and the learners' L2 proficiency was only of medium strength and lower in first-year learners than in fourth-year learners. This could lead us to think that metalinguistic knowledge lies on explicit knowledge, that it is somehow related to L2 proficiency as well and that it increases along with other individual variables such as general cognitive ability.

A principal components analysis resulting in one single factor which explained 82% of the variance provided an answer to the second research objective: language analytic ability and metalinguistic knowledge as operationalised in this study are components of the same construct, which is somehow related to Ranta's (2002) viewpoint that language analytic ability requires the previous development of metalinguistic skills. Besides, taking into account the stages of the learners' L2 development, according to Roehr, it could also be hypothesised that both L2 language analytic ability and L2 metalinguistic knowledge arise from L2 knowledge.

Other studies that consider the role of analytic abilities in communicative learning contexts are, for instance, Horwitz's (1987), who found moderate and significant correlations between the MLAT Words in Sentences and both a grammar test and a communicative competence task; and Ehrman and Oxford's (1995), who found that the MLAT Words in Sentences correlated with the Foreign Service Institute ratings of speaking and reading.

To sum up, from the studies reviewed above and from the information-processing model perspective, the ability to perform in the MLAT subtest Words in Sentences, which is meant to measure grammatical sensitivity, also appears to be related to metalinguistic skill, as this skill allows focusing on grammatical form. It has also been considered to be involved in the ability to extrapolate linguistic patterns (Erlam, 2005; Ranta, 2002) and to bear some kind of relationship with learning styles. However, as said at the beginning of this section, inductive language learning ability as defined in Carroll's model of aptitude is not directly tested in the MLAT. It is, therefore, a fact that the relationship between grammatical sensitivity and inductive language ability needs further operationalisation and a clearer disambiguating definition.

1.4.3. Memory

In Carroll's four-component model of aptitude, memory for language learning was defined as "Rote Memory for Foreign Language Materials", it being the capacity to learn a large number of associations of new words in a relatively short time. This view of memory as merely associative derives from the psychological prevailing associationist accounts of memory when Carroll's main workload was carried out. This perspective is very limited (Dörnyei & Skehan, 2003; Skehan, 1982), as memory is considered to be independent from phonological coding ability and only related to vocabulary acquisition. While it is true that the process of acquisition of vocabulary in a FL is, at least at the initial stages, based on learning new words by pairing them with the words in one's L1, memory also plays a part in coding and in retrieval skills. Actually, learning by means of pairs is obviously too narrow a perspective as far as vocabulary learning is concerned since, for example, there are terms which do not correspond exactly to another term in the target language. Identifying a pair is a relatively easy task, yet what makes attentional resources come into play is the integration of this word into the IL system so that it can be effectively retrieved when

required. IDs in memory are, therefore, likely to affect the learners' ability not only to learn new vocabulary but also to notice and to rehearse what has been noticed (Nagata, Aline & Ellis, 1999).

Most researchers who study the relationship between memory, L1 and FL acquisition and aptitude make a distinction between three kinds of memory: short-term memory (STM), working memory (WM) and long-term memory (LTM). The nature of LTM is nowadays clearly depicted: it consists of explicit memory (semantic and episodic memory) and implicit memory (procedural, priming and conditioning) (Schachter, 1996). Explicit memory refers to "learnt knowledge of which individuals are aware and which they can imagine or verbally express on request or at will" (Fabbro, 1999:96). Implicit memory refers to "a type of learning or knowledge that depends on repeated execution of a task, even though the subject is not aware of the nature of implicit knowledge, has forgotten or cannot remember when he has learnt the task" (Fabbro, 1999:98). Ericsson and Kintsch (1995; Ericsson & Delaney, 1999), in contrast, propose a special type of LTM, namely "long-term working memory", which refers to the unusually efficient retrieval of well-learned structures in LTM and excludes attention to information presently perceived while domain-specific knowledge is being used.

STM is memory for recent events that does not last long. It is commonly measured using digit or word span tasks in which information must be reproduced as it is presented without being processed (Klapp, Marshburn & Lester, 1983; Turner & Engle, 1989). STM is involved in low-level cognition tasks such as reading recognition (e.g. Daneman & Carpenter, 1980) and it reflects the use of a phonological code (spelling and handwriting) (Salamé & Baddeley, 1982). Although, in principle, STM should not be involved in high-level cognition tasks as is WM, it has also been associated with the learning of new lexical items (Daneman & Case 1981; Papagno, Valentine & Baddeley, 1991; Papagno & Vallar, 1992; Service & Kohonen, 1995). STM has even been suggested to be involved in the acquisition of grammatical rules, along with WM (e.g. Ellis & Schmidt, 1997; Ellis & Sinclair, 1996; Williams, 1999).

Although for some (e.g. Brainerd & Kingma, 1985; Cantor, Engle & Hamilton, 1991; Carlson et al., 1990; Engle, Nations & Cantor, 1990; Klapp, Marshburn & Lester, 1983; Swanson, 1993), STM is thought to operate independently of WM, the differences between STM and WM appear surprisingly blurred in cognition theory (Anderson, 1983; Cowan, 1995). For the past years, research into WM has focused exclusively on the storage of information for retrieval after a brief interval, although more recent trends take into account processing activity as well (Cowan, 1995, 1996; Engle & Conway, 1998; Gathercole & Baddeley, 1993; Just & Carpenter, 1992). This

change of approach has entailed the creation of numerous labels for WM (Richardson, 1996). Although some (Cowan, 1995; Engle et al., 1999, among others) define STM as a subset of the WM system, other researchers use the term WM to denote a general processing system with limited capacity (Daneman & Carpenter, 1980; Kintsch & van Dijk, 1978; Pascual-Leone, 1970), which is in charge of maintaining LTM traces active and controlled (Cowan, 1999; Engle, Kane & Tuholsky, 1999). Others assume two broad categories for WM, namely WM for visual-spatial material, and WM for language and numerical material, which appear to be highly related (Oberauer et al., 2003). Yet the structure of WM still remains uncertain since significant correlations have been obtained that relate WM directly to general intelligence (*g*), irrespective of the differentiation between storage and processing WM tasks (Ackerman, Beier & O'Boyle, 2002; Colom, Flores-Mendoza & Rebollo, 2003; Conway et al., 2002; Conway, Kane & Engle, 2003; Süβ et al., 2002).

Other theories only take into account WM processing functions, as is the case of Just and Carpenter's (1992) framework; others focus on both processing and attentional capacity (Cowan, 1993, 1997); and others consider that there is a separate WM for spatial thinking and for language processing (Shah & Miyake, 1996). There also exists a neo-Piagetian line of research which at the beginning was not connected with Baddeley's WM approach (e.g. Case, 1985; Pascual-Leone, 1970). Morra (2000) tried to integrate both approaches, although the results obtained do not fit entirely in Baddeley's model. Pascual-Leone's model (1987; Pascual-Leone & Morra, 1991; Pascual-Leone & Johnson, 2005) includes two types of constructs, namely "schemes" (derived from Piaget's developmental stages theory) and "general-purpose operators". These participate in generating and/or activating schemes, among which we highlight the M-capacity, which is the limited amount of attentional capacity a human being has that increases with age and makes it possible to activate other schemes. This M-capacity is believed to increase in the same way as Piagetian stages take place, that is, as it increases by one unit every two years. Its growth is thought to account for developmental language changes (Johnson, Fabian & Pascual-Leone, 1989).

A great deal of research dealing with WM is based on Baddeley and Hitch's WM model (1974). They first considered WM to be a part of STM; later on, though, their multiple-component model was refined and extended (Baddeley, 1986, 1990; 2000; Gathercole & Baddeley, 1993; Baddeley & Logie, 1999). WM was then considered a more consistent "system containing and processing information only temporarily and participating in other essential tasks such as reasoning, comprehension, learning and

consciousness" (Fabbro, 1999:93). The construct of what they call WM consists of the "central executive" and its "slave systems".

The central executive, or supervisory attentional system possesses limited-capacity processing resources (Miller, 1956; Simon, 1974) and is in charge of focusing attention and, eventually, controlling behaviour. It is also suggested that it inhibits the disrupting effect of stimuli other than the one to which the individual pays attention and that it plays an active role when it comes to holding and manipulating information in WM and LTM (Baddeley, 1996; Engle & Oransky, 1999).

The slave systems are related to verbal functions. Some believe the slave systems are two: the visuospatial sketchpad and the phonological loop[4]. On the one hand, the visuospatial sketchpad "is a slave system specialised for the processing and storage of visual and spatial information, and of verbal material that is subsequently encoded in the form of imagery" (Gathercole & Baddeley, 1993:17). On the other hand, the phonological loop is specialized in the storage and rehearsal of verbal material, the latter being essential to escape language decay or displacement (Hitch, 1978; Hulme et al., 1984; Reitman, 1974).

Of both slave systems mentioned so far, the phonological loop appears to be the most relevant as far as language acquisition is concerned. Actually, it appears to be essential in the acquisition of both one's L1(s) and FLs (Papagno & Vallar, 1995), mainly of vocabulary, especially in spoken language acquisition (Baddeley, Gathercole & Papagno, 1998; Gathercole & Baddeley, 1989; Service, 1992). It is also related to L1 phonological and orthographical ability, which has been found to have an influence on SLA (Meschyan & Hernández, 2002). Similarly, failure to store material in the phonological loop may be one of the causes of the poor performance of SLI children (Gathercole & Baddeley, 1989).

Besides being entwined with language encoding ability, the phonological loop is also thought to be active in the acquisition of syntax (King & Just, 1991), although this role has been questioned by Caplan and Waters (1999), arguing that no statistical information was reported either in King and Just (1991) or in Just and Carpenter (1992) to support their claims. Caplan and Waters also point out that, in their results, Just and Carpenter did not distinguish between performance on sentences in which the subjects did not have to retain the sentence-final words and those in which they did have to. Bearing these flaws in mind, Caplan and Waters (1999) designed an experimental study that enabled them to claim that the verbal working memory system used in

[4] Some cognitive theories add a third slave system to WM, the episodic buffer (e.g. Alloway et al., 2004; Baddeley, 2000).

syntactic processing and in determining sentence meaning is different from the one resorted to when using the meaning of a sentence for further functions. Therefore, the WM system contains specialisations for different verbal processes. These claims appeared corroborated in Waters and Caplan (2005). In this research, WM correlated positively with both the reading comprehension measures used and with the end-of-sentence plausibility judgment tasks measures.

On the whole, WM is considered the key element in a variety of cognitive functions such as memory span for digits (Baddeley & Hitch, 1974), logical reasoning (Baddeley & Hitch, 1974), the recollection of events from LTM (Hitch, 1980), mental calculation capacities and arithmetical problem solving (e.g. Passolunghi & Siegel, 2001; Swanson & Sachse-Lee, 2001). In addition to that, it has been found to maintain a clear relationship with linguistic functions such as writing in L1 (e.g., Swanson & Berninger, 1996), writing in a FL (Abu-Rabia, 2003), vocabulary acquisition (e.g., Atkins & Baddeley, 1998; Gathercole & Baddeley, 1989; Winke, 2005a), syntactic processing (King & Just, 1991; Miyake & Friedman, 1998), and reading and/or listening comprehension (e.g. Carpenter & Just, 1989; Daneman & Carpenter, 1980, 1983; Dixon, LeFevre & Twilley, 1988; Gathercole & Baddeley, 1993; Kyllonen & Christal, 1990; Masson & Miller, 1983; Nation et al., 1999; Seigneuric et al., 2000).

In some studies, WM appears to be dependent on the language tested (N. Ellis, 1992) or on whether what is measured is one's L1 or a FL (e.g. Brown & Hulme, 1992; Cook, 1977, 1979), WM being always superior in one's L1 (Cook, 1997) or linked to language dominance among bilinguals (Chincotta & Underwood, 1996). Other studies of memory in reading span tests (Osaka & Osaka, 1992; Osaka, Osaka & Groner, 1993), however, prove that WM is independent from language. As items differ in their articulatory duration across languages, not simply the number of syllables (Gathercole & Baddeley, 1993), what is shared across languages is the number of semantic units that individuals can retain, not the number of phonemes and digits (Ardila, 2003).

Lack of WM correlates with several learning disorders such as dyslexia (Baddeley, Logie & Ellis, 1988; Gathercole & Baddeley, 1993; Masutto, Bravar & Fabbro, 1993), difficulty in learning foreign languages (e.g. Ganschow et al., 1991), poor reading comprehension (e.g. De Jong, 1998; Swanson, 1992, 1993, 1994, 1999, 2003; Swanson & Berninger, 1995; Swanson, Cochran & Ewars, 1989; Turner & Engle, 1989), poor writing skill (Swanson & Berninger, 1996) and developmental motor disorders, among others.

In order to measure WM capacity, Daneman and Carpenter (1980) designed reading span tests in which the subjects have to read successive sentences distributed

in steadily increasing sets of sentences while remembering the last word in them to, later on, be able to recall them. Consequently, one's WM index is measured either according to the number of final words recalled (Turner & Engle, 1989) or according to the maximum set size which all or some of the sentence-final words the subject is able to recall correctly (Carpenter & Just, 1989; Daneman & Carpenter, 1980, 1983). Reading span tasks are especially useful to measure performance when both processing and storage capabilities of WM are active and to test reading comprehension ability, whereas measures of passive STM span do not seem to correlate with reading comprehension (Carpenter & Just, 1989).

Assuming it is possible to use WM measures in L1 acquisition studies, two issues arise regarding WM: first, whether WM capacity in L1 is related to WM capacity in FL; and, second, what the relationship of WM (both in L1 and FL) is in relation with FL proficiency.

As for the first issue, Harrington and Sawyer (1992) used WM measures (tests of digit, word and reading span) both in the L1 (Japanese) and in the FL (English) in a study with 32 Japanese learners of English at an advanced level. The means obtained were consistently higher in the L1 tests but no significant difference was found in the reading span measures regarding the language used in the test. They also correlated these WM measures. Focusing on the results relevant to our purposes, the memory span measure that obtained the highest and significant correlation was the word span measure (r=.46, p<.001) and only a moderate correlation was found regarding the reading span measure (r=.39, p<.05). Also using a population of highly proficient bilingual speakers, Osaka and Osaka (1992; Osaka, Osaka & Groner, 1993) found a strong correlation between L1 and FL reading spans (between Japanese and English in the first case, and German and French in the second case). The conclusion that could be drawn from these findings is that FL processing may use similar WM resources as those used in L1, at least in highly proficient subjects.

Another issue around WM (both in L1 and FL) is its relationship with FL proficiency in terms of rate and quality. In a study which used Japanese 6-graders, after 20 hours of instruction in English (language which the cohort had never before been taught), Ando et al. (1992; in Miyake & Friedman, 1998) found that reading and listening spans in L1 were better predictors of the FL post-test than other cognitive and personality measures used. In fact, L1 spans correlated even higher than the Raven Progressive Matrices test, which is one of the most widely used measures of *g*.

To Skehan (1982), memory is an essential component of language aptitude. Actually, he claims it is even more important than linguistic analytic ability, especially

for the language-specific talented learners who possess striking memory abilities, particularly of verbal material. This fact offers further evidence of the modular organisation of the human brain, which allows the development of syntax and semantics separately and the development of memory subtypes in different hemispheres (Baddeley, Papagno & Vallar, 1988).

Considering WM as a central component in language aptitude, Miyake, Friedman and Osaka (1998) found that WM had an influence on FL syntactic comprehension of complex sentence structures and FL listening comprehension. Miyake and Friedman (1998) also found that listening (WM) span measures in Japanese (L1) and English (FL) correlated significantly and positively with FL syntactic comprehension (r=.49, p<.001 and r=.52, p<.001 respectively) and significantly but negatively with cue preference distance. Apart from that, both L1 and FL WM correlated significantly (r=.58, p<.001) as well. From these results, yet again a relationship between L1 and FL memory was observed, at least for advanced L2 learners (the participants in this study had been learning English for at least 6 years). In a similar light, the significant contribution of FL WM to FL comprehension mirrors the findings in L1 research regarding L1 reading span and comprehension of complex sentence structures.

Winke (2005b) also considered WM to be a central aptitude factor. In order to demonstrate so, she used the MLAT as well as a phonological WM measure based on Waters and Caplan's (1996) modification of Daneman and Carpenter's (1980) reading span test and a visual-spatial WM test designed after Atkins and Baddeley's (1998). The L2 Chinese scores obtained by the 17 learners of this study, whose L1 was English, were correlated with a Chinese achievement test that measured vocabulary production, writing, reading, listening and speaking and the end-of-semester course marks. The MLAT 1, which is supposed to measure memory, was found to correlate with vocabulary production (r=.50, p<.05) and with speaking fluency (r=0.54, p<.05). The MLAT 5, which is also assumed to measure WM, was not a reliable measure in this study, as its skewness value represented a non-normal range of distribution. The other WM measures were also correlated with achievement test scores. Listening comprehension correlated significantly with phonological WM as well as with speaking complexity, which is in accordance with the belief that memorisation is especially relevant in fluency in languages such as Chinese, which are significantly different from Western languages as regards the writing system (Perfetti, Liu & Tan, 2002; Wang & Geva, 2003). In contrast, all the coefficients involving the visual-spatial WM test used were low and non-significant. Apart from that, and in contrast as well with Carroll's

findings which proved that the composite score of the MLAT was useful to predict overall language learning, this was not the case in this study (*r*=.36), but the correlation coefficient improved when adding the phonological WM measure to it (*r*=.43).

In her doctoral dissertation, Winke (2005a) designed a study which involved two groups of 42 and 91 learners of Chinese at an elementary and advanced level respectively. In this study, similar results to the previous one were found in the group at an elementary level, except for speaking proficiency, which did not appear to have any relation with either language aptitude or memory as measured by the MLAT. In contrast, the correlations between the five MLAT sections, the MLAT composite and the Chinese proficiency tests used in the group at an advanced level did not reveal any significant results. Consequently, it could be concluded that "the utility of the MLAT in predicting Chinese language learning is limited to the beginning levels of study" (Winke, 2005a:177). However, the phonological WM test used did prove to be moderately related to vocabulary, writing and reading in the group of 42 subjects and only partially to listening proficiency in the group involving 91 subjects.

So far in this section the main aptitude factors have been explored. Now is the time to take a look at how they work in the different information-processing stages through which the input that FL learners receive goes.

1.4.4. Information-processing stages in relation to aptitude components

IDs in general and aptitude in particular are attached more or less importance depending on the SLA models that researchers follow. One such model is the information-processing, which accounts for the process of language acquisition from input to output and which stems from cognitive theories that have been adapted to SLA studies.

One information-processing model used by SLA researchers is Anderson's Adaptive Control of Thought (ACT*) (1983, 1990). According to this model, cognitive skills are acquired in three stages: (1) the cognitive stage (development of declarative knowledge), (2) the associative stage (proceduralisation of declarative knowledge), and (3) the autonomous stage (automatisation of error-free procedural knowledge). Declarative knowledge is the knowledge about facts and things, while procedural knowledge is the knowledge of how to perform cognitive activities. If we apply this

theory concerning higher-level cognition or thought to language acquisition, language is seen as the result of approaching sentence generation as a problem-solving task. Having an explicit knowledge of L2 rules can then be seen as the first stage in developing L2 skills, since the production at this stage is not without errors. When declarative knowledge becomes procedural, L2 performance is even slower and contains more errors. Finally, at the autonomous stage, performance is automatic and almost no mistakes are made. Although both types of knowledge coexist in SLA, procedural knowledge is the one which allows the learner to have an optimal performance, whereas subsequent skill improvement in the automatisation of processes increases WM load. Anderson's point of view as for the WM load needed is in clear contrast with McLaughlin's (1987, 1990, 1995), as will be explained below.

Segalowitz (1997, 2000, 2003) adopted Ackerman's (1987, 1988, 1989, Ackerman & Schneider, 1985) information-processing model and applied it to L2 learning. Ackerman's model is very similar to Anderson's; it actually consists of the same three stages in which analogous processes to those proposed by Anderson are believed to take place. Ackerman also postulated in his skill acquisition and integrative theory that individuals converge on performance speed and accuracy as tasks become less dependent on attentional resources thanks to practise. In the first stage of Ackerman's model, performance is based on declarative knowledge; it is slow and tends to contain errors. At this stage, performance needs both general and domain specific content abilities to be active, but not abilities related to skill execution, which come into play once the task becomes progressively automatised (stage 2). In stage 3, procedural knowledge is responsible for performance not making demands over attention but over autonomous psychomotor aspects of performance. In terms of L2 acquisition, Segalowitz (1997) establishes a correspondence with the stages posited by Ackerman. In the first stage, the L2 learner is only able to compose words but unable to use them in conversation. In the second stage, the learner would start being able to build new sentences by using the words that he or she was only able to produce before by making use of the declarative knowledge active in the first stage. At this stage, the L2 learner starts testing new patterns. These patterns are implemented at different speed depending on the individual's ability to automatise skill components (stage 3), so here is where IDs in aptitude become relevant.

Another application of Anderson's (1983, 1985) model of information processing to SLA along with E. D. Gagné's (1985) is that by O'Malley and Chamot (1990, 1993). To them, declarative knowledge is involved in the way this knowledge is stored and transferred and how this schema affects performance depending on whether it was

originally stored in the learner's L1 or L2. Declarative knowledge is also considered to be knowledge about language as a grammatical system. To use a language for communicative purposes, it is procedural knowledge that it is required instead so that communication is performed automatically, although at times some rules may be applied consciously. According to O'Malley and Chamot, therefore, during Anderson's cognitive stage, L2 learners “focus on different aspects of the L2 depending on the context of learning” (1990:77). Consequently, they may focus their attention on meaning and language use rather than on form(s) if they are communicating in an informal context. In the associative stage, L2 learners start to develop their IL, which happens to present errors that gradually disappear as proficiency increases. L2 learners are not able to deal with complex information in the L2 because their attention is invested in developing language skills. When the third stage is reached, L2 learners are able to process language automatically, being now able to focus on language for functional purposes.

Besides adopting Anderson's model, O'Malley and Chamot (1990) relate it to the cognitive and learning strategies that L2 learners use to make their language learning more efficient so that they are able to use language properly depending on the setting in which they are. Consequently, when performing in the FL, not only do L2 learners have to face language coding, but they also have to make a choice of the appropriate L2 use depending on the demands of the setting. In so doing, they use their procedural knowledge, as they would in any other problem-solving situation. This ability to manage in problem-solving, using domain-specific knowledge and applying a variety of strategies depending on the task demands, is precisely what distinguishes “expert” from “novice” L2 learners (McLaughlin, 1990).

The strategies L2 learners use are closely related to Carroll's four major components of aptitude, which O'Malley and Chamot relate in parallel to Anderson's (1980) comprehension model. Firstly, phonetic coding ability is thought to be paramount at the perceptual processing stage, in which the acoustic or written message is encoded. Grammatical sensitivity corresponds to Anderson's parsing stage of comprehension, in which grammar rules are recognised by means of deductive strategies and language functions are inferred resulting in a mental representation of the combined meaning of the words. Declarative knowledge is clearly depicted in Carroll's rote learning ability factor, as relevant schemata in LTM is activated by making associations between sounds and meanings. Carroll's inductive language learning ability is active again in Anderson's parsing stage and in the utilisation stage, in which the mental representation of the sentence's meaning is actually used.

McLaughlin (1987) introduced his own information-processing model into SLA based on previous work by Shiffrin and Schneider (1977), who believed that, as long as a task is not automatised, a large amount of effort needs to be invested in processing energy for that task. In contrast, once a task has been automatised, it only involves the activation of certain nodes in memory that have been trained after having been exposed repeatedly to a consistent pattern of activation. Training is needed but, once the pattern is learned, the automatic process involved is effortless and does not make demands on attention. At the beginning, any process of SLA, which is here considered a complex cognitive skill, needs controlled processing from the learner since it involves a temporary activation of the WM nodes activated in any input sequence. Only after the sequence has been activated and controlled several times will it become automatic and more stable (Segalowitz & Segalowitz, 1993) and be adapted to the different performance contexts without any extra effort, thus providing the learner with attention that he can use in new input sequences (McLaughlin, 1995). That a linguistic sequence is automatised does not mean that it remains unchanged: restructuring is in order so that IL can continue advancing while "allowing (…) old components to be replaced by a more efficient procedure involving new components" (McLaughlin, 1990:118). Altering a pattern once automatised is not easy, though, and that is the reason why the U-shape development pattern is a commonplace in SLA, as the alteration of a pattern can "cause a restructuring of the whole system" (Lightbown, 1985:177) and, consequently, affect the quality of performance due to the demands made on WM.

One major advantage of taking an information-processing perspective in SLA research is that, first, this construct allows researchers to specify in more detail what role each aptitude factor plays in each of the stages in the path towards FL native-like proficiency; second, it also lets us know how all the factors interact with one another in each stage; and finally, it overcomes the recurrent criticism towards aptitude tests, which were attacked for only achieving prediction, not explanation of SLA (Skehan, 1989).

The model relating the processing stages and the aptitude factors allegedly related to them, which were already referred to in the introduction to this section (see section 1.4), was later on extended at a more detailed level (Skehan, 2002). Skehan admits that his model may not be widely accepted in the SLA field because it merges his information-processing perspective with the Focus-on-Form approach and does not follow a universally accepted sequence of development in SLA. However, it does help us to show how aptitude components are related to SLA processes and to try to find an

answer to whether there is variation in the speed of learning in each stage depending on the aptitude component involved.

Table 1.3. SLA processing stages and potential aptitude components (adapted from Skehan, 2002:90)

SLA Processing Stage	Aptitude Component
1. noticing	auditory segmentation attention management working memory phonemic coding
2. pattern identification	fast analysis / working memory grammatical sensitivity
3. extending	inductive language learning ability
4. complexifying	grammatical sensitivity inductive language learning ability
5. integrating	restructuring capacity
6. becoming accurate, avoiding error	automatisation proceduralisation
7. creating a repertoire, achieving salience	retrieval processes
8. automatising rule-based language, achieving fluency	automatising, proceduralisation
9. lexicalising, dual-coding	memory, chunking, retrieval processes

These stages can be condensed under the following labels and related to the aptitude factors suggested by Carroll, as in Table 1.4:

Table 1.4. SLA processing stages, operations and aptitude components (adapted from Skehan, 2002:90)

SLA Processing Stage	Operation	Carroll's aptitude component
Stage 1	Noticing	Phonemic coding ability
Stages 2-5	Patterning	Grammatical sensitivity and inductive language learning
Stages 6-8	Controlling	-
Stages 8, 9	Lexicalising	Associative memory

Such presentation helps us as well to see which areas of SLA processing remain more or less untapped in both Carroll's MLAT and other existing aptitude tests.

Skehan (Dörnyei & Skehan, 2003:597) modified his information-processing model in some aspects. In Table 1.5, those widely accepted FL aptitude constructs are shown in normal text whereas those which are considered “potential” ones, as Skehan (2003:596) calls them, appear in italics.

Table 1.5. SLA stages and aptitude constructs (Dörnyei & Skehan, 2003:597)

SLA stage	Corresponding aptitude constructs
Input processing strategies, such as segmentation	*Attentional control* *Working memory*
Noticing	Phonemic coding ability *Working memory*
Pattern identification	Phonemic coding ability *Working memory* Grammatical sensitivity Inductive language learning ability
Pattern restructuring and manipulation	Grammatical sensitivity Inductive language learning ability
Pattern control	*Automatisation* *Integrative memory*
Pattern integration	*Chunking* *Retrieval memory*

Skehan's latest model is more detailed and includes many more constructs than his original model of information processing stages (Skehan, 1998). For one thing, it should be noticed that memory acquires a central role in all SLA stages except for the pattern restructuring and manipulation stage. Notice as well that WM appears already in the first stage together with attention. In the 1998 model, Skehan just mentioned that different aspects of memory take part in the coding, storage and retrieval processes of material, but memory as such did not appear in the model until the output stage.

Attention was not mentioned in the first model, although Skehan does mention it when dealing with psycholinguistic processes occurring in SLA. In the 2003 model, however, Skehan acknowledges that attention participates in the stage previous to noticing. Actually, attention is thought to be a central element in language processing, although the learner may not be consciously aware of the associations taking place during the acquisition process (Hsiao & Reber, 1998; Schmidt, 1990, 1994, 2001). Noticing also seems to be a central concern for Skehan, since he wonders why noticing varies among individuals, other external conditions being equal, as several studies have shown (e.g. Chapelle & Green, 1992; Miyake & Friedman, 1999; Sawyer & Ranta, 2001). Therefore, Skehan concludes, there are individual differences which do have an influence on input noticing. In addition to this, Skehan suggests further empirical research to demonstrate if noticing is central to language development, as it may be related to abilities other than the phonemic one. Notice that, to Schmidt (1990, 1993, 1994, 1995, 2001), conscious noticing of input is central as it is the condition *sine qua non* form can be subsequently imposed on input. However, from Krashen's (1985) point of view, L2 learners do not need to be aware of the input they are exposed to in order to succeed in their L2 development.

Not only does phonemic coding ability appear in this model in the noticing of input stage but, in contrast to the two previous models, it also appears to play a role when it comes to processing the input and identifying patterns in it. This ability is needed to segment the input stream properly so that a structure can be imposed upon it and further identification and restructuration can take place. That is the reason why, once again, WM should also be taken into account in the patterning substages, because it involves not only noticing but also complex processing. At this stage, Van Patten (1990) showed that learners only attended to form in input, provided they had spare processing capacity. Hence, in the pattern identification of the input, while phonemic coding ability and WM are still involved, both grammatical sensitivity and inductive learning ability come also into play as well and become the main constructs in the fourth stage, pattern restructuring and manipulation. Not just that, these two constructs, which had been merged deliberately in Skehan's 1998 model as “language analytic ability” (see section 1.4.2) are seen as two separate constructs in this model. In relation to these processing stages, it must be recalled that there is a hot debate in the SLA field regarding whether the processes that foster IL development are implicit or explicit (see sections 1.6.1 and 1.6.3). Needless to say, there are also individual factors and external influences such as the modifications of the input and types of feedback which also affect the nature and speed of language processing (Mackey et al., 2002; Robinson, 2002a; Skehan, 2002).

The last two stages correspond to the control, automatisation and effective retrieval of the components of the learners' IL system so that they can hopefully be integrated free of errors in the learner's IL system and be retrieved without making any extra effort. Keeping consistent with the 1998 model, memory is still central in this stage because it is the basis of the creation of chunks which, being accessed as single units, reduce the amount of processing (Foster, 2001; Skehan, 1998) and, therefore, boost learners' fluency in the FL at real-time processing (Bygate, 1987; Schmidt, 1992). Skehan (2002) points out that if the use of communicative strategies is added to chunking and to pressures of real-time language processing, then a reconsideration of the role of memory is in order. In previous models, memory was seen especially relevant in encoding phases and closely related to phonemic coding ability. This new approach makes memory be present not only in the encoding phase, but also in the storage and retrieval phases.

With this model, Skehan opens a new and original line for further research into aptitude constructs and processing stages. Skehan acknowledges that somehow at least two lines of research are consistent with the framework he suggests: DeGraaff's

study (1997) and Robinson's "aptitude complexes" model, the results of which are consistent with the findings of other research studies of SLA in naturalistic settings (e.g. Reves, 1983; in Skehan, 1986, 1998, 2003), for instance.

This section should not finish without making reference to Carroll, the model of whom Skehan bases his information-processing on. Carroll fails to offer an information-processing model that accounts for SLA (Carroll, 1985). Nevertheless, he does relate the different abilities supposedly tapped in the MLAT with what he speculates are the most appropriate teaching methodologies that will make the most of these abilities. Accordingly, he relates phonetic coding ability with the production and the discrimination of speech sounds in the FL and mentions that, although these tasks involve only STM, these phonetic images must be stored in LTM to be retrieved when needed. As for grammatical sensitivity, although it is present in L1 acquisition, he says that it may not be strictly necessary to learn a second language. Regarding inductive language-learning ability, Carroll suggests that it is probably related to "fluid intelligence" and to the LTM containing hypotheses of possible types of linguistic rules. Finally, he says that rote-learning ability needs rehearsal and other strategies so that knowledge is finally stored in the individual's LTM. In his Model of School Learning (Carroll, 1963), Carroll applies a theory (Carroll, 1962) which, as regards L2 learning, tries to account for the variation in FL learning outcomes taking into account variables such as opportunity to learn, quality of instruction, motivation, general verbal intelligence and aptitude seen as the amount of time every individual needs to learn a language. Thus, if optimal learning conditions are present, aptitude is taken over by them and its role is diminished, but it will still be relevant if the learning conditions are not the most appropriate. As can be seen, acquisition stages are not mentioned in Carroll's Model of School Learning, but he relates the different aptitude factors to some other relevant aspects in SLA such as memory and language analysis, which are also relevant for FL instruction purposes.

1.5. Aptitude and types of learners

Assuming that there exists a specific talent for language learning, different learner profiles can be found depending on the abilities in which these learners excel. For instance, Skehan (1986c) studied two groups of learners (N=60 and N=71) in intensive Arabic-as-a-FL courses using standardised measures. After carrying out a cluster analysis which resulted in between 7 and 8 clusters, he interpreted the clusters

and merged them obtaining three main profiles. However, he warns, the cluster analysis technique is not conclusive, as many interpretations could be accepted when merging clusters, and many subjects are needed that make up for clusters with few subjects. The features of the profiles found were the following. Some successful learners presented a linguistic orientation and saw language as a problem-solving task in which there are rules underlying linguistic patterns whereas some other students were more memory-oriented and see language as a sum of chunks (Skehan, 1989). There seemed to be a third group who were balanced in both memory and analytic skills but they took advantage of only one of these skills in order to succeed in their language learning endeavour.

Identifying learner profiles is useful in order to accommodate these profiles to the teaching methodology that benefits them the most (Carroll, 1984). Bearing this in mind, Wesche (1981) streamed FL learners in three different groups according to their responses in an aptitude battery and interviews: a memory group, an analytic group, and another one with an even profile. Assuming that mismatching students and their preferred style of learning leads to failure and dissatisfaction, the analytic group was matched to a traditional analytical teaching approach; the high-memory group was matched to a functional, situational approach; and the even-profiled group was assigned to an audio-visual course. At the same time, some of the students were mismatched on purpose. Those students who were appropriately matched obtained positive results in L2 outcomes and showed positive attitudes, while those who were mismatched did worse and showed a negative attitude towards the type of instruction to which they had been allocated. Consequently, both aptitude and affective variables proved to be relevant in the results of the experiment.

Knowing the learners' aptitude profiles can be useful to teach them so that their weaknesses are deviated, according to Sparks and Ganschow (1991). Although theirs is a proposal aimed at populations with clear deficits as compared to regular learners, Skehan (1998) and Ranta (1998) adopted the same rationale in normal populations. The general line of results is that in communicative settings, non-analytic learners might benefit from form-focused instruction as they are not able to impose structure on the input by themselves.

Sternberg’s triarchic model (Sternberg, 1985a, 1985b, 1988b) has also been implemented to assess whether students placed in a psychology course whose type of instruction matched their pattern of abilities (analytical, creative and practical), which draw on a common set of information-processing components, performed better than students who were mismatched (Sternberg et al., 1999; Sternberg & Grigorenko,

2002). A total of 199 students was selected on the basis of their patterns of ability-test scores (memory, analytical, creative and practical ability) and thus classified into five groups (high in analytical, creative or practical ability, a high balanced group and a below-the-average group). The subjects had to complete a test series that involved the three abilities in Sternberg's model (analytical, creative and practical thinking) and followed a course in which the materials used also followed this triarchic model. The courses they were placed in at random emphasised only one of the four abilities measured in the initial ability test (memory, analytical, creative and practical ability). The results showed that matching the triarchic abilities with the appropriate instruction benefitted the learners. Although this study did not involve L2 learning, Sternberg's model may well be applied to FL teaching and ability. The CANAL-FT, the test used within this framework, simulates a continuous learning situation taking into account the processes of knowledge acquisition and provides diagnostic information that might be used to devise optimal FL teaching, as it provides information of the preferred ways of learning (auditory vs. visual) and preference for implicit or explicit learning. This information can surely be applied to adapt the teachers' methodology to the learning preferences and types of learners (Sternberg & Grigorenko, 2002).

Depending on their strengths and weaknesses, learners develop their own learning styles and strategies. Learning styles are considered to be strongly related to the choice of specific learning strategies, which make it possible to distinguish good from poor language learners (e.g., Ehrman & Oxford, 1988, in Oxford, 1990; Ehrman & Oxford, 1989; Oxford & Ehrman, 1989; O'Malley et al., 1985; O'Malley & Chamot, 1990; Oxford, 1986; Wenden, 1987a). Besides, it is thought that learner strategy training can enhance L2 learning capabilities although this method is not as straightforward as accommodating learner aptitude profiles to instructional methods (see section 1.6.3). Research into this area, however, has not reached a clear conclusion to determine whether learning styles and strategies can be considered components of aptitude (Oxford, 1990). Nevertheless, Ehrman (1996, 1998) claims that the MLAT is a very useful tool for diagnosis of learning style and finds a correspondence between the scores on the five different parts of the MLAT and the different types of learner strategies and styles.

Foreign language acquisition research has also focused on the distinction between FD and FI cognitive styles and their relationship with aptitude. FD individuals are those who process information more globally whereas FI individuals tend to analyse and restructure the information to solve a given problem. Given the lack of a test of cognitive styles specifically aimed at language learning, as the Group

Embedded Figures Test by Witkin and colleagues (1971) is considered an ability rather than a style measure, Skehan (1989) and Griffiths and Sheen (1992) suggest abandoning research into the relationship between FD/FI and L2 learning. Nevertheless, Chapelle (1992; Chapelle & Green, 1992) believes this kind of research can help us understand the individuals' cognitive restructuring ability and, obviously, she defends the idea that FD/FI studies are relevant to SLA studies. Not many studies are conclusive as regards the relationship between FD individuals and aptitude. However, some (e.g. Bialystok & Fröhlich, 1978; R. Ellis, 1990; Gardner, Tremblay & Masgoret, 1997) have reported significant moderate correlations between aptitude measures and FI.

Accordingly, Skehan's (1998) framework tries to reveal the relationship between aptitude, cognitive styles and task demands. In this framework, Skehan follows the justification for task-based instruction proposed by Long and Crookes (1991), who claim that instruction enables acquisition processes to operate through negotiation of meaning and that it should maintain a focus on form, as opposed to a focus on forms. Skehan provides a general model which contains four individual components:

1) modality preferences, which refers to one's predisposition to use visual, auditory or kinesthetic approaches to learning (also related to personality, according to Reid, 1995);
2) the prevalence of the three main aptitude factors (see above) and one's preferences (an analytic predisposition, which tends to be concerned with accuracy and a memory predisposition, which attaches more importance to communicative fluency);
3) learning style (analytic vs. holistic, visual vs. verbal and active vs. passive);
4) learning strategies (meta-cognitive, cognitive and social-affective).

Taking these four main components into account and assuming that learners vary in the extent to which they are balanced, analytic- or memory-oriented learners, Skehan proposes that instruction should be adjusted to one's individual differences by selecting tasks of appropriate level of difficulty and which predispose learners towards particular processing goals. These tasks should also be adapted to the conditions under which they are carried out and should vary in the focus of attention so that, in the end, the learner can become autonomous.

At a general level of language development, individuals stand out in some language skills over others (Carroll, 1984, 1993). This specialisation of skills may have some kind of relationship with the preponderance of some aptitude factors over others.

Discrimination power is, therefore, a topic of concern regarding the MLAT. The literature (e.g. Ehrman, 1998) shows that it is very useful to detect learners likely to succeed or to fail instantaneously, although this is true only up to a certain extent. High scores show that all subparts have been passed with a high mark; low scores, however, could be due to reasons unrelated to language aptitude itself such as fatigue, error in filling the answer sheet or unwillingness to take the test, to mention a few. Unlike extreme scores, mid-range scores are less predictive. Hence, the scores obtained in each subpart are to be examined so as to be able to trace the aptitude profile. It is therefore another open field of study to investigate which aptitude factors foster the specialisation in reading, listening, writing and speaking skills. It must be acknowledged, though, that the tests that are the marrow of this dissertation, the MLAT and the MLAT-E, have been criticised precisely because they are suspected not to contain a reliable measure of a factor that helps to predict speaking ability or, rather, communicative competence (e.g. Horwitz, 1987).

1.6. Relationship between language aptitude and other factors

Aptitude has been considered, along with motivation, the most determining factor to guarantee FL learning success. However, it should never be considered alone but in interaction with other factors that also have an influence on the acquisition of an FL. This section is, therefore, devoted to the interaction that aptitude has been found to have with some of these factors. Section 1.6.1 deals with how L1 and training in either language or in cognitive skills may make aptitude change, although the opposite view, i.e., that aptitude is innate and stable, has also been defended. Section 1.6.2 explains the differences that have been found between adult and young learners in relation to aptitude and how the Critical Period affects as well their success in SLA. Very much related to the previous section, section 1.6.3 contrasts how aptitude is seen depending on whether acquisition is taking place in formal or informal settings. The latter have been considered to be the most similar context to that in which L1 acquisition takes place or, somehow, to how young learners acquire FLs.

Although research so far in relation to success in FL learning and sex has been inconclusive, the relationship between language aptitude and sex is presented along with how sex has been found to play a different role depending on the language learning at work. Bilingual speakers have often been found to have some advantage

over monolinguals when it comes to learning languages. This advantage may also be due to some kind of influence of aptitude. Section 1.6.5 reviews how aptitude is related to bilinguals' advantages. Finally, section 1.6.6 deals with intelligence, an overlapping factor with aptitude although research shows that high intelligence is not necessarily correlated to FL aptitude and vice versa.

1.6.1. Language aptitude: innateness, stability, trainability and the role of L1

As already presented in section 1.3, whether aptitude is innate and/or stable has been a controversial topic for as long as aptitude has been an issue in SLA studies. Views towards this issue have varied over time. Carroll, for instance, modified his consideration towards the stability of aptitude at several points. If he first affirmed that aptitude was stable (1973) and innate, as opposed to what Neufeld (1978) and Lepicq (1973; in Carroll, 1981) argue, later on, he wrote:

> "I must also state that I am in general sympathy with writers like Neufeld (1978) who want to emphasize that foreign language aptitude, whatever it is, is not fixed or innate. They may be correct, and I would like to believe that they are. I am simply neutral on this matter, since we do not have the kind of evidence that would enable us to decide it, and are unlikely to get such evidence readily. Further, I have no hard evidence that would impel me to disagree with the idea that foreign language aptitude, considered as the individual's initial state of readiness and capacity for learning a foreign language, and probable degree of facility in doing so, is crucially dependent upon past learning experiences. Yet, what evidence I have suggests that foreign language aptitude is relatively fixed over long periods of an individual's life span, and relatively hard to modify in any significant way."
>
> (Carroll, 1981:86)

Were we to have the evidence for which Carroll longed, we could freely claim that aptitude is a residue of one's L1 learning ability. This challenges Neufeld's (1978) claim that there is no individual variation in L1 learning abilities, which comes out not to be true, as has been explained in section 1.2.2.1.

Both L1 abilities and disabilities are to be taken into account in relation to FL aptitude issues. One of the factors that prevents individuals from learning a FL, despite their theoretical aptitude to successfully achieve it, is, for instance, dyslexia, as Dinklage (1971; in Grigorenko, 2002) first pointed out. Actually, neither the PLAB nor

the MLAT are appropriate to measure language aptitude in this kind of individuals because these tests require perceptions of language segmentations and their correspondences with graphemic symbols. This handicap led Sparks, Ganschow and Pohlman (1989) to introduce their Linguistic Coding Differences Hypothesis (LCDH), first, into the learning disabilities literature and, two years later, in the FL literature (Sparks & Ganschow, 1991). On the basis that IQ is not a critical variable in determining FL learning (Sparks, Ganschow & Pohlman, 1989; Ganschow et al., 1991), they suggested that students who have difficulty in learning a FL may in fact have L1 learning problems (Ganschow & Sparks, 1986, cited in Ganschow et al., 1991; Sparks, Ganschow & Pohlman, 1989), mainly in phonology and orthography. In fact, Spolsky (1989) suggests as well that FL learning problems may exist due to physiological or biological limitations present in one's L1. Findings after testing the efficacy of the LCDH have led its creators to conclude that successful FL learners exhibit significant stronger L1 skills than unsuccessful ones mainly on measures of phonology, orthography and syntactic skills, but not on semantic tasks (Ganschow et al., 1991, 1994; Sparks, Ganschow & Pohlman, 1989; Sparks et al., 1992a; 1992b, 1997, 1998a; Sparks & Ganschow, 1993a, 1993b) (for more references on word recognition and the development of L2 phonological/orthographic skills, see Koda, 1992, 1998, 1999). The results confirming the LCDH also suggest that low proficiency does not necessarily correlate with weak aptitude as measured by the MLAT (Sparks et al., 1998b), or even with mathematical skill (Ganschow et al., 1991). Nevertheless, the MLAT has actually been used to detect FL learning disabilities successfully (Gajar, 1987).

If L1 disabilities can predict difficulties in FL learning, fast development of one's L1 (as shown by measures of MLU and sentence structure complexity) corresponds as well to higher scores on FL aptitude tests, as Skehan (1986b) found in the analysis of the results of the Bristol Language Project (Wells, 1981, 1985). This "general language processing capability" would interact with another cluster of factors, which are very diverse in nature: on the one hand, with the individual's sociolinguistic situation (L1 vocabulary, the students' family class background, and the educational level and literacy standard of their parents) (Bates, Bretherton & Snyder, 1988); on the other hand, with what Skehan calls the "ability to use language in a decontextualized way", also relevant for L1 acquisition (Wells, 1985, 1986). Thus, FL aptitude is not just a "residue" of L1 development (Carroll, 1973) but a major component of FL learning that accounts for the differences ignored by UG explanations that are meaningful both for formal and informal contexts of language learning.

The Bristol Language Project provided Skehan and Ducroquet with the raw material that made it possible for them to continue the study of the IDs involved in L1 development as related to possible differences in FL aptitude and achievement. This new project was named “the follow-up to the Bristol Language Project”. Approximately one decade after the data in L1 had been collected, 103 subjects participating in the former project were administered some aptitude and standardised achievement tests of speaking, listening, writing and reading in French or German. The fundamental aim was, therefore, to examine the interrelationship between these three main groups of variables.

As regards the L1 measures, the following indices were collected: global and specific measures of rate development, test-based measures of comprehension and vocabulary size, demographic/biographical information, and quantity and type of input the child receives (child-directed speech). The indices of FL aptitude used were measures already available and as comprehensive as possible because of time restrictions for the data collection: the AH2 (a verbal intelligence test), subtests 1 and 2 of the MLAT-E (Hidden Words and Matching Words), the York Language aptitude test and subtests 5 and 6 of the PLAB (Sound-Symbol Association). L2 achievement in French and German was measured by using the NFER/APU tests, which included receptive and productive measures which had already been used and proved to have high reliabilities in several contexts. The collection of these data was meant to answer questions on:

(i). the relationship between individual differences in first language development and foreign language achievement, i.e. whether fast developers in the mother tongue learn foreign languages more quickly;
(ii). the origin of foreign language aptitude, i.e. whether such aptitude can be regarded as the residue of a first language learning ability;
(iii). the similarity of the dimensions of first language development, on the one hand, and foreign language aptitude and achievement, on the other;
(iv). the relative contributions of environmental influences, such as class of family background and the nature of the linguistic environment of the child to subsequent language development, versus individual make up concerned either with route or rate of development.

(Skehan & Ducroquet, 1988:13-14)

Two cohorts were tested in this project. An older cohort (N=53), who were 15 months old when the data started to be collected in the Bristol Project, only 23 subjects of whom FL achievement data is available and a younger cohort (N=50), who were 39 months in Well's study, only 32 of whom FL achievement data is available.

The correlations between the early L1 measures and the ones in FL aptitude regarding the older cohort showed that, broadly speaking, structural indices of L1 development tended to be more highly correlated with aptitude than did more semantic/pragmatic indices. Correlations were significantly related at a moderate level. FL aptitude and FL success were also highly correlated but none of the relations was significant. In contrast, L1 development and FL achievement did not seem to have any clear relationship to one another. However, comprehension and vocabulary indices in L1 did seem to be related to both aptitude and achievement at a moderate/moderate-to-strong level. Finally, family background indices were related to FL aptitude measures at a moderate level and only at a weak-to-moderate level with achievement measures.

Regression analyses were also run so as to eliminate the overlapping that may have been present in the correlational results and to identify the real path of cause-effect in the variables. These analyses, in which FL achievement was the dependent variable, showed that aptitude tests were the ones to have a more powerful influence over the other variables and that they were the ones that account for FL achievement, along with L1 test-based measures (not developmental ones nor family background measures). The regression analyses which had FL aptitude as a dependent variable showed that L1 indices had some kind of influence, although not so high as those that relate achievement tests using all the L1 and FL aptitude indices, and that this influence varied depending on the aptitude measure, i.e. the York and the MLAT-E Part 2 Matching Words (for a description, see 2.3.1.1) entered in higher correlations than did auditory-ability tests. Regarding the L1 measures, family background and MLU at 42 months seemed to have some importance in the development of aptitude, which would support Carroll's (1973) idea of aptitude as a “residue” of one's L1.

The correlational analyses in the younger cohort, in contrast with the older one, did not show any significant relationship between L1 development and FL aptitude. However, some convergent points between both cohorts were found. For instance, background indices were very similar and suggested there is a consistent moderate relationship between one's background and FL aptitude. Some other correlations (indices of range of syntactic complexity, nominal group complexity and the MLUs at 42 months) were higher than in the older cohort. With reference to the correlations between FL aptitude and FL achievement, none of them was significant. Comparing the correlations of the younger group to the correlations in the older cohort, while the correlational patterns involving the York Language Analysis test and the PLAB 6 (sound-symbol discrimination subtest) were similar to those of the older cohort, the other tests were much lower. The researchers could not find any plausible explanation

for this. Finally, the correlations between the L1 measures and FL achievement were not significant either. The general index of family background once again proved to be the most predictive index, but its strength was lower than it was in the older cohort. Generally speaking, though, the connection between L1 development and FL achievement was stronger for this cohort than it was for the older one.

Besides finding that aptitude and L2 achievement were strongly related, L1 development and L2 achievement, however, did not keep a strong relationship in this research. This could have been due to the inappropriateness of the measures used or due to the FL teaching approach followed in the schools the subjects of this study attended. Skehan (1986c, 1989, 1990) concluded from this follow-up phase that aptitude is an innate capacity for learning and a sort of residue of L1 development, on the grounds that L1 speed of learning was correlated with FL measures of rate of learning. Nevertheless, it should be born in mind that biographical/background variables were also relevant. The linguistic developmental indices, however, did not correlate very highly with the background/test measures, which may be due to the fact that they are independent sources of prediction for FL aptitude.

Another recent study (Sparks et al., 2009) has also proved that L1 skills, especially L1 word decoding, partially explain L2 word decoding skills and L2 proficiency in general, which provides further proof that L1 skills can transfer to L2 skills when the L2 has a similar orthography to the L1. The high power of L1 word decoding as a predictor of L2 word decoding skill was also found in another study (Sparks et al., 2008) in which this measure alone accounted for 52% of the variance in L2 word decoding skill. In the 2009 study, the long form of the MLAT was used, which obtained significant positive correlations ranging from .54 to .75 (p<.01) with all the L1 and L2 measures used in the study and accounted for 56% of the variance on the L2 proficiency measures. Prior to this study, in a longitudinal study, 54 learners were followed over 10 years, from grade 1 to grade 10 (Sparks et al., 2006). They were administered, in the first place, measures of L1 academic aptitude, L1 literacy (word decoding, spelling, reading comprehension, phonological awareness) and oral language (vocabulary, listening comprehension, verbal ability). In grade 9, they were administered the MLAT and measures of L2 word decoding, spelling, reading comprehension, writing, and listening/speaking at the end of two years of L2 study. In the first study, L1 literacy in elementary school explained 40% of the variance in oral and written L2 proficiency in high school, and L1 literacy (reading, spelling), receptive vocabulary and verbal ability in elementary school explained 73% of the variance in L2 aptitude on the MLAT in 9th grade.

Considering WM as an aptitude factor, another interesting question that arises from the parallelism between L1 and L2 is whether WM capacity is shared or, on the contrary, it works independently. Research carried out by Osaka and colleagues (Osaka & Osaka, 1992; Osaka, Osaka & Groner, 1993) suggest that at least advanced L2 learners make use of the same WM resources when processing information in the L1 or in the L2. This finding is in agreement with other correlational studies which have found that L1 proficiency correlates with proficiency in the L2 (e.g. Carson et al., 1990; Hulstijn & Bossers, 1992; Sparks, Ganschow & Patton, 1995). Phonological memory as measured with an adaptation of Service's (1989) test along with L1 literacy (word recognition and comprehension skills) were also found to have positive effects on learning English as a FL (Dufva & Voeten, 1999), explaining 58% of the variance in early stages of English proficiency.

In addition to the issue of innateness, another controversial topic in FL aptitude research is whether aptitude is fixed at birth and whether it develops or not with training. Several studies reject the assumption that aptitude is fixed at birth and that it does not develop. It has been noticed that certain cognitive aptitudes (grammatical sensitivity and semantic relations) keep on rising markedly after puberty (Bloom, 1964; in Walsh & Diller, 1981). Besides, if language aptitude is considered as being part of the general cognitive processes, it should be possible to modify it through instruction or training as it happens with other skills (R. M. Gagné, 1967, 1968). For instance, WM efficiency is believed to increase with the use of specific strategies commonly used by good language learners (Chase & Ericsson, 1982). Sternberg (1998) also argues that if language aptitude is comparable to any other kind of expertise, it can also develop with training given its flexibility. McLaughlin (1990:173) claims that “aptitude should not be viewed as a static personality trait; novices become experts with experience” since “experience with one language gives the learner strategies and metacognitive skills that generalize to subsequent languages”.

Carroll admits that there may be some transfer of skills from one language to another but that “the idea that language training increases language *aptitude* is false, (as) people who already have high aptitude for second-language learning are the ones who are more likely to learn more languages; people with low aptitude are less likely to try learning many languages beyond a second” (Carroll, 1984:99). The opposite idea is defended by McLaughlin (1990, 1995), who claims that prior L2 learning experience enhances language aptitude, which, therefore, makes it unstable. Otherwise, he argues, the multilingual adults that learned an artificial language implicitly in Nation and McLaughlin’s study (1986) would not have been more successful than bilinguals and

monolinguals, who were learning under the same implicit learning conditions. This is so because multilinguals take advantage of the strategies and metacognitive skills that they have acquired along their language learning history and apply them to subsequent language learning (see also section 1.6.5 on issues related to bilingualism). These skills are believed to be stored in the individual's WM, which will be resorted to more often at beginning stages of language learning. In addition, McLaughlin (1995) believes that some strategies can be taught to increase the efficiency of WM processes, which necessarily entails a change in language aptitude capacity.

In the same line as McLaughlin, O'Malley and Chamot (1993) also relate Carroll's aptitude factors to learning strategies and styles (see section 1.4.4). Since there is a strong link between aptitude and effective learning strategy use, they conclude that “aptitude should not be seen as an innate trait but as a strategic ability that can be learned” (1990:163). Besides, since the learning strategies used by the learner are closely related to their preference for some specific learning styles (FD/FI, auditory learning versus visual, etc.), the proper choice of one strategy over another will increase language learning effectiveness, which, in a way, reflects that these learners have an aptitude to learn an L2 effectively which learners who do not succeed in choosing L2 learning strategies properly surely lack. Apart from choosing the right strategy according to the problem to solve, good language learners have been found to have and use a wider repertoire of strategies than do poor language learners.

Politzer and Weiss (1969, in Carroll, 1973), however, attempted to train adults to perform better in the MLAT, but they did not find any improvement either in their language aptitude scores or their L2 proficiency. These results coincide with Carroll's view that aptitude cannot be trained in principle, or at least, not significantly (Carroll, 1984). What can be trained is language learning strategies, although without extremely outstanding results (Cohen et al., 1996; Wenden, 1987b).

1.6.2. Language aptitude and age

Lenneberg's Critical Period Hypothesis (CPH) (Lenneberg, 1967, 1970) is one of the longest debated topics in the field of SLA, and it has also been taken into consideration in aptitude research. While it is widely assumed that a CP does exist for L1 acquisition, in the SLA field the age effect is, more often than not, a controversial factor that has awaken the interest of many researchers. As a general rule, children do

not have such great difficulty in learning FLs as do older learners. However, the difference between children's and adults' L2 learning is not a matter of black or white, especially if we add yet another variable: aptitude. In this section, insights will be given, first, relating aptitude to the CPH (section 1.6.2.1) and, second, relating aptitude to rate of acquisition/learning and age (section 1.6.2.2). The latter will focus on the use of language analytic abilities and implicit learning, thought to be especially relevant in adult learners, along with cognitive maturity.

1.6.2.1. Aptitude and the Critical Period Hypothesis

Issues such as innateness and the trainability and stability of aptitude cannot be dealt with without taking into account another variable: age. If, as said before (section 1.6.1), aptitude is considered to be innate, fixed and difficult to train, the CPH reinforces these hypotheses because of the constraints that it imposes on the L2 acquisition process. In addition, whether language abilities are considered to be part of general learning or not will determine the influence of this assumed CP. Piaget (e.g. 1983; Piaget & Inhelder, 1966), for instance, agrees that development is innate but, as he does not ascribe any particular module in the brain to language acquisition, it is one's external circumstances and social interaction that makes language develop with processes changing systematically with age, as it happens with other cognitive abilities.

From a generativist perspective, taking for granted the existence of a CP[5] for language learning, which would be consistent with the existence of an LAD[6] (N. Chomsky, 1986) both for L1 and L2 acquisition, it should be wise to have a look at the main findings related to the age factor, understood as the age at which L2 learning/acquisition started[7]. As Krashen, Long and Scarcella (1979/1982) very

[5] Since there is not an agreement on when the CP starts and on its pattern of evolution, some (Harley & Wang, 1997; Long, 1990; Oyama, 1978) distinguish between the existence of a critical period and of several sensitive periods which do not appear at a fixed point in time but develop progressively over later childhood, puberty and adolescence. In practice, however, these two terms appear used interchangeably in the literature.

[6] The role of UG in SLA is controversial as is the existence of the LAD is not universally accepted (Bates & MacWhinney, 1989; Jacobs & Schumann, 1992; MacWhinney, 1997).

[7] A new turning point in studies into the age factor is the acknowledgement that “onset age” is not as decisive as is the age of first significant exposure to the L2. That is, the overgeneralisation of results of studies of “the earlier the better” in naturalistic settings should be rephrased to “the earlier might be the better” when applied to instructional contexts, as the early exposure is effective provided it is associated with enough significant exposure distributed intensively and with opportunities for participating in a variety of L2 social contexts (Muñoz, 2008).

succinctly summarise, three main generalisations can be found in the literature related to the CP which stems from the empirical studies carried out in the 1970s:

> (1). Adults proceed through early stages of syntactic and morphological development faster than children (where time and exposure are held constant).
>
> (2). Older children acquire faster than younger children (again, in early stages of syntactic and morphological development where time and exposure are held constant).
>
> (3). Acquirers who begin natural exposure to second language during childhood generally achieve higher second language proficiency than those beginning as adults.
>
> (Krashen, Long & Scarcella, 1979/1982, reprint:161)

Focusing on the third point on Krashen and colleagues' list, while it is true that younger starters have been found to be better learners in the long run because their ultimate attainment is superior to that of older learners, this does not necessarily mean that adults are at a clear disadvantage when it comes to language learning. To begin with, ultimate attainment does not equal native-like proficiency (Birdsong, 1999). What is more, some adults have been found to achieve near-native proficiency despite maturational constraints (e.g. Birdsong, 1992; Birdsong & Molis, 2001; Bongaerts et al., 1997; Bongaerts, 1999; Ioup et al., 1994; White & Genesee, 1996; see also review in Birdsong, 1999). Conversely, some children have been found to fail in their endeavour to acquire a FL (e.g. Ioup, 1989) and some other studies suggest that starting early is not a guarantee of native-like achievement (e.g. Harley & Wang, 1997).

Other challenges to the CP are found in the Schneiderman and Desmarais (1988a, 1988b) studies, in which they point out that talented learners, for instance, irrespective of the age they start to learn a FL, may achieve native-like competence in all grammatical aspects of the FL except for accent (Scovel, 1969). This failure in the acquisition of native-like accent could be due to the separation of talent for pronunciation from the rest of linguistic skills (Neufeld, 1980) or due to the loss of neuromuscular flexibility as time passes by (e.g. Birdsong, 1999; Harley, 1986; Harley & Wang, 1997; Long, 1990; Seliger et al., 1975; Seliger, 1978; Seliger, Krashen & Ladefoged, 1975; Singleton, 1989). The CP for FL learning is, therefore, an optimal explanation only for problems in pronunciation acquisition (see references in Schneiderman & Desmarais, 1988), since later developmental stages "are actually more pertinent to the integration of higher order linguistic processes" (Walsh & Diller, 1981:14). However, there are studies which prove children's superiority over adults in

ultimate attainment in syntax (e.g. Oyama, 1978; Patkowski, 1980). In this same line, nevertheless, Skehan (1998) and others argue that post-critical period learners should have some advantage when learning a FL, since they have already mastered a complete language system which can be of use to acquire further languages, as a linguistic core system has already been set and can be transferred to further acquisition processes.

Besides using the argument of full, partial or no L1 system transfer, at least two opposite branches (with gradation between both) are to be found within the UG school: one which defends the "full access" to UG and another one which pleads for the "no access" to it. The (full) access position argues in favor of UG constraining subsequent L2 development in the same way as it does in L1 acquisition (e.g. Birdsong, 1992; Young-Scholten, 1994). It is believed that the inappropriate application of these skills can even impinge on the L2 acquisition process (Felix, 1985; Krashen, 1981a, 1981b; Lenneberg, 1967, 1970; Schwartz, 1993; Scovel, 1969) as it can cause interference errors, especially recurrent in the early stages of acquisition (Krashen, 1981a). The dissimilarities existing between L1 and L2 acquisition would then be due to the difference in cognitive maturity of the learner. In contrast, the "no access" position defends that UG is by no means involved at any stage of L2 acquisition, that it is weakened by age and so L2 learners have to resort to more general problem-solving skills.

Bley-Vroman (1989, 1990) explains the differences between child and adult language learning in his FDH[8], in which it is claimed that, when learning a FL, adults must rely on any indirect knowledge of UG they may have through their L1 and on their ability in problem solving whereas children learn languages through implicit, domain-specific mechanisms, as they still have access to UG. This means that UG can be reconstructed from the native language system, but variation in L2 learning will depend on the individual learner's ability.

In contrast, Robinson's (1996b, 1997a, 2001b) FSH[9] defends that there is insufficient evidence for a dissociation between dual systems of implicit and explicit learning in adulthood as others (Reber et al., 1980; Reber, Walkenfield & Hernstadt, 1991) claim (see also section 1.6.3). Long (1990) also argues that if children and adults happened to learn FLs in a different way, we would expect to see evidence of different acquisition processes, but this is not the case indeed.

[8] FDH stands for Fundamental Difference Hypothesis, as presented in section 1.3.
[9] FSH stands for Fundamental Similarity Hypothesis, as presented in section 1.3.

One oft-cited study concerning the CPH is that by Johnson and Newport (1989), who reported a linear relationship between age and language learning success until the onset of puberty in native Chinese or Korean speakers who learned English as an L2. This population was chosen because of the typological dissimilarity existing between Chinese and Korean (L1s) and English (L2). While age of first exposure to English was the predictor of performance before the age of 15, this variable was not decisive from the age of 17 to 39. Age of first exposure to L2 English formal instruction of the late arrivals was also negative and non-significant, while no significant differences were found between the group of native speakers and those who had arrived when they were between 3 and 7 years old, who were as well the only ones who reached native-like performance. The pattern Johnson and Newport were able to trace, however, showed that the waning in performance is scattered for adults and gradual until the age of 15, which makes it difficult to fix an exact threshold for the beginning of the CP.

In order to both test Bley-Vroman's FDH and replicate the Johnson and Newport (1989) study, DeKeyser (2000) studied the acquisition of English of 57 Hungarians who had arrived in the United States when they were from 1 to 40 years old and who had been living there for 10 years or more. They were administered a modified version of the grammaticality judgment test used by Johnson and Newport and the Hungarian Language Aptitude Test, Words in Sentences (Ottó, 1996), which is an adaptation of the MLAT. DeKeyser did not find any significant correlations between test scores and variables such as years of schooling or age at time of test, which confirmed the results in Johnson and Newport. Nevertheless, he did find that six of the late starters (age of onset >16) produced relatively high test scores, three of which being overlapped to those of child arrivals (age of onset <16), which is in line with the prediction of the FDH. What is relevant for the subject matter of this dissertation is the data scores DeKeyser uses to justify this advantage: these six subjects had high verbal analytical aptitude, which would have allowed them to reflect on grammar rules explicitly, thereby providing an explanation for the success in L2 learning of some adults. Apart from that, as he found that, for child arrivals, aptitude was not relevant in the grammaticality judgment tests (r=.07 *ns*) but it was higher in adult arrivals (r=.33, p<.05), he claimed that this could be so because aptitude is only relevant for adult learners. From these results, it follows that maturational constraints apply only to implicit language learning mechanisms. The results found in the DeKeyser study have nevertheless been questioned by Hyltenstam and Abrahamsson (2003).

Harley and Hart (1997) were also interested in knowing what aptitude components are most relevant in relation to age of immersion. Their study showed that

analytic ability was the only significant predictor of several L2 proficiency measures for 11-grade students who had been immersed in the L2 community since grade 7. Language analytic ability, however, was not a significant predictor in early immersion students (grade 1), as in DeKeyser's (2000) study, but memory. In this study, though, the late immersion students had attended classes of a focus-on-form kind of instruction, which may have conditioned the results obtained. This hypothesis is consistent with Sharwood Smith's (1981) considerations towards the age limitations of the use of conscious strategies for the acquisition of an L2. That is, using explicit instruction in primary and secondary schools is of no use because of the children's age, as they are not cognitively mature enough. It is also worth remarking that the research conducted by Harley and Hart did not include any oral proficiency measure; therefore, maybe the late immersion subjects, who showed higher analytic abilities than the early immersion ones, may not have been superior in their performance in natural conversation in the FL.

Despite the advantages that adults may have when learning a FL thanks to their superior language analytic abilities, adults, as mentioned above, have to fight against the neurological plasticity loss they have undergone, which starts at infancy. The problem underlying the justification using the argument of the neural plasticity loss is that this loss is said to be mostly complete by around age 5, while the CP is said to occur at the onset of puberty, coinciding with the completion of brain lateralization. Consequently, if age of onset of L2 learning occurs once UG parameters have been set, as is the case of some feral children such as Genie, Kaspar, Hauser and Chelsea (see Curtiss, 1988, for further references), the already established structures of one's first language would not be relevant either (Cook, 1985). Moreover, they could make the task of learning an L2 more difficult because of the inability to reset the L1 parameters for the L2 (White, 1989, 1992).

1.6.2.2. Aptitude and rate of foreign language learning

In the presence of the inconclusive findings regarding adulthood versus childhood as the time of first exposure to and ultimate attainment in a FL, another variable should be taken into consideration envisaging, perhaps, more enlightening results: rate. This variable is common to Krashen's et al. (1979/1982) first and second points mentioned above, in which two different types of population are compared:

adults and children in the first point, and older children and younger children in the second point.

Besides being approached in age factor studies, rate is also a key word in Carroll's definition of aptitude, in which, apart from claiming that it is “relatively fixed” and “relative hard to modify” (1981:84), Carroll suggests that “aptitude should be defined in terms of prediction of *rate* of learning” (1981: 91) and he also remarks that “people differ widely in their capacity to learn foreign languages easily and *rapidly*" (1981:97) (italics added). Consequently, it is a matter of interest whether rate in adults, younger learners or older learners depends strictly speaking on their age (since age of acquisition appears to be premium when social and environmental variables are removed) or if, on the contrary, aptitude is also somehow involved.

What is a matter of interest in aptitude terms is not so much the starting age of acquisition/learning and thereby the L2 learners' ultimate attainment but, first, how aptitude factors interact or function depending on the learners' age and how this affects their rate of learning and, second, how changes over time in aptitude components (if any) affect the L2 learning process. In principle, given the tendency for adults, as opposed to children, to resort to both explicit and implicit mechanisms to learn a language, language analytic abilities will be especially relevant for this population. Krashen et al. (1979/1982) believe that, where time and exposure are held constant, in early stages of syntactic and morphological development, adults overtake children. The same happens when comparing older children's with younger children's rate of acquisition. This pattern has been shown in studies in phonology (e.g. Asher & Price, 1967; Olson & Samuels, 1973; Snow & Hoefnagel-Höhle, 1977) and syntax (e.g. Snow & Hoefnagel-Höhle, 1978) in which, unlike in studies of ultimate attainment which tend to show a superiority of early starters, older learners move towards second language proficiency more quickly than children do, although this advantage applies only in the short run.

Numerous studies have evidenced the older learners’ faster rate over younger learners in instructional settings (e.g. Burstall et al., 1974, in Singleton & Ryan, 2004; Oller & Nagato, 1974), immersion programmes (e.g. Harley, 1986; Swain, 1981) and naturalistic settings (e.g. Ekstrand, 1976; Ervin-Tripp, 1974; in Singleton & Ryan, 2004). This short yet “glorious” period for older learners has been repeatedly confirmed in the results obtained from the data of two projects conducted in Spain – at the University of the Basque Country and at the University of Barcelona (the BAF Project). Both projects took advantage of the advancement in the introduction of English as a subject at school to compare how learners progress in their L2 learning process

depending on the age of first exposure to the FL. In the case of the Basque Country, the participants are Spanish/Basque bilingual and started formal instruction of English at the age of 2, 8 or 11. The data were collected when the subjects had received the same amount of hours of instruction. Basically, the results in the Basque country are that the older beginners significantly outperform the younger beginners (e.g. Cenoz, 2003; García Lecumberri & Gallardo, 2003; García Mayo, 2003; Lasagabaster & Doiz, 2003).

The subjects in the BAF Project (for a compilation of the results of this project regarding several skills, see Muñoz 2006a) are Catalan/Spanish bilingual learners of English who started instruction at the age of 8, 11, 14 or beyond 18. As in the project of the Basque country, one of the main aims of this project was to determine the effects of advancing the time of implementing English as a subject at school. In several studies of this project, the overall results show that younger learners catch up with older starters in aural perception, oral production and in some fluency measures in the written composition task. Nevertheless, the younger learners are slower in the morphosyntactic and listening comprehension tasks, showing a take-off in these abilities between the ages of 11 and 13.

Three main different data collection times were set to study the rate and ultimate attainment of acquisition as shown in Table 1.6.

Table 1.6. Main subject groups in the BAF project (adapted from Muñoz, 2006a:15)

	Group A AO=8		Group B AO=11		Group C AO=14		Group D AO=18+	
Time 1 200 h	A1	AT=10;9 N=284 OSE=164	B1	AT=12;9 N=286 OSE=107	C1	AT=15;9 N=40 OSE=21	D1	AT=28;9 N=91 OSE=67
Time 2 416 h	A2	AT=12;9 N=278 OSE=140	B2	AT=14;9 N=240 OSE=105	C2	AT=17;9 N=11 OSE=5	D2	AT=39;4 N=43 OSE=21
Time 3 726 h	A3	AT=16;8 N=338 OSE=71	B3	AT=17;9 N=296 OSE=58				

AO=Age of onset AT=Age of testing OSE=only school exposure

Several tests were administered to the cohorts so that different language subcomponents could be tapped and thus obtain a global picture of the acquisition development of the subjects, both longitudinally and cross-sectionally. When comparing the longitudinal subjects of the two central groups, the one that started at grade 3 (early starters – ES) and the one that started at grade 6 (late starters – LS), at

the two first times of data collection, the general tendency is for the LS to always obtain higher scores than those obtained by the ES. Moreover, the differences between the groups were highly significant at Times 1 and 2 for both the cloze and the dictation tests, but only significant at Time 2 for the listening comprehension. Likewise, the LS did much better in Time 2 in the cloze and dictation tests, but they obtained similar scores to those of the ES in the listening comprehension tests. In terms of aptitude and age, taking DeKeyser's (2000; DeKeyser & Larson-Hall, 2005) argument that young learners necessarily learn implicitly and that the CPH only applies when this type of learning takes place, young learners could never obtain the same grades as the older learners because not being supplied with enough input prevents their implicit learning mechanisms, i.e. the basis of their learning capacity, to function. Moreover, older learners can benefit from their superior cognitive development, which also triggers explicit learning mechanisms that younger learners cannot use (Muñoz, 2001, 2006a, 2008).

When analyzing the groups cross-sectionally at three different times (excluding those groups for which there was insufficient data - groups C and D), it was found that the LS always obtained higher scores. However, when contrasting the groups between times, different results were found for all tests and times: at Time 1, no significant difference was found between groups A1 and B1 in the cloze test and the listening comprehension test, and it was only marginally significant in the dictation test. Groups C1 and D1 were not significantly different on the listening comprehension test either. However, a clear pattern was found when considering all groups together, as the order from highest to lowest scores was always D1, C1, B1, A1 for all the tests. Yet again, reprising DeKeyser's and Muñoz's argumentations, massive exposure could be the key to this pattern, as the quality and quantity of the adults' exposure as compared to that of the younger learners could probably have exerted some kind of influence.

The same linear pattern was found at Times 2 and 3. At Time 3, significant differences were found on all tests except on the measure of reception in the oral interview, probably because of the plateau that this ability reaches at a determinate level of proficiency (see sections 1.4.1 and 1.4.4). Furthermore, the adult subjects in this project were the fastest learners overall. However, their rate of development decreased between Times 1 and 2 on the two measures of aural comprehension, which could also probably be due to this same reason. The younger learners caught up with older starters in aural perception and production (Fullana, 2006) and in some fluency written measures (Torras et al., 2006) as well. In contrast, the tapping of the learners' analytic abilities points in the opposite direction, as it is around puberty,

coinciding with the cognitive growth's heyday, when an increase in performance is found in those tests with a strong morphosyntactic component (Muñoz, 2006c). In contrast, this phenomenon is not found in the development of listening comprehension skills, as it was evidenced in the findings of previous studies of this same project (Muñoz, 2001, 2003).

Not many studies have reported the opposite tendency, i.e. younger learners being faster than older ones, for instance in phonology (e.g. Cochrane, 1980; Tahta, Wood & Loewenthal, 1981) and in vocabulary acquisition (e.g. Yamada et al., 1980). That suggests a reliance on components other than analytic abilities, probably memory and phonemic coding ability, or a reduced effect of the age difference in tasks involving communicative skills such as story comprehension and storytelling. The inconsistency in the results obtained taking into account the effects of age in relation to different types of tasks has also been interpreted in the light of different effects of age for different components of the L2 (C. Snow, 1983).

Besides linguistic components, as mentioned above, cognitive development is also clearly dependent on age. One study that would confirm the resort to different aptitude components depending on the age of learning and to cognitive development is Mägiste's (1987), who studied cross-sectionally the development of response times for naming picture objects and for naming two-digit numbers in bilingual German and Swedish students. Taking into account variables such as length of residence and degree of bilingualism, Mägiste could infer that students in the 6-to-11-year-old age range took some years less than did students in the 13-19-year-old age range to acquire an elementary vocabulary in the L2. Interestingly, this advantage disappeared when the task became more difficult (the two-digit number task was considered more cognitively demanding and not so depending on imitation, which involves memory at a greater level). Other available evidence also suggests that older children are faster L2 learners because their WM capacity is larger (Ando et al., 1992; in Miyake & Friedman, 1998) and because their mastery of their L1 is superior to that of younger children (e.g. Cummins et al., 1984; Cummins, 1991). This superiority shows particularly in L2 syntax, morphology, vocabulary and reading comprehension (Cummins, 1980), but not in skills which do not belong to what Cummins defines as the Cognitive Academic Language Proficiency (CALP) (Cummins, 1979), such as oral fluency and pronunciation.

The references to the studies carried out in the 1970s mentioned above appear repeatedly in literature reviews of the age factor, although some (e.g. DeKeyser & Larson-Hall, 2005; Krashen et al., 1979/1982; Long 1990) claim that these studies did

not revolve around the age factor, but around rate at initial phases of acquisition, which is not supposed to question the CPH. Therefore, alternative explanations to the short-lived advantage of older learners, at least in the stages observed, should be sought. Needless to say, the point should also be made that we ought to separate the studies carried out in naturalistic contexts from those conducted in instructed ones. In instructed contexts quantity of output prevails over other variables as exposure to the L2 is far higher in naturalistic contexts than in instruction ones. In instructed contexts, in contrast, not only the quantity but also the quality of input to which learners are exposed necessarily affects rate of acquisition. DeKeyser and Larson-Hall (2005:103) provide the following explanation for the short-lived older learners' advantage and for their usual failure to reach native-like standards:

> "Children necessarily learn implicitly; adults necessarily learn largely explicitly. As a result, adults show an initial advantage because of the shortcuts provided by the explicit learning of structure, but falter in those areas in which explicit learning is ineffective, that is, where rules are too complex or probabilistic in nature to be apprehended fully with explicit rules. Children, on the other hand, cannot use shortcuts to the representation of structure, but eventually reach full native speaker competence through long-term implicit learning from massive input. This long-term effect of age of onset is most obvious to the casual observer in pronunciation, but on closer inspection appears to be no less robust in the domain of grammar."

It can, therefore, be concluded that differences in rate are due to not only the ways learners adopt in order to learn an L2 depending on their age, but also to time and quantity of exposure. Projects like the one carried out at the University of the Basque Country and the BAF Project supply the SLA field with a rich source of information that should by no means be neglected for their pedagogical implications. Besides, as DeKeyser and Larson-Hall (2005:101) put it, "children and adults use different mechanisms for learning, which draw on different aptitudes, and (…) these aptitudes play a different role depending on the instructional approach", which is what will be examined in the next section.

1.6.3. Aptitude in formal and informal contexts

Very much related to the issue of age and the prominence of the aptitude factors at each age is the issue of the learning context. While there is no doubt that, given the essential conditions (exposure to input before the CP starts), L1 acquisition

will necessarily take place, there is no such assumption as far as L2 acquisition is concerned. One reason for this, from the generativist point of view, is whether UG is still available or not when acquiring an L2. If it is, all the learner needs is exposure to input and will not need to be taught grammar in order to become a fluent L2 speaker. This acquisition process will then be especially favoured within communicative language teaching settings, where meaningful interaction should take place for successful acquisition to occur thanks to the input supplied in this interaction (Gass, 1997). From a connectionist point of view, however, language learning is not different from other types of learning, but it is the result of shifting from controlled processes to automatised processes stored, which should be retrieved quickly and effortlessly from where they have previously been stored thanks to repeated practice.

In both the UG and cognitive/connectionist models, the major concern is to explain the learning internal mechanisms and how they interact with the input in order to generate learning. The emphasis on the role played by the input varies in these models, though. From a generative perspective, provided input is present, L2 learning will take place automatically, as it happens when acquiring one's L1. In contrast, from a cognitive perspective, what is important is how the input is decoded by learners. Connectionists draw their attention to concepts such as noticing and attention. For them, the nature and the use that learners make of input, as well as the interaction and feedback that take place in communication, are also issues at stake in successful SLA. Moreover, while both generativist and connectionist accounts of SLA focus their attention on the acquisition of syntax and morphology, there is much more to acquiring an L2, such as the acquisition of pronunciation, vocabulary and pragmatics as well as fluent language use in real time. That is to say, mastering morphosyntax alone is not enough. Therefore, bearing all these aspects in mind, a much better understanding should be gained of the implicit and explicit learning processes that take place depending on the context and the type of L2 input therein. For our purposes, these processes have to be considered along with the effect that aptitude factors have in each communicative or instruction context.

As already presented in section 1.3., in his Input Hypothesis, Krashen (1981b, 1982) establishes the Acquisition-Learning dichotomy, by which it is understood that language learning is a conscious process that is explicit and intentional whereas acquisition is a subconscious process that is implicit and incidental. The ultimate aim for any “L2 learner” would, therefore, be to become an “L2 acquirer”, assuming that an L2 can be not simply learned but also acquired. The squabble is set when the implicit/explicit learning processes dichotomy comes up against the type of

learning/acquisition setting. Is acquisition possible in formal contexts? Does learning take place only in formal settings? Are explicit processes restricted to formal contexts and implicit processes to informal settings? What processes are involved in formal and informal contexts? What is the role of aptitude in each one? Is aptitude only relevant in formal contexts or does it have a place in informal contexts? If it does, what aptitude components are most relevant in each context? How can instruction bolster acquisition taking into account these processes? Several explanations have been provided to find plausible answers to such and other questions. Some of the explanations suggested revolve around two complementary hypotheses: Bley-Vroman's (1989, 1990) Fundamental Difference Hypothesis and Robinson's (1996b, 1997) Fundamental Similarity Hypothesis (see sections 1.3 and 1.6.2). According to Robinson, in adult L2 learning, both implicit and explicit learning occurs when exposed to L2 input in whichever context thanks to the contribution of general cognitive abilities. These take on a role in attention, noticing and rehearsal in memory. When solving experimental tasks in classroom learning, however, different conditions for L2 input to be processed are imposed. These, along with the interaction with the structure of information processing abilities, have an impact on learning outcomes.

There is widespread support that children and adults learn differently. Nevertheless, Robinson (2001b) casts doubt on the fact that adults' implicit and explicit learning can be dissociated in adulthood. Schmidt (1990, 2001) contends that L2 learning is initially conscious due to the high levels of awareness, which implies that implicit learning can by no means occur in adult SLA. This idea is partially supported by Perruchet and Pacteau (1990) and Whittlesea and Wright (1997), among others, who assert that changes in performance when learning under implicit conditions could originate from conscious knowledge of repeated instances in the input. Besides, they complain about the fact that the measures of awareness used so far in research do not tap conscious knowledge. Consequently, caution should be taken when assuming that learning is taking place implicitly, i.e. drawing on unconscious implicit cognition only because learning conditions are also implicit (Robinson, 1996a, 1996b, 2002b).

Another point to take into account is the fact that different patterns of abilities will likely be activated or inhibited by the learning conditions in which input is received (Robinson, 2007) as tasks differ in the information-processing demands required (e.g. Bygate, 2001; Robinson, 1995b, 2001a, 2005b; Skehan, 1998). In addition to the input conditions, dynamic views of aptitude (Sternberg & Grigorenko, 2000) and its probable trainability (Sternberg, 2002a) have originated a new line of research which pinpoints that the interaction of abilities with processing demands of a given context and the

instructional classroom context entail the learners' bound adaptation to the learning environment as much as their success in L2 learning.

From Krashen's (1981b, 1982) and Reber's (1989, 1993; Reber, Walkenfield & Hernstadt, 1991) claims, it would follow that analytic ability is more important in adult learners under formal instruction conditions and less important for those under informal teaching conditions, since these two distinct conditions represent two distinct types of learning: implicit in informal acquisition and explicit in formal learning conditions. It is precisely this feature which justifies the distinction between language "learning", conceived as a cognitive process that "involve(s) internal representations that regulate and guide performance" (McLaughlin, 1995:370) and language "acquisition", which is supposed to develop under the constraints of UG. Consequently, according to this dichotomy, "knowing a language rule does not mean that one will be able to use it in communicative interaction" (Lightbown, 1985:177), which would rule out the possibility of teaching following a communicative approach.

The dichotomies conscious/unconscious, formal/informal, or learning/acquisition are not always clear-cut (DeKeyser, 2000), and they are less so if we add the "learning strategies" component. Paradis (1994, 1997), for instance, supposes the existence of separate memory systems for acquiring an L1 and for acquiring an L2, which imply, consequently, two distinct types of learning strategies. Paradis explains that L1 use is based on implicit processes, although both implicit and explicit strategies are involved, whereas L2 learning is based on explicit memory processes and, hence, explicit strategies, such as learning grammatical rules and the activation of mental translation processes, come into play. That is to say, in contrast with L1 use, which is automatic ("implicit knowledge" strategies), when an L2 is used, there is a need for conscious intervention and monitoring ("declarative knowledge" strategies) (Paradis, 1994). Moreover, the more formal the teaching method, the greater the extent of metalinguistic knowledge and the need for declarative knowledge strategies. The use of such strategies presupposes that subjects are older than 15, although adults also use strategies based on implicit memory (Sharwood Smith, 1981).

Actually, different studies reach very varied conclusions regarding the relationship between type of instruction, type of information-processing involved in each one and aptitude. Several pieces of experimental laboratory SLA research has been conducted that has concluded that, contrary to Krashen's and Reber's beliefs that implicit learning is more effective than explicit learning, explicit L2 learning involving metalinguistic awareness and instructions can prove fruitful as well. For example, DeGraaff (1997), in his "eXperanto experiment", found that explicit instruction eases

the acquisition of L2 grammar. One of the hypotheses of this study was that language aptitude would affect test performance both under explicit and implicit instructional conditions. DeGraaff found that the mean score of language aptitude, as measured by a Dutch version of some parts of the MLAT (Drenth & van Wieringen, 1969) and a language-learning capacity test to measure aptitude, did not affect test performance in either the implicit or the explicit learning conditions.

DeGraaff's conclusions serve as confirmation of Robinson's (1995a) study on the relationship between several independent variables (learning condition, difficulty of rule and aptitude) in 104 learners of English as a FL. Aptitude was measured by MLAT 4 Words in Sentences and MLAT 5 Paired Associates. The rules to be learned were subject-verb inversion (easy rule) and pseudo-cleft location (hard rule). The learners were learning these rules under four different teaching conditions (implicit, instructed, rule-search and incidental). Robinson found, on the one hand, that grammatical sensitivity as measured by Part 4 Words in Sentences correlated with the criterion tests of learning in all conditions, but only in the incidental one, in which the participants were only asked to perform a comprehension activity and, afterwards, a grammaticality judgment task. On the other hand, memory as measured by MLAT 5 only correlated with performance in the easy- and hard-rule learning for those subjects who had been in the instructed teaching conditions, and only in the hard-rule learning for the rule-search learners. As for the measures of awareness used by Robinson (noticing, looking for and verbalising rules), the ANOVAs show that only the level of looking-for-rules distinguished the participants: implicit learners were positively affected by awareness whereas incidental learners were not. Where a concern for language analysis was associated to the implicit and memory conditions, the effects of aptitude were more significant. In a later study (Robinson, 1997a), memory only correlated with learning in the instructed conditions, in which explicit knowledge was involved, and it did not correlate either under the implicit or the incidental (focus on meaning) conditions. Besides admitting that this finding supports Krashen's beliefs of aptitude not being relevant in this type of learning, Robinson hypothesises that this insensitivity of aptitude under implicit or incidental conditions could be a consequence of using an inappropriate aptitude measure (Robinson, 2001a).

The possible differences in the learners' degree of attention to and awareness of form in classroom settings have also been studied to see the effect of aptitude depending on the Focus on Form techniques used in the presentation of input, such as input flooding (e.g. White, 1998), input enhancement (e.g. Robinson, 1997b), recasts (e.g. Lyster, 2004) and structured input processing with and without rule explanation

(e.g. VanPatten & Cadierno, 1993; VanPatten, 2004) (see Robinson, 2005, 2007 for further references). Structured input processing seems to be the only one that consistently shows positive effects in L2 learning. Robinson (2007) believes that the other techniques have not been explored deeply enough in relation to IDs in patterns of cognitive abilities. He argues, though, that the evidence available showing that input processing with and without rule explanation is successful because it is very much related to metalinguistic and analytic abilities. Thus, the other techniques do not show such a clear pattern of effectiveness because they would rely on other abilities. Robinson also remarks that further research is needed that explains why the other techniques are not so effective at improving L2 learning. He mentions, though, two studies (Robinson, 1999; Robinson & Yamaguchi, 1999) which relate learners' aptitudes with recasts. They found that phonetic sensitivity and rote memory (using Sasaki's Language Aptitude Battery for the Japanese) showed significant positive correlations with learning. Another piece of research (Mackey et al., 2002) found that WM was relevant for only those learners who had an initially lower level of development when faced to recasts.

Other studies have included not only explicit and implicit learning conditions but also implicit and explicit feedback (Leow, 2001; Rosa & Leow, 2004; Sanz & Morgan-Short, 2004) to find out what effects the type of feedback has in L2 learning in relation to the learners' aptitude. Again, the general findings are that higher levels of awareness are not only associated with more explicit conditions but they are also substantially more effective than lower levels of awareness. Sheen (2007), for example, investigated the extent to which language analytic ability affects the acquisition of articles receiving two different types of corrective feedback (direct-only correction and direct metalinguistic). The task consisted in rewriting a story the subjects had listened to and read one week before. There was also a control group which did not receive any type of correction. Besides this task, performance was also measured using a speeded dictation test, another writing test to measure the possible transfer of the corrective feedback received and an error correction test. Language analytic ability, measured using a test in which the subjects had to choose the correct translation of a sentence out of four possible answers, was more strongly related to the mastery of articles in the direct metalinguistic group than in the direct-only group. Besides, high language analytic ability students benefited more from both types of corrective feedback, and it was even more positive when under metalinguistic conditions of corrective feedback.

Admittedly, conditions of practice are relevant in L2 learning and they should also be related to the information-processing stages that take place when being

exposed to L2 input. Consequently, information processing models such as Skehan's (1998, 2002, 2003) are a rich source to use so as to be able to match the L2 learners' aptitude with conditions of practice. That is, if each stage imposes different demands and L2 learners face some difficulties because of their strengths and weaknesses in their abilities, appropriate reinforcement in instructional contexts could help them go over these handicaps. This is not so feasible in naturalistic contexts, but it is so in formal ones, where activities or input delivery could be adapted in such a way that learners can notice the gap, redirect their attention, proceduralise and automatise the input better, or lexicalise learned rules. The ultimate aim in doing so is "build(ing) an emphasis into task-based instruction which counteracts what may be natural tendencies to take unbalanced paths towards language development" (Skehan, 1998:271). In this way, an effort should be made so that analytic learners gain fluency and capacity to express themselves faster and without paying so much attention to form, while memory-oriented learners should feel encouraged to draw their attention to complexity and accuracy.

Given the wide array of factors that affect SLA (e.g. IDs, implicit and explicit instruction, implicit and explicit cognitive processes, information-processing stages), it is a challenge to establish a system where Aptitude-Treatment-Interaction (ATI) can be operative in instructed L2 learning. Perhaps this is the reason why not much research has tried to link aptitude to instructional methods. SLA theory has nevertheless adopted some notions from the field of instructional psychology (Corno et al., 2002, in Robinson, 2002a; Cronbach & Snow, 1977) so as to explain variation in language learning success under particular instructional conditions while attending to individual differences in language learning aptitude, learning styles and strategies. Of particular interest is R.E. Snow's (1987, 1994) conception of "aptitude complexes", which takes both person and situational variables into account and the aim of which is to match students' strengths with the appropriate type of instruction to make the student's achievement increase. Although Cronbach and Snow (1977) failed to show substantial positive effects of ATIs, possibly because of the small samples used, studies carried out afterwards have demonstrated their usefulness, but mainly for low general ability learners, as high general ability learners are autonomous enough to learn following their own learning style and strategies. Consequently, if a treatment different to their own style is imposed on them, it may just interfere in their learning process (for further references see Snow & Lohman, 1984). A practical demonstration of this theory was carried out by Wesche (1981), as explained in section 1.5.

In fact, Robinson's (2001b, 2002a, 2005a, 2007) Aptitude Complex/Ability Differentiation model of aptitude, which Robinson has designed for the purpose of being applied to L2 instruction contexts, stems from Snow's (1987, 1994) interactionist approach. This model of aptitude attempts at relating information-processing models with pedagogy by combining aptitude complexes in such a way that communicative practice in the classroom is enhanced by drawing on techniques that focus on form. Robinson identifies four different aptitude complexes. As explained in Robinson (2007), the first complex is a combination of the aptitude for noticing the gap thanks to the recasts that learners receive in relation to their prior utterances. This ability also includes memory for contingent speech, as it is necessary for learners to be able to contrast the recast with the error made in their utterances and recognise the differences between the two. Aptitude complex 2 is active in incidental learning from oral input. It consists of memory for contingent speech, like aptitude complex 1, and of deep semantic processing, which enables the learner to infer word meaning or to build analogies with the elements in the input. Aptitude complex 3 for incidental learning from floods provided in written input only differs from aptitude complex 2 in the fact that it is memory for contingent text what combines with deep semantic processing, and not speech. Finally, aptitude complex 4 is the one active for learning from written rule explanations that are applied in subsequent comprehension and production activities. This complex, made up of memory for contingent text and metalinguistic rule rehearsal, could be measured by MLAT subtests Words in Sentences and Paired Associates. The second part of Robinson's framework is based on the Ability Differentiation Hypothesis which lies on the assumption that patterns of strengths in abilities have some kind of influence on aptitude complexes in such a way that different techniques bearing upon input will have more or less power in developing the abilities needed at each information-processing stage. This hypothesis also takes into account the learners' age, as considered in Deary (2000; Deary et al., 1996, cited in Robinson, 2007). To Deary, older learners do not present the same aptitude profiles as younger learners; actually, their profiles may be more liable to be affected by learning and practice conditions. In sum, Robinson's model advocates for a match of conditions of learning and practice for learners whose abilities are more clearly differentiated than those of other learners for whom it may be easier to learn in a variety of contexts of exposure and practice.

As seen so far, it is widely accepted that language aptitude is relevant to learning success under several types of instruction, which would confirm Carroll and Sapon's (1959) suggestion that the MLAT taps learning abilities that are independent of

the teaching methodology. Besides the doubt of whether existing aptitude tests can tap ability to deal with language in real-life situations or only ability to deal with decontextualised language, it is also a controversial matter how relevant aptitude is in non-instructed contexts. To Skehan (1998), aptitude may be even more relevant in informal situations, since this type of context is more demanding and, although an L2 — not an L1 — is being used, implicit strategies are also required.

In two studies combining two opposite teaching approaches ("situational" and "structural" in Hauptman, 1971; and "audiolingual" and "conscious approach" in Harper & Kieser, 1977), the MLAT-E led to very interesting conclusions. As for the study by Hauptman, it was concluded that 10-year-old children with high language aptitude (or high IQ) benefitted more from classes with a situational approach (i.e. without taking into account the difficulty of the language used in teaching but the context/situation itself), which would be the opposite of what Krashen and Reber, among others, defend. As for the study by Harper and Kieser, the total scores on the MLAT-E correlated moderately and significantly with the achievement marks of both the group following an audiolingual teaching method and the group following a "conscious-active" (i.e. involving communication, writing and some aspects of formal grammar) teaching approach.

In order to research language aptitude in naturalistic contexts, Harley and Hart (2002), as an extension of the piece of research carried out in 1997, conducted a study among students in grades 10 and 11 whose first intensive exposure to the L2 took place in a naturalistic environment during a 3-month-long bilingual exchange. Their aptitude was tested using a measure for text memory and a measure of analytical language ability (the Language Analysis of the PLAB). Their overall proficiency was measured in two rounds (pre-test and post-test) with tests designed to provide a picture of the test takers' vocabulary recognition, listening and reading comprehension, and oral and written production. The results obtained supported the hypothesis that language analysis and L2 proficiency would correlate in a moderate-high degree, although it obtained negative correlations in the open writing task. As regards memory, it obtained only one significant positive correlation with a measure of the open writing task. The other correlations obtained entered a range of moderate-low results. To Harley and Hart, these results are surprising given a context of immersion and justify them by pointing out that there was a subject who stood out of the rest due to her high aptitude, both in the language analysis and in the memory measure. That somehow confirms that, although memory is involved in early language learning (Harley & Hart,

1997), analytical language ability is related to it as well, as it is also in communicatively oriented programmes (Ranta, 1998).

To shed some more light on the controversy of whether aptitude is more relevant in formal (conscious) or informal (unconscious) contexts, Reves (1983; in Dörnyei & Skehan, 2003) evidenced that aptitude is a good predictor in both contexts in Arabic L1 learners of Hebrew in a naturalistic setting and of English in an instructed setting. Reves' findings are in clear opposition to both Krashen's (1981, 1985) and Reber's (1989, 1993; Reber, Walkenfield & Hernstadt, 1991) point of view that aptitude is only relevant where explicit learning — which "denotes a conscious analytic awareness of the formal properties of the target language" (Sharwood Smith, 1981:159) — takes place, that is, in formal contexts. Clearly, though, an insurmountable obstacle posed by formal instruction is the fact that it is limited in time of exposure and it tends not to put emphasis on the implicit learning skills of the child, which, in a chain reaction, results in slow development and failure to attain native-like proficiency, even in early-immersion programmes (e.g. Swain, 1985).

Implicit and explicit acquisitional processes are influenced by the different components of aptitude and drawing on them depends not only on the context (be it formal or informal) but also on other factors (e.g. the type of input and feedback received, the amount of exposure to input, the learners' age and learning strategies, the teacher, etc.). Consequently, finding a unique teaching method or context that caters for all these learners' IDs is an enticing but almost impossible mission. Leaving aside immersion contexts, were we to obtain a clear picture of all L2 learners and were we able to distribute them by their features, ATI and, hopefully, subsequent learner autonomy in task-based instruction or project work would undoubtedly be the key to success in L2 learning for everyone.

1.6.4. Language aptitude and sex

In their classic monography *The Psychology of Sex*[10] *Differences*, Maccoby and Jacklin (1974) reviewed about 1,600 studies which compared either on purpose or in passing, males and females. From these studies, more than 75% of which dealt with

[10] "Sex" is used in this dissertation as a generic term to refer to both biological differences ("sex") and psychosocial differences ("gender").

subjects younger than 13, Maccoby and Jacklin concluded that men and women are different in three main abilities. Women were found to be superior to men in verbal aptitude while men were better at visual-spatial tasks and at maths. In principle, biology is partially responsible for the females' superiority, as women have been found to have more nerve cells in the left hemisphere, in charge of language (Legato, 2005) and their connections between both sides of the brain are more abundant than in males' brains, so in language activities females may use both hemispheres, while men use preferably the left one (Tyre, 2005). Language aptitude as measured by a test should also be an objective way to discriminate whether there is an advantage of females over males in language aptitude, although some defend the idea that the way males and females face a test (strategies, styles, self-esteem) is different (Sunderland, 2000).

Not many studies into aptitude have been set up that deal with the differences between boys and girls' aptitude to learn languages using FL aptitude measures, although these differences have been found from an early age (Powell, 1979; Lynn & Wilson, 1993). In all those studies in which either the MLAT-E or an aptitude test based on it was used, the advantage tends to be found in girls over boys (Harper & Kieser, 1977; Kiss, 2004; Kiss & Nikolov, 2005). Harper and Kieser administered the MLAT-E to grade-7 and grade-8 boys. The girls in both grades outperformed the boys in the total scores and in the part scores except for the girls in grade 7, the mean of whom was 0.23 lower than that of the boys'. Kiss and Nikolov (2005) also found that not only did grade-6 girls significantly outperform boys on the language aptitude measure used as a whole, but they also did better on each individual aptitude task, including those addressing English language proficiency. In a later study (Kiss, 2009) concerning two groups of subjects (one for the piloting phase and another one for the study proper), the 23 grade-2 girls in the pilot study did only slightly better than did the 17 boys in the same study. The scores of the 21 boys and 31 girls in the study group were almost identical, as the boys scored only 2 decimals higher than the girls.

The dearth of studies that look into the sex variable led López Rúa (2006) to determine its role "in foreign language success by reviewing and connecting data gathered from several tests and studies, all of them dealing with boys' and girls' achievement, attitudes, motivation, opinions and learning strategies as regards foreign languages" (López Rúa, 2006: 99), though not with language aptitude proper. If verbal intelligence is very much related to aptitude and aptitude can be enhanced by affective factors such as motivation, attitude and self-confidence, according to López Rúa, it is likely that girls will be more successful than boys in FL learning. She finally hypothesises that girls' higher achievement as compared to that of boys may be due to

not only the interaction of the learner's intrinsic factors such as neurological, cognitive and affective factors mentioned above, but also to external factors. Among these are, on the one hand, social factors such as society's sex-stereotyping of jobs and patterns of interaction that are seen in a positive light in girls and, on the other hand, educational factors such as the teacher and the teaching method followed.

Research has shown that girls tend to be superior to boys in some verbal abilities (e.g. Feingold, 1992) and that already at an early age, girls' lexicon is larger than boys' (Nelson, 1973). This superiority continues during childhood and adolescence, although it is not clear as far as listening ability is concerned. Besides, this general superiority on behalf of girls seems to decrease progressively with age (Hyde & Lynn, 1988), which could partially explain the variability in the results of the studies which take this variable into account.

While the body of research into sex in FL learning is scarce in young learners, it is larger in adults. Neurophysiologic studies have proved that the female brain functions differently from that of males, as males outperform females in tasks involving visual and spatial abilities while females outperform their counterparts in most verbal skills (although there is some disagreement when it comes to listening abilities). Female adults have been found to perform better than males in syntactical tasks and their fluency is higher than males' (Gordon & Lee, 1986; Stumpf, 1995). They have also been found to have higher verbal memory and perceptual speed, among other language learning aspects (Kimura, 1996) and they are more concerned about accuracy of phonological production (Díaz-Campos, 2004). They are also superior in productive tasks related to vocabulary (Jiménez Catalán & Ojeda Alba, 2007) and in the frequency of use and range of FL learning strategies (Oxford & Ehrman, 1993; Young & Oxford, 1997). Sex contrasts were also found in Ho's (1987) study, in which sex accounted for 19.4% of the total variance of all the criterion variables. In this study, female EFL learners were found to be superior to males in expressive skills while males were found to be better in receptive tasks. Actually, in this type of tasks there is a tendency for males to be superior to females (Boyle, 1987) or to have a similar performance (Phatiki, 2003). No significant differences were found between females and males in reading comprehension performance (Brantmeier, 2003; Young & Oxford, 1997) nor were they found in receptive vocabulary learning (Grace 2000) or in receptive vocabulary size (Jiménez Catalán & Terrazas Gallego, 2005-2008).

Some other studies show that males are more advantaged than females or that there are no differences at all as regards sex when learning a FL (Bacon, 1992). For instance, Feyten (1991) did not find any significant sex differences in different types of

listening ability in relation to FL proficiency in speaking, grammar, reading and vocabulary; and neither did Markham (1988) in listening comprehension, although differences in sex were found regarding the perception of speaking expertise in males and females. Women have not always been found to be superior to men in language tasks in which verbal incidental memory is involved either, although they excel in tasks involving verbal recall of past information (McGuinness, Olson & Chapman, 1990; Stumpf & Jackson, 1994).

Sex differences in L1 performance have also been found. Some studies report female advantages in L1 syntactic and semantic performance and reading comprehension (Halpern, 1996) and in spelling, though not in vocabulary (Halpern & Wright, 1996). Females have also been found to be superior to males in verbal memory (Halpern & LaMay, 2000), which depends mainly on declarative memory, rather than procedural (Ullman, 2004). In contrast, the work with language done by males could rely on their procedural system, which would cause them to be apparently slower in real time situations (Ullman, 2004), at least during the first stages of SLA, when FL learners are supposed to rely more on the declarative memory system. Indeed, these differences in memory processing led Ullman and colleagues (2002) to review research that supported sex differences as far as L1 processing is concerned. They claimed that when studying sex differences in language learning, maybe the focus should be placed not on performance but on language processing and use.

In a study about over-regularisation of past tense forms by children, Hartshorne and Ullman (2006) hypothesised that girls would remember irregular past tense forms better than boys on the grounds that females have been found to be better than males at verbal memory tasks that make use of declarative memory mainly. Hartshorne and Ullman assumed that irregular past tense forms are stored in the declarative memory. Therefore, boys were not expected to be better because they were expected to make more use of their procedural memory, which would participate in the analysis of the grammatical composition of complex forms (base form + -ed). Their hypothesis, though, was not confirmed, as girls over-regularised some irregular past tense forms such as “holded” or “blowed”. The over-regularisation by girls may have been due to the girls’ reliance on their associative-declarative memory only to wrongly generalise the form of the past tense. It is important to remark that this experiment only involved a group of 10 boys and 15 girls from ages 2 to 5, so further research is needed to confirm the results obtained.

Although previous research has concluded that females perform better than males on verbal tasks and men are, in contrast, superior in visual-spatial and

quantitative tasks, many contradictions appear in the literature, as exposed so far. In order to clarify the status of sex differences (if any) in learning, Halpern and Wright (1996) suggest that further studies into sex differences should perhaps take into account the underlying cognitive processes in each task. That is to say, research classifies the tasks used in the research into sex differences according to the type of information that is being learned and recalled (i.e., verbal, quantitative and visual-spatial), but each tasks requires more than just one cognitive system to be solved. It is perhaps here that sex differences lie, in the success or failure in using the cognitive processes needed to solve the tasks, and not in the type of content of the tasks themselves. For instance, "naming words that start with a particular letter (…) involves encoding and responding stages, but primarily it requires a search through memory that is sound-based rather than semantic. Thus, it is possible to identify processes that differentiate between the tasks at which females tend to excel and the tasks at which males tend to excel" (Halpern & Wright, 1996:10).

In sum, it can be concluded that sex is a variable that has not been explored much, especially in young learners, and that more research is needed that explores the role of sex, not only in L1 learning, but also in FL learning and in relation to FL aptitude, both in adult and young learners. Apart from that, since the results obtained so far do not consistently follow the same direction, perhaps the connection between language and sex in relation to language aptitude should not be considered in isolation, but along with other individual differences and underlying cognitive processes in the tasks used.

1.6.5. Aptitude and bilingualism

If setting parameters in two languages accounts for cognitive advantages of childhood bilingualism[11] in terms of brain flexibility, these advantages should also show in learning further languages, even in adults. This would also support the lay belief that the more languages one knows, the easier it is to learn new ones (McLaughlin, 1990, 1995), as several individuals suggest when interviewed (Naiman et al., 1978). McLaughlin (1995) admits that this kind of evidence justifying this lay belief is, nevertheless, anecdotal.

[11] Bilingualism is here used to refer to both bi- and multilingualism (Bhatia & Ritchie, 2004; Romaine, 1995).

Nation and McLaughlin (1985) decided to carry out an experiment to check empirically if “expert” learners benefited from the positive transfer derived from the number of languages they had learned in contrast with "novice" learners, who are supposed to use different information-processing strategies and techniques than do “expert” learners. They found that multilingual subjects outperformed bilingual and monolingual subjects learning a miniature linguistic system in an implicit-learning task. Consequently, Nation and McLaughlin concluded that this advantage was due to the multilingual subjects' transfer of certain automatised basic skills that they had already built up in their previous language-learning experiences, such as auditory- and pattern-recognition skills, word-decoding skills and superior auditory memory.

Besides the supposed automatisation of basic skills, as Von Hapsburg and Peña (2002) point out, many other aspects have to be taken into account when approaching the issue of bilingualism such as the number of languages learned, whether a bilingual functions as two monolinguals or not, the type and degree of bilingualism, the linguistic context, the differences in language processing, the amount of exposure to each language, the language competence and the demand for language use, among many others.

Díaz (1985), for instance, compared bilingual kindergarten and first-grade children who represented extreme groups of high and low English proficiency twice in 6 months’ time on a variety of cognitive tasks. He found that the relationship between the degree of bilingualism and cognitive abilities (as measured by three metalinguistic awareness tasks, among other tests) was positive for children of low L2 proficiency while the relation between the degree of bilingualism and cognitive variability seemed to diminish for children of relatively high L2 proficiency. Díaz concluded that there is a strong relationship between the degree of bilingualism and cognitive variability in early stages of proficiency, thus questioning Cummins’s (1976, 1977) Threshold Hypothesis, in which he states that the level of L1 and L2 competence of a student determines if he or she will experience cognitive deficits or benefits from schooling in the second language. Cummins’s (1979) “developmental interdependence hypothesis” is also questioned, as it suggests that if the use of the L1 is promoted by the child's linguistic environment outside the school, then a high level of L2 achievement is also likely to occur at no cost of L1 competence. L1 and L2 literacy skills are, therefore, seen to be interdependent, i.e., they are manifestations of a “common underlying proficiency”. High levels of L1 proficiency help L2 acquisition, and conversely, high proficiency in L2 has a positive effect on L1 development. Nevertheless, it must be taken into account

that Díaz's groups were not controlled for the number of years they had been exposed to English as an L2.

Although Galambos and Hakuta (1988) defend that only a balanced degree of bilingualism is advantageous for certain types of semantic ambiguity (recognition of phonetically ambiguous items), Bialystok's model (1986, 1987, 1988, 1991, 1994) emphasises that bilinguals are better in tasks highly demanding on the control of processing, but irrespective of the speaker's degree of bilingualism. These tasks are those in which anomalous meanings are involved and, consequently, require the "ability to switch back and forth between form and meaning" (Bialystok, 1986:499). She also claims that only those bilinguals with a high level in both languages are more advantaged than both the monolinguals' and the unbalanced bilinguals' performance in tasks requiring more analysed linguistic knowledge (Bialystok, 1988, 1992). Andreou and Karapetsas (2004) also investigated L1 verbal skills among low and highly proficient bilinguals using the WISC III verbal subtests. Their findings showed an advantage for highly proficient bilinguals in almost all verbal subtests, thus supporting Cummins' Threshold Hypothesis and questioning Díaz's (1985) findings. As the WISC III was distributed in the subjects' L1, Andreou and Karapetsas could prove other researchers' (e.g. Carroll, 1973, 1981; Ganschow & Sparks, 1995; Koda, 1992; Sparks & Ganschow, 1991) claims that L1 proficiency is the grounds of FL performance and that aptitude is probably a residue of one's L1 learning ability.

Generally speaking, there is support for the advantages that being a bilingual entails, such as advantages on metalinguistic awareness and analysis (Bialystok, 1988, 1991, 2001a, 2001b, 2004; Cromdal 1999; Cummins, 1978, Swain & Lapkin, 1982); cognitive flexibility (Cummins, 1976) and the accelerated cognitive development and use of cognitive strategies even when showing lower vocabulary level (Ben-Zeev, 1977). Bilinguals also show better performance than monolinguals or unbalanced monolinguals in grammatical awareness, classification, reasoning, visual-spatial skills and creativity measures (Hakuta, Ferdman & Díaz, 1987), higher perceptual organization and reading achievement (Ricciardelli, 1992), among others.

For their close linkage with language analytic abilities, metalinguistic abilities are especially relevant in relation to bilingualism and aptitude. They are prone to be one of the most important factors increasing bilinguals' ability to learn languages, as proved in the literature (e.g. Thomas, 1988). They have also been found to trigger early metalinguistic development in bilinguals (e.g. Ben-Zeev, 1977; Cummins & Mulcahy, 1978). However, an advantage due to bilingualism in this kind of tasks is not always granted. Although the majority of studies do report a bilingual advantage, the type of

tasks used do not reveal, in principle, at which tasks bilinguals are better. Bialystok (2001b) interprets that it is only at the level of underlying processing, particularly control of attention processing, that we can determine at which metalinguistic tasks bilinguals outperform monolinguals.

From the evidence available it is not possible to determine whether bilingualism affects aptitude in a direct way. Consequently, it has been argued that what bilingualism furnishes the language learner with is, besides language experience, a wider choice of strategies as well as the possibility to generate hypotheses grounded on language comparison (Jessner, 1999). For instance, in a study by Nayak and colleagues (1990), in which both expert and novice learners were assigned randomly to two different learning conditions (memory and rule-learning) when learning a limited artificial linguistic system, the performance of experts was not significantly better than the novices', although there were differences in the way the two groups approached the tasks: experts tended to use mnemonic devices in the memory condition, but in the rule-learning condition both kinds of learners went for linguistic strategies rather than mnemonic ones. However, experts did use a wider variety of strategies in the rule-learning condition, thus showing more flexibility in the choice and use of language learning strategies.

The advantages that bilingualism supposes have been widely acknowledged, as well as those relating to third or additional language achievement (e.g. Sanz, 2000; Swain et al., 1990). Bilingualism proved to be positive regardless of sex and socioeconomic status in Sanz (2000) and regardless of the L1 typological nature in Swain et al. (1990), though the level of L1 literacy did have an impact on the learners' L3.

Nevertheless, bilingualism does not always show to be advantageous. Instead, it has also been found to make more difficult certain aspects of language acquisition such as the following: speech perception by older subjects (e.g. Buus et al., 1986; Mayo, Florentine & Buus, 1997; Takata and Nabelek, 1990; all in Von Hapsburg and Peña, 2002); the interaction between L2 and L1 in general (e.g. Cook, 2003; Kecskes & Papp, 2000); the understanding of word-object relationship (Rosenblum & Pinker, 1983); progress in metalinguistic achievement (Macnamara, 1967, in Bialystok, 1987; Palmer, 1972); or even one's cognitive development when bilingualism is unbalanced or very low in each of the languages (Darcy, 1963, in Ricciardelli, 1992).

Although the general tendency is to believe bilingualism to be an asset when learning further languages and for sustaining cognitive development, studies relating bilingualism and aptitude specifically do not show such a clear pattern: while Eisenstein

(1980) and Sternberg and Grigorenko (2002) found an association between one's number of languages and higher levels of aptitude, other studies (Harley and Hart, 1997; Sawyer, 1992) found the opposite to be true.

Eisenstein (1980) hypothesised, and could demonstrate, that bilingual children (those who acquired an L2 before the age of 10) would have a higher FL aptitude in adulthood. The 93 college students participating in this study were all either native Americans or had arrived in the US before the age of 5 and so had native proficiency in English. They were given the Modern Language Aptitude Test (MLAT) and were asked to rate themselves on L2 skills. The 93 subjects were divided into the following groups: monolinguals, bilinguals, bilinguals with formal education, bilinguals without formal education, multilinguals and simple bilinguals. Bilinguals were found to outperform the monolingual subjects on the MLAT. Learning several languages in childhood also appeared to have a cumulative positive effect, both in language learning and in other school subjects.

Nevertheless, Sternberg and Grigorenko (2002:157) point out that what studies like the ones above show is only "a mere association" that "does not reveal underlying causal relations" and "FL aptitude is much more than a matter of experience" (Sawyer & Ranta, 2001; Skehan, 1989, 1990). For instance, Sawyer (1992) administered the short version of the MLAT, a linguistic background questionnaire and L2 proficiency tests to a group of 129 students enrolled in courses of various Asian languages. By performing correlational and principal components analyses, he found that aptitude correlated moderately with final course marks and some L2 proficiency measures, but not with the exposure to other languages. Besides, in the principal components analyses, language learning experience, aptitude and proficiency appeared as individual factors. Further proof is provided in the study by Harley and Hart (1997) (see also sections 1.4.2 and 1.6.2), who compared the aptitude and L2 proficiency of early- and late-start learners. After administering them two memory measures, the Language Analysis subtest from the PLAB (having overruled the MLAT 4 Words in Sentences for possible formal training in grammar effects), and several L2 proficiency measures (vocabulary, listening, grammar and writing), they found that early starters did not have higher levels of aptitude than late-immersion starters.

The evidence available, as already pointed out, is inconclusive. What should be taken into account, though, is that bilingual subjects, because of several reasons (e.g. the number of languages they speak, their language learning experience, their ample strategies choice, their particular metalinguistic sensitivities and cerebral representation of the languages they speak, among others) cannot be compared to monolinguals

without taking their multilingualism into proper consideration or escaping any bias (e.g. Cook, 1995, 1999; De Angelis, 2007; Pavlenko, 2005), as has been done on several occasions.

1.6.6. Language aptitude and other cognitive skills: intelligence and talent

Aptitude consists of several components, the number and conceptualisation of which vary depending on the line of research. Notice, though, that none of the most recent approaches includes intelligence as an aptitude factor, although there is some kind of overlap between the components of aptitude and intelligence (including "verbal intelligence") and academic aptitude, which makes of intelligence a controversial aspect in some studies into aptitude. These two aspects open the door to two peripherical aspects related to aptitude: intelligence (section 1.6.6.1) as a factor or independent of the aptitude construct and the case of talented and untalented learners, individuals who, despite lacking certain cognitive skills, have been capable of standing out as language learners and those who despite outstanding in other cognitive skills, find it almost impossible to learn an L2 (section 1.6.6.2).

1.6.6.1. Language aptitude and intelligence

Skehan (1991:276) remarks that the study of language aptitude implies "that there is a talent for learning languages that is independent of intelligence". Actually, if language aptitude was exclusively general intelligence as applied to the task of learning a language, there would not be much point in examining it as a unique learner trait common to both language proficiency and aptitude. Nevertheless, Oller and Perkins (1978b; Oller, 1981) considered aptitude as a unitary construct on the basis of their research. Later, Oller (1983a) rejected the strong version of his unitary hypothesis and admitted ability could be made out of some other components besides a general factor. In so doing, Oller considered the components in the communicative proficiency construct adopted by Bachman and Palmer (1982), who, in turn, worked under the theoretical framework of communicative competence developed by Canale and Swain (1980).

Several empirical studies have been carried out which investigate the relationship between IQ and language aptitude with different results: from low to moderate (e.g. Gardner & Lambert, 1972; Skehan, 1989) and from moderate to strong (Sasaki, 1996; Wesche, Edwards & Wells, 1982) correlations have been found. Therefore, an overlapping up to a certain degree could exist between aptitude and intelligence. For instance, Gardner and Lambert (1959, cited in Gardner & Lambert, 1965) first found that language aptitude was factorially similar to intelligence. In a later study, however, Gardner and Lambert's (1972) results showed that the relationship between FL proficiency, intelligence and aptitude varied even if the sample populations were kept the same, yet they found that aptitude and intelligence factors were correlated moderately to relatively highly (.3 to .7) with those of French proficiency. In yet another study, Gardner and Lambert (1965), using Carroll's MLAT and Thurstone and Thurstone's (1938, 1941) Primary Mental Abilities (PMA) test battery as measures of aptitude and several tests to measure French proficiency, found that aptitude and intelligence were correlated with French grammar scores and grammatical sensitivity aptitude, but not with French comprehension scores and word fluency intelligence. Therefore, aptitude and intelligence were relatively independent of one another. Similar results were obtained by Genesee (1976), since he found that intelligence was highly correlated with achievement in academic language skills (reading, grammar and vocabulary) though it was not with interpersonal communication skills (speaking and listening comprehension).

Other studies (Dockrell & Brosseau, 1967; Genessee, 1979; Krashen, 1974; all of them cited in Genesee & Hamayan, 1980) concluded that intelligence may be less strongly correlated with the achievement of younger learners than of older ones. However, they still confirmed the existence of a positive correlation between IQ and language aptitude, though not necessarily with achievement of interpersonal communication skills in the second language (Genesee, 1976). Skehan (1990) also found significant correlations with IQ. Nevertheless, he argued that general intelligence and aptitude are not equivalent. Actually, Skehan (1998) criticises the fact that those studies into the relationship between aptitude and intelligence that used factorial techniques and found moderate to strong correlations (e.g. Sasaki, 1991, 1996; Wesche et al., 1982) used streamed learners as subjects. All these subjects shared the same formal FL instruction background, which made the nature of this sample population selective (Upshur & Homburg, 1983). Consequently, the results of these studies are not generalisable, from Skehan's point of view.

Through correlations and factor analyses of the MLAT and the PMA, Wesche and colleagues (1982) found that these measures were redundant and identified a second-order general factor which they considered very close to Spearman's *g*. They also found three first-order factors, which would include L1 verbal knowledge, abstract reasoning ability and the ability to learn new language elements and associations (i.e. aptitude). According to this hierarchy, language ability would depend on a general ability or intelligence, so results on the MLAT - and probably other similar aptitude batteries – would not be independent of intelligence measures.

As for Sasaki's (1991, 1996) pieces of research, it is true, as Skehan (1998) argues, that they are not as generalisable as it would be desirable. Sasaki herself admits that "the results can only be generalized to Japanese university students who have studied English through formal education" and "the results cannot be generalized beyond that particular aspect (organizational competence) of ESL proficiency" (Sasaki, 1996:9). Sasaki also admits that parameters could change when contrasted to experiential intelligence and contextual intelligence (Sternberg, 1984, 1985b, 1985c; Sternberg et al., 1999). Nevertheless, thanks to her studies, not only is Sasaki able to reject the model that assumes all specific trait factors of language proficiency to be independent of each other (the totally divisible model) — result that is consistent with previous findings (Bachman & Palmer, 1982, 1983; Carroll, 1983, 1991a, 1991b, 1993; Fouly, Bachman & Cziko, 1990; Kranzler & Jensen, 1991a, 1991b, 1993) —, but she is also able to reject Oller's (1979, 1983a) view of second language proficiency as a unitary construct.

In the past some researchers equated language aptitude with general models of intelligence such as Spearman's two-factor model of general intelligence, multiple factors and hierarchical organisation (Vernon, 1960) as well as other relevant related concepts, such as Cattell's (1971) fluid and crystallised intelligence. Modern views of intelligence, however, start to break away from *g* theory. One example is H. Gardner's studies (1983, 1993, 1999), in which a theory of multiple intelligences (linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal and naturalistic) is proposed. Sternberg (1984, 1985a, 1990, 1997, 1999, 2002a, 2002b), in the same line as Gardner, is also opposed to the view of intelligence as a general factor. He proposes instead his own notion of successful intelligence, which takes into account one's ability to achieve success by "capitalizing one's strengths and correcting or compensating for one's weaknesses through a balance of analytical, creative, and practical abilities". These will finally lead one to learn a language successfully if correctly applied to different kinds of tasks and situations depending on

whether they require analytical, creative, or practical thinking, or a combination of these kinds of thinking and after having developed some kind of expertise (Sternberg, 1998). That is to say, these abilities are information processes that operate on mental representations at varying levels of experience that change depending on the environment in which the individual is (see Sternberg, 1985a for further details). Thus, analytical intelligence is used when intelligence components are used to analyse, evaluate, judge, or compare and contrast (Sternberg, 2002a). Creative intelligence, instead, plays a role when the learner is faced with a novel activity. For its part, practical intelligence is involved when individuals have to apply their abilities to daily life problems.

Associative memory is considered to form part of language aptitude and as such, it is measured in tests such as the MLAT Paired Associates, intended to measure the ability to recall the relationship between previously presented stimuli. Carroll (1962, 1965, 1971a, 1993), in fact, includes associative memory as a factor of memory ability in general intelligence. Consequently, intelligence should come to bear some kind of influence on language aptitude or, at least, on language learning.

Although intelligence may be moderately relevant for language aptitude, as Pimsleur (1968) assumes, further evidence that language ability is specific and independent of general cognitive abilities is to be found in the cases of both talented and unsuccessful language learners (Skehan, 1998), where IQ does not correlate with their language aptitude. Rather, what this fact demonstrates is that human beings present strengths and weaknesses in specific abilities (Skehan, 1986b, 1989; Wesche, 1981). However, R. Ellis (1994) stays neutral as for the independence of intelligence of general language learning ability, since he thinks that the underlying general language learning capacity identified by Skehan (1989) could be related to Cummins' (1983) Basic Interpersonal Communication Skills (BICS), regardless of IQ or academic aptitude. Therefore, this communication skill factor would be related to oral fluency and sociolinguistic skill. Apart from that, if we consider Skehan's conception of aptitude being the ability to handle decontextualised language, it could also be somehow related to Cummins's Cognitive Academic Language Proficiency (CALP).

As presented, intelligence is a trait that is taken into consideration in L1 processing. Neither has it been completely neglected in the SLA field in relation to its role in general ability, in language aptitude, in analytic intelligence and in memory, with different results. It has to be taken into account, though, that these factors, especially memory, are also researched as independent components of *g.* Consequently, it

remains inconclusive up to which extent intelligence contributes to language aptitude and L2 acquisition in general.

1.6.6.2. The case of talented and untalented learners

Several case studies, which Selinker (1972) estimates to be 5% of the total population, prove that unsuccessful language learners are not necessarily unsuccessful in all other cognitive abilities and that talented language learners are not necessarily talented learners of everything. Geschwind and Galaburda (1985a, 1985b, 1985c) observed that certain phenomena (talents and some cases related to brain lateralisation, such as left-handedness and dyslexia) cluster in certain subjects. They point out that the discovery of the asymmetry in the human brain could account for the predominant localisation of speech to the left hemisphere in the majority of humans though gross asymmetries may not have any relationship to linguistic functions (Galaburda, Sanides & Geschwind, 1978).

Skehan (1998) mentions five major case-studies that focus on individual or small groups of talented learners. The first one is CJ, a 29-year-old graduate student (Novoa, Fein & Obler, 1988; Obler, 1989) who presented most of the factors mentioned by Geschwind and Galaburda. He was a native speaker of English who learned several languages postpubertally quickly and to native-like proficiency. Although he was quite good in maths, sciences and graphic arts, he admits being poor in directionality and spatial orientation, thus confirming Schneiderman and Desmarais's (1988a, 1988b) suggestion of concomitancy between visual-spatial functions and exceptional second-language aptitude. CJ was also outstanding in verbal memory scores and in acquiring new verbal codes, but not out of the ordinary in other measures such as IQ, his ability to manipulate abstract verbal concepts, his score on Digit Span and his score in material-visual memory.

Another talented language learner was Julie (Ioup et al., 1994), a British woman who was judged to have attained native-like oral proficiency in Arabic in about two-and-a-half years. Since she did not receive any formal instruction, she could neither read nor write the language. Hers is, therefore, a challenge to the Critical Period Hypothesis (CPH), since she began to learn Arabic at the age of 21 and yet her scores were outstanding in the translation, the grammatical judgment, the interpretation of anaphora, the speech production and the accent identification tasks. It is remarkable that the Geschwind cluster was also present in Julie's family. She also excelled in

associative memory, the ability to master new codes and in phonetic cues recognition, as CJ did.

There exists another case of an exceptional learner, Christopher (O'Connor & Hermelin, 1991; O'Connor et al., 1994; Smith & Tsimpli, 1991, 1993, 1995; Smith, Tsimpli & Ouhalla, 1993; Tsimpli & Smith, 1991), who, despite being mentally handicapped and brain damaged in his cerebellum and in his frontal lobes, achieved as an adult a high degree of fluency in 16 languages, one of them artificial). Christopher's IQ was average and he only scored remarkably on the verbal tests, since his performance in the non-verbal ones was significantly low.

Humes-Bartlo (1989) also found some learners who, despite their limited English proficiency, were able to enter English schooling in no more than three year's time thanks to their special talent for learning English; and Schneiderman and Desmarais (1988a, 1988b) found two learners who passed as natives in spite of having learned the FLs after puberty.

Skehan (1998) highlights the fact that all these subjects do not seem to have exceptional intelligence and cognitive ability and are not good at phonemic coding ability and language analytic ability. However, they are outstanding in assimilating new material and in memory-functioning tasks.

Although some neurological explanations have been given for talented learners, some are simply speculations on the neuroanatomical brain structure and the influence of other factors such as the environment (Waterhouse, 1988). It is easier, however, to present neurological proofs for cognitive deficits: lesions in the left hemisphere may produce either general or selective impairment of verbal memory disturbances related, for example, to aphasic disorders or mild developmental brain lags as is the case of some children in immersion programs in Canada (Trites & Price, 1976; in Humes-Bartlo, 1989). Besides, the use of scan techniques to study the functions of the cerebellum appear to be revealing (Leiner, Leiner & Dow, 1986), particularly for procedural and verbal short-term memory functioning (Silveri & Misciagna, 2000).

As regards unsuccessful language learners, Pimsleur (Pimsleur, Sunland & McIntyre, 1966; Pimsleur, 1968) highlights the importance that auditory abilities have in the process of learning a language. Thus they justify the fact that those who, on the basis of their general abilities, ought to be able to learn a language fail to do so in practice because of their inferior auditory abilities. Although Carroll (1990) and Wesche (1981) admit hearing loss as a potential factor for not learning a language, Carroll (1990) adds that it may not be the only factor involved in auditory ability, but also other individual differences in understanding when speech is unclear or accompanied by

masking sounds (Stankov & Horn, 1980). The ability to code phonologically one's L1, as studied by Sparks and associates is also closely related to many L2 learning failure cases (see sections 1.4.1 and 1.6.1).

In the same way as there are specific cases of talented learners, there are also concrete cases of untalented ones. Humes-Bartlo (1989) hypothesised that difficulty in second language learning may be associated with ability in other skills subserved by brain areas which are adjacent or homologous to language regions and vice versa. Although she did not find differences between fast and slow learners on the lateralisation task, thus contradicting Geschwind and Galaburda's work (1985), her hypothesis was confirmed since slow learners scored higher on the arithmetic and visual-spatial tasks, as Schneiderman and Desmarais (1988) defend, but their verbal memory was poor. The results also support the idea that being mildly deficient in first language ability may have an influence on the ability in a FL.

Ioup (1989) also found out that many of the Southeast Asians who immigrated to the US as young children had failed to acquire native English. She selected one Chinese and five Vietnamese immigrants to check whether they had mastered aspects of English grammar shown to derive from two principles of UG, subjacency and empty category principle. As Ioup found great variability in subject performance on the test of UG, she decided to focus her study on the Chinese immigrant Jeanne, who only spoke Chinese with her family. Ioup did not find any plausible explanation for Jeanne's impossibility to learn English despite performing well on all cognitive tasks except, obviously, second language learning.

Both the cases of talented and untalented learners are extreme and not generalisable. Consequently, no further insights into them will be given in this dissertation. However, they should be taken into account as a model for possible (though rare) extreme cases that could be found in any naturalistic or instructed environment. Regarding instructed contexts, spotting one such case would be especially relevant, as the talented or untalented learner would deserve special attention and some catering for diversity concern from the FL teacher.

1.7. Summary of chapter 1

Throughout this first chapter, several issues have been presented that connect FL aptitude with the individual's context and characteristics. First of all, since second

language acquisition is not independent of how one's L1 is acquired, the acquisition of one's L1 has been tackled from two main perspectives: cognitive development and individual differences. While Piagetians believe that there is no language development without prior higher cognitive development, others adopt lighter perspectives or add other aspects that they consider also relevant to L1 acquisition. Thus, neo-Piagetians who take an information-processing perspective believe that experience with information processing, recoding, modification and further retrieval and production are crucial for one's development. In addition, memory is also considered to be crucial in the cognitive developmental process, as without enough (and automatised) memory strategies and memory span, it is not possible for the individual to develop cognitively. The role that social context, literacy and metalinguistic awareness play in one's L1 acquisition has also been exposed in this chapter.

Chapter 1 has also presented aptitude from a historical perspective and from a multicomponential construct, the three main components being phonemic coding ability, analytic ability and memory. These have been related to the different stages of L2 processing (Skehan, 2003) and have been considered to be more or less relevant depending on the learners' age. While analytic ability is believed to be especially relevant in adult learning, memory is the construct more widely used by young learners, although this does not mean that these components are exclusive for these ages. They are relevant, though, when it comes to determining if language learners are analytic, memory-oriented or balanced.

Finally, Chapter 1 gives a general overview of several factors that have been related to aptitude. These are, first of all, its supposed innate status and direct relation to one's L1 acquisition and how L1 also influences SLA. Secondly, aptitude has been presented together with the "age" individual difference, as the age at which one starts learning a FL can be crucial in how and how fast the FL will be acquired, considering as well the FL learning context. Lastly, the individual differences that have also been related to aptitude but the role of which is still controversial in the literature are also found in this Chapter. These are sex, bilingualism and intelligence. Among these, we highlight the sex variable, which has for long been thought to benefit females over males as far as FL learning is concerned, but this female advantage, it is suggested, should not be studied independent of the underlying cognitive processes that each FL task requires. We also highlight bilingualism as one of those aspects that has proved to be beneficial for FL learning, yet its role regarding FL aptitude is not clear yet.